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INDEX.

Accumulators, Blowing a Church Organ by. Illustrated 15, 16, 17
Accumulators in England by Wind Power, Charging. Illustrated 123
Accumulators, Specialization of 332, 333
Acme Expanding Wire Guard. Illustrated 289
Ahearn's Electric Water Heater. Illustrated 122
Ahearn Electric Heater, The Improved. Illustrated 312
Ahearn Electric Heater in Ottawa, Can., The. Illustrated 205, 206, 207, 208, 209
Ahearn Electric Stove, New. Illustrated 253
Alternating Dynamo, New English. Illustrated.... 2
Alternating Current Fan Motor, the Berstein. Illustrated 24
Alternating Current Motor, The Stanley-Kelly. Illustrated 74, 75
Alternating Current Station, Model German. Illustrated 77
Alternating Currents, Experiments with. By Dr. Louis Duncan, assisted by E. R. Canchaff and R. H. and G. E. Hutton. Illustrated. Discussion (American Institute of Electrical Engineers) 80, 81
Alternating Current Electric Railway System, Badt's. Illustrated 113
Alternating Current, Power Transmission by. By Gisbert Kapp. Illustrated 137
Alternating Currents of High Potential, Ducretet and Lejeune's Apparatus for Generating. Illustrated. 172
Alternating Currents on the Human Body, Effects of. By Chas. P. Steinmetz 185
Alternating Motor, Operation of the Tesla. Illustrated 261
Alternating Current, Therapeutic Effects of....320, 321
American Street Railway Association, Convention at Cleveland, O.—
President's Address 219
A Model Electric Street Railway Roadbed and Underground Wiring. By George W. Baumhoff 219, 220
Invitations Accepted 220
A Perfect Overhead Electric Construction. By Charles H. Smith 220
Committee on Nominations 220
Economy of Machine Shops for Electric Street Railways. By J. H. Bickford. Discussion. 220, 221
Relative Cost of Operation of Horse, Cable and Electric Roads. By W. M. Ramsey, F. R. Green and J. L. Heins. Discussion.223, 224
World's Columbian Exposition 224
Standards for Electric Street Railways. By O. T. Crosby and H. L. Bettis....224, 225
Experiments on the Expansion of Continuous Rails. By A. J. Moxham 225, 226
Delegates and Visitors 226, 227, 228
The Banquet 228
Exhibits, Convention Notes and Personals.228, 229
American Institute of Electrical Engineers....19, 36, 37, 38, 80, 81, 164, 187, 234, 239, 253, 275, 277, 288
American Street Railway Association 7, 285
American Street Railways 75
American Association for the Advancement of Science 127
American Electrical Machinery for China 234
Ammeter, Volt and. Illustrated 201
Ammeter, the Cutler Non-inductive. Illustrated.... 254
Annunciator, New Automatic Set Back. Illustrated.. 152
Antwerp Electric Express, Brussels 115
Aphorisms for Central Station Managers 66
Appleton, Wis. (Correspondence) 130
Arc Lamp, Rutherford's. Illustrated 4
Arc Light Adapted for the Ophthalmoscope, the.... 25
Arc Light Dynamo. Illustrated 249
Armature, a Large. Illustrated 260
Armour's Elevated Electric Road. Illustrated 169
Arrester, Fulman Lightning Illustrated 10, 11
Arrester for Incandescent Circuits. Illustrated.... 93
Atlantic Cable, First 50
Atmospheric Electricity, Phenomena of 112, 113
Auditorium Plant, New 181, 182
Automatic Current Regulator, Keller. Illustrated... 11

Badt's Alternating Current Electric Railway System. Illustrated 113
Badt, F. B. Practical Notes on Electrolytic Copper Refining. Illustrated 235
Bain, Foree. High Duty Generator. Illustrated... 23
Bain, Foree. Protecting Dynamos. Illustrated. .. 58
Bain, Foree. Testing Dynamos. Illustrated 72
Baker Submarine Boat and Sims Edison Torpedo 17
Baker Submarine Boat in Chicago Waters 299
Baltimore Electrical Exhibit, A 115
[illegible] by Electricity. Illustrated 332
[illegible] Clutch Pulleys. Illustrated 321
[illegible] Electric Light 66
Battery, The Ford Washburn Storage. Illustrated 49
Battery, [illegible] Primary. Illustrated 66
Battery, [illegible]. Illustrated 230
Baumhoff, George W. Model Electric Street Railway Roadbed and Underground Wiring 219, 220
Bickford, J. H. Economy of Machine Shops for Electric Street Railways 220, 221
Belgian Telephone System, Government Control of the 189
Bell, Huebel & Manger Electric. Illustrated 188
Bellamyism in Chicago 331
Bernstein Alternating-current Fan Motor. Illustrated 24
Berliner's Thermo-electric Generator. Illustrated.. 160
Bettis, H. L. Standards for Electric Street Railways 224, 225
Black Copper and Blister Copper 163
Bliss Geo. H. Electrical Development at Idaho Springs, Colo. Illustrated 163
Boiler, Sectional Water Tube. Illustrated 324
Book Table, The 112, 323
Boring Mill for Electric Machines. Illustrated 38
British Association Meeting 139
Brown & Boveri's Slow Speed Dynamo. Illustrated 237
Brown Coal Mining Machine. Illustrated 8
Brotherhood of Electrical Workers 275
Bruckner Electrical Engraving Machine. Illustrated 306
Brussels-Antwerp Electric Express 115
Bryan, Wm. H. Central Station Lighting in Small Cities 58, 59
Buffalo Exposition, Electrical Desplay at. Illustrated 234
Burner, New Hand Lighting. Illustrated 230

C. & C. Switches. Illustrated 10
Cable, First Atlantic 50
Cables under the Pacific 51
California Electrical Society 201
Canada, Financial Aspect of Electric Lighting in.21, 22
Canada, Electric Heater in. Illustrated 44, 45
Capturing Monkeys by Electricity 164
Car Stables Burned, West End 331
Carpenter Enameled Rheostat. Illustrated. 136
Carpenter Car Heater. Illustrated 289
Carpenter, Chas. E. A New Rheostat. Illustrated 239
Carriage on Chicago Streets, An Electric 103
Central Power Station, An Ideal. Illustrated. By C. J. Field, E. J. Cook and F. Bourne (Chicago Electric club) 333, 335, 336, 337
Central Station Lighting in Small Cities. By Wm. H. Bryan 58, 59
Chicago, Bellamyism in 331
Chicago Postoffice, Electric Stamp Canceling Machines in the. Illustrated 1
Chicago Electric Lighting in 35
Chicago Theatrical Lighting Plant, New....45, 46
Chicago's Aurora Borealis 49
Chicago, Railway Problem of 50
Chicago and North Shore Railway. Illustrated 60
Chicago, Isolated Lighting Plant in the Masonic Temple. Illustrated 85, 86
Chicago Streets, An Electric Carriage on 103
Chicago Terminals, Electricity for 103
Chicago, New Isolated Lighting Plants in. Illustrated 134
Chicago, The First Electric Carriage on the Streets of. Illustrated 145, 146, 147
Chicago Electric Club...171, 270, 284, 294, 295, 305, 325
Chicago, Recent Growth of Electric Lighting in 173
Chicago and St. Louis Electric Railway 187
Chicago, Electric Railways in 188
Chicago to New York, Telephoning from 218
Chicago's Parks and Boulevards, Electric Lighting in. Illustrated 269, 270
Chicago, Western Union Progress in. Illustrated..272, 273
Chicago Edison Company 275
Chicago's City's Lighting Plant, Extending 287
China, American Electrical Machinery for 234
Church Organ with Accumulators, Blowing a. Illustrated 15, 16, 17
Cigar Lighter, Electric. Illustrated. 136
Cincinnati, O. (Correspondence) 67, 68
Cincinnati, Electrical Display at 323, 324
Clark-Carhart Standard Cells. Illustrated 240
Cleat, A Simple. Illustrated 19
Cleat, New. Illustrated 265
Cleveland Street Railway Men. Portraits 212, 213
Cleveland, Street Railway Convention at 212, 213
Coal Cutting Machine, Electric. Illustrated 272
Columbus Celebration, Electrical Features of the New York. Illustrated 208, 209
Commandoer's Wave Power System. Illustrated 88
Commercial Dynamos and Motors. Illustrated 324
Compound Winding of Generators from a Practical Standpoint. By M. Willis. Illustrated. Discussion. (Chicago Electric club.) 284
Concord, N. H. (Correspondence) 106
Conover's Insulator. Illustrated 122
Concord and Montreal Railroad Station Plant. Illustrated 123
Conduit Plan in Rochester, N. Y 161
Cooking, Electric 35, 36
Copper, Black and Blister 163
Copper Combine 308
Cornell University, Test of a 17,500 Watt Stanley Transformer Illustrated 172
Correspondence 12, 26, 27, 39, 40, 41, 51, 52, 53, 54, 55, 67, 68, 81, 82, 91, 105, 106, 117, 118, 128, 129, 130, 140, 141, 142, 153, 154, 164, 165, 166, 177, 178, 179, 189, 190, 201, 202, 213, 214, 215, 231, 240, 241, 242, 254, 255, 265, 266, 267, 278, 290, 291, 301, 313, 314, 325, 326, 338
Cost of Operation of Horse, Cable and Electric Roads, Relative. By W. M. Ramsey, F. R. Green and J. L. Heins. Discussion. (American Street Railway Association) 223, 224
Cranes Used in the Construction of a Spanish Breakwater. Illustrated 196, 197
Cranes in Railroad Shops, Electric. Illustrated.... 305
Crosby, O. T. Standard for Electric Street Railways 224, 225
Cushman Dynamo, The. Illustrated 81
Cutler Non-inductive Ammeter. Illustrated....253, 254
Cutter's Suspension Street Hood. Illustrated 289
Cutler Non-inductive Voltmeter. Illustrated, ... 324
Cut-outs, Improved. Illustrated 265

"D & D" Electric Machine, New. Illustrated 152
Dashiell, B. J., Jr., The Electric Railway as Applied to Steam Roads 9, 10
Decorations at Denver, Electrical 65, 66
Dedication of the World's Fair in Chicago, Electrical Features of the. Illustrated..217, 218, 219, 220, 221
Denver, Colo. (Correspondence) 82, 166, 190
Denver, Electrical Decorations at 65, 66
Departments 13, 14, 27, 28, 41, 42, 55, 56, 69, 70, 82, 83, 84, 95, 96, 106, 107, 108, 118, 119, 120, 130, 131, 132, 142, 143, 144, 155, 156, 167, 168, 179, 180, 191, 192, 203, 204, 215, 216, 232, 243, 244, 255, 256, 267, 268, 278, 279, 280, 291, 292, 302, 303, 315, 316, 327, 328, 339, 340
Detroit, Mich., (Correspondence.) 40, 52, 53, 68, 142, 166, 255
Detroit Strike, The 173
Diplomatic Telegraphing, Cost of 184
Direct Coupled Dynamos and Engine. Illustrated.. 3
Direct Coupled Generator and Engine. Illustrated.. 312
Discharges, High Pressure Electric. Illustrated.... 35
Divining Rods, Unscientific and Scientific. By George M. Hopkins. Illustrated 127, 128
"Doctor" at Hot Springs, The Electrical. Illustrated. 2
Drill for Mines, Electric. Illustrated 116
Drill, Pulsating Electric Rock. Illustrated 263
Ducretet and Lejeune's Apparatus for Generating Alternating Currents of High Potential. Illustrated. 172
Duncan, Dr. Louis. Experiments with Alternating Currents. Illustrated. (American Institute of Electrical Engineers.) 80, 81
Dutch Ship Lighting Outfit, A. Illustrated 124
D'Unger Case, The 89
Dynamo, New English Alternating. Illustrated.... 2
Dynamo and Engine Direct Coupled. Illustrated... 3
Dynamo Indicator or Instantaneous Curve Writing Voltmeter. By George S. Moler. Illustrated. (American Institute of Electrical Engineers.) 19
Dynamo of the Detroit Electrical Works, New. Illustrated 22
Dynamos, Protecting. By Foree Bain. Illustrated.. 58
Dynamos, Testing. By Foree Bain. Illustrated.... 72
Dynamo, The Cushman. Illustrated 81
Dynamo and Engine Combined. Illustrated 116
Dynamo, Small Steam. Illustrated 182
Dynamos for the World's Fair, Mammoth. Illustrated 183
Dynamo, Five Hundred Horse Power. Illustrated.. 184
Dynamos, Packard Motors and. Illustrated 201
Dynamo, Brown & Boveri's Slow Speed. Illustrated 237
Dynamo, Leeds Arc Light. Illustrated 249

"Earth," What Electricians Mean By. By Sidney F. Walker 147, 148
Edison Companies, Convention of the.. 72
Edison Companies at Toronto, Convention of 103
Edison Lamp Patent Sustained 185
Edison Lamp Litigation Ended 195
Editorial, ... 6, 20, 34, 48, 62, 76, 90, 102, 114, 126, 138, 150, 162, 174, 186, 198, 210, 222, 238, 250, 262, 274, 286, 298, 310, 322, 334
Election Returns by Telephone and Telegraph.... 275
Electric Railway as Applied to Steam Roads, The. By B. J. Dashiell, Jr. 9, 10
Electric Heater in Canada. Illustrated 44, 45
Electric Lighting for Microscopic Work. Illustrated. 123, 124
Electric Railways on the Pacific Coast. Illustrated 133, 134
Electric Carriage on the Streets of Chicago, The First. Illustrated 145, 146, 147
Electric Light Companies as Manufacturing Corporations 169, 170
Electrical Method of Tanning. Illustrated 5
Electricity in the Jungle 18
Electricity, Light and Fire. By C. C. Haskins..183, 184
Electricity in South African Gold Mines 331
Electrolytic Refineries, Tell-tale for. Illustrated.... 158
Electrolytic Copper Refining, Practical Notes on. By F. B. Badt. Illustrated 235
Electrostatic Switch and Phase Indicator. Illustrated 149
Elevator Plant, New Electric. Illustrated 59, 60
Elevated Electric Road, Armour's. Illustrated.... 169
Elevated Roads, Substituting Electricity for Steam on 173
Elevated Electric Road, Johnston's. Illustrated.... 283
Engine, Direct Coupled Dynamo and. Illustrated.. 3

Engine for Electric Street Railway Service, Heavy Duty. Illustrated 24
Engine, Electric Fire. Illustrated 89
Engine, Combined Dynamo and. Illustrated 116
Engine, New Horizontal. Illustrated 188
Engine, Heavy Duty Electric Railway. Illustrated. 289
England, A Whale Story from 32
England, Telephone and Telegraph in 161
English Electric Mining Machines. Illustrated 64
English Electric Car with Four Motor Armatures. Illustrated 79
English Electric Pumping Plant. Illustrated 125
English Electric Pumping Plant. Illustrated 260
English Transmission Scheme 331
Excavator, an Electric. Illustrated 281, 282
Expansion of Continuous Rails, Experiments on the. By A. J. Moxham (American Street Railway Association), ... 225, 226
Experiments with Alternating Currents. By Dr. Louis Duncan, assisted by E.R.Carichoff and R. H. and G. E. Hutton. Illustrated. Discussion (American Institute of Electrical Engineers). .80, 81
Extinguishing the Electric Arc, Method of. Illustrated 49

Factory Driving by Electricity. Illustrated 321
Fahrig's Electrostatic Process for the Manufacture of Ozone. Illustrated 109, 110, 111
Fall Festivities, Illumination at the St. Louis 136
Fan, New Electric. Illustrated 24
Fan Motor, The Bernstein Alternating Current. Illustrated 24
Field, Cyrus W. Portrait 29
Field, Cyrus W., an English Estimate of 63
Field, C. J. An Ideal Central Power Station 333, 335, 336, 337
Financial Aspect of Electric Lighting in Canada. 21, 22
Ford-Washburn Storage Battery. Illustrated 49
Forging and Tempering, Electric. Illustrated 18
Fountain, Trouve's Portable Electric. Illustrated 2
France, Recent Thunderstorms in. Illustrated 31
French Electrical Engineer's Achievement 11
French Electrical Manufacturers and the Tariff 287
French Prizes for Inventors 296
Fulmen Lightning Arrester. Illustrated 10, 11

Galvanometer, Queen's Portable Reflecting. Illustrated 337
Galvanometer and Potential Indicator. Illustrated. 289
Gambling by Electricity. Illustrated 33
Gas Burner, New Electric. Illustrated 201
Gear Cutting Machine, Automatic. Illustrated 81
General Electric Company's Mining Locomotive, The. Illustrated 177
General Electric Company in Chicago, Illustrated. 246, 247, 248, 249
Generator, Bain's Special High Duty. Illustrated 23
Generator, National Multipolar. Illustrated 153
Generator, Berlioer's Thermo-electric. Illustrated 160, 161
German Alternating Current Station, Model. Illustrated 77
Giraud's Thermo-electric Battery. Illustrated 199
Gold Mines, Electricity in South Africa 331
Governing Water Wheels in Railway Service. Illustrated 257, 258
Government Telegraph and the People's Party 171
Government Control of the Belgium Telephone System 189
Gould, Jay, Death of 297
Grand Rapids Controversy. Illustrated 7
Gravity Copper Anchor. Illustrated 51
Green, F. R., Relative Cost of Operation of Horse, Electric and Cable Roads 223, 224
Green's Improved Fuel Economizer. Illustrated 312
Greenville Electric Light Station. Illustrated 65

Hart & Hegeman Switch. Illustrated 65
Haskins, C. C. Electricity, Light and Fire 183, 184
Havre, Electric Light Plant at. Illustrated 321
Hazard Problem, A Proposed Solution for the Electrical. By George P. Low 263, 264
Heater, Carpenter's Car. Illustrated 289
Heater, Ahearn's Electric Water. Illustrated 126
Heater in Ottawa, Can., The Ahearn Electric. Illustrated 205, 206, 207, 208, 209
Heating, Electric. Illustrated 236
Heins, J. L. Relative Cost of Operating Horse, Electric and Cable Roads 223, 224
Henrion Lubricator. Illustrated 263
Hercules Switch. Illustrated 11
Herz, The Career of Mr 330
Homestead, Electricity at 103
Hopkins, George M. Unscientific and Scientific Divining Rods. Illustrated 127, 128
Houston, Edwin J. Physiological Effects of Alternating Currents of High Frequency. (Franklin Institute) 7
Human Electricity 77
Huebel & Manger Electric Bell. Illustrated 188

Idaho Electrical Transmission Project 214
Idaho Springs, Colo., Electrical Development at. By George H. Bliss. Illustrated. 163
Ideal Central Power Station, An. Illustrated. By C. J. Field, E. J. Cook and F. Bource (Chicago Electric club) 333, 335, 336, 337
Illinois Institute of Mining Engineers 270
Incandescent Lamp, A Peculiarly Marked. Illusted 60
Incandescent Circuits, Arrester for. Illustrated. 93, 94
Incandescent Cigar Lighter. Illustrated 122
Incandescent Lamps for Mines 127
Incandescent Circuits, Street Brackets for. Illustrated 152

Incandescent Lamps for Railway and Power Circuits. Illustrated 301
Indianapolis, Ind., (Correspondence) 339
Indicator, Electric Mill. Illustrated 17
Indicator, Speed. Illustrated 30
Indicator, Alarm Bell. Illustrated 93
Insulating Medium, Oil versus Air as an. By James Bowstead Williams, M. D. (American Institute of Electrical Engineers) 277, 288
Insull, Samuel, Testimonial Banquet to 1, 2
Insull, Samuel, Dinner in Honor of 47
Insurance Rules and Electric Installations 189
Insurance Risks, Electric Stations as 249
Inventions and First Commercial Applications, Electrical 81
Iona Ceiling Cut-out. Illustrated 116
Iona Soap Switch, The. Illustrated 164
Ireland, To Utilize Water Power in 151
Iron, The Electrical Habits of 287
Isolated Lighting Plants in Chicago, New 134
Italian Submarine Boat Audace. Illustrated 63
Italy, Progress in 331
Iwadare, Kunihiko. Electricity in Japan. Illustrated. 270, 272, 295, 296

Japan, Electricity in. By Kunihiko Iwadare. Illustrated 270, 271, 295, 296
Japan, The Kioto Canal in. Illustrated 309
Johnston's Elevated Electric Road. Illustrated 283
Joule Meter, A Large. Illustrated 19

Kansas City, Mo., (Correspondence) 82, 106, 130, 153, 190
Kapp, Gisbert. Power Transmission by Alternating Current. Illustrated 137
Keller, E. E., Appointment of. Portrait 7
Keller Automatic Current Regulator. Illustrated 11

Lamp, The Packard. Illustrated 24, 25
Lamp Trimmers, Hint for. Illustrated 137
Lamp, American. Illustrated 152
Lamp Patent Sustained, Edison 185
Lamp Litigation Ended, Edison 195, 196
Lamp Decision, Effect of the 197
Lamp, New Westinghouse. Illustrated 211
Lamp, The Acorn Sunbeam. Illustrated 231
Lamp Litigation Continued 277
Lamp Decision, Another 318, 319
Lane & Bodley's Shafting Stand. Illustrated 188
Laws of Falling Bodies, The. Illustrated 78, 79
Lighting Contract, Large 293
Lighting Discharges, Wurt's Method of Arresting. Illustrated 4
Lightning Arrester, Fulmen. Illustrated 10, 11
Lightning, His Hair Cut by 11
Lightship, Electrical 104
Lightships, Electric Communication with 245
Litigation, Patent. (Communication from the International Ore Separating company.) 11
Little Rock, Ark., Electric Street Railway System at. Illustrated 97, 98, 99, 100, 101
Little Rock, Ark. (Correspondence) 338
Locomotives, Electric. (Communication from Silvanus P. Thompson.) 11
Locomotive, New English Electric 139
Locomotive, New Mining. Illustrated 237
Long Distance Telephoning 209
Loomis, H. B. Modern Views of the Electric Current. (Wisconsin Electric Club) 4
Louisville, Ky. (Correspondence.) 82
Love Trolley, The Improved. Illustrated 8, 9
Low, George P. A Proposed Solution for the Electrical Hazard Problem 263, 264
Lubricator, Henrion. Illustrated 263
Ludwig's Combination Telegraph Key and Sounder. Illustrated 149
Lundell Motors. Illustrated 300

Machine Shops for Electric Street Railways, Economy of. By J. H. Bickford. Discussion. (American Street Railway Association.) 220, 221
Magnetic Lock. Illustrated 30
Magnets, Rudd's Method of Measuring the Strength of. Illustrated 182
Marketing Vegetables by Electricity 112
Marvin, Henry N. The Electric Percussion Drill in Theory and Practice. Illustrated. (American Institute of Electrical Engineers.) 91, 92, 93
Masonic Temple, Chicago, Isolated Lighting Plant in the. Illustrated 85, 86
Maver's Relay. Illustrated 158
McIntyre, L. H. Recent Improvements in Electric Traction. (New York State Street Railway Association.) 175, 176
McTighe's Rail Bond. Illustrated 49
Measuring Instruments for Students. Illustrated 265
Meeker, George H., Death of 299
Meter, Electric. Illustrated 182
Method of Extinguishing the Electric Arc. Illustrated 49
Michigan, Electrical Entertainment in 66
Microscopic Work, Electric Lighting for. Illustrated. 123, 124
Mill Work, Electricity in 263
Milwaukee, Wis. (Correspondence.) 27, 28, 40, 105, 129, 130, 142, 166, 178, 231, 241, 242, 254, 255, 266, 278, 302, 313
Milwaukee Street Railway Litigation 128
Mining Locomotive, The General Electric Company's. Illustrated 177
Mining Locomotive, New. Illustrated 237
Mining Engineers, Illinois Institute of 270
Model Electric Street Railway Roadbed and Underground Wiring. By George W. Baumhoff. (American Street Railway Association) 219, 220

Modern Views of the Electric Current. By H. B. Loomis. (Wisconsin Electric Club.) 4
Moler, George S. A Dynamo Indicator or Instantaneous Curve Writing Voltmeter. Illustrated. (American Institute of Electrical Engineers.) 19
Montreal Railroad Station Plant, Concord and. Illustrated 123
Motors as Substituted for Steam Locomotives, Electric. By Arthur T. Woods 23, 24
Motors for Bridges, Electric 63
Motor Installations, Unique. Illustrated 75
Motor, New Wagner. Illustrated 214
Motors and Dynamos, Packard. Illustrated 201
Motor, Operation of the Tesla Alternating. Illustrated 261
Motors, Lundell. Illustrated 300
Motors, Driving Portable Drills by Electric. Illustrated 320
Mouldings, Painting. Illustrated 152
Mount Washington, Search Light Signaling from ... 122
Moxham, A. J. Experiments on the Expansion of Continuous Rails 225, 226

Nashville, Tenn. (Correspondence) 338, 339
National Electric Light Association 281
National Multipolar Generator. Illustrated 153
Neutral Points, Indications of the Shifting of. By C. O. Poole 312
New York Notes (Correspondence) 12, 26, 51, 52, 67, 81, 82, 94, 105 117, 128, 129, 140, 153, 164, 165, 177, 189, 201, 202, 214, 215, 231, 240, 254, 265, 266, 278, 290, 301, 313, 325, 338
New England Notes (Correspondence) 12 13, 129, 140, 141, 154, 165, 178, 179, 190, 202, 242, 266, 267, 278, 290, 301, 338
New York Street Railway Association 139
New England, Electric Railway in 170
New York State Street Railway Association, the Convention of the 175, 176
New York Columbus Celebration, Electrical Features of the. Illustrated 208, 209
New York, Telephoning from Chicago to 218
Niagara, Preparations for Electrically Utilizing the Power of. Illustrated 193, 194, 195
Niagara, Electricity at 214, 219
Northwestern Notations (Correspondence) 52, 118, 141, 142, 153, 154, 166, 177, 178, 189 190, 202, 215, 242, 254, 267, 278, 290, 291, 302, 313

Oakland, Cal., Electric Railways for 140
Ohio, Electric Railroading in 89, 112
Oil versus Air as an Insulating Medium. By James Bowstead Williams, M. D. (American Institute of Electrical Engineers.) 277, 288
Organ Blowing, Utilizing Electricity in. Illustrated. 43
Ottawa, Can., The Ahearn Electric Heater at Illustrated 205, 206, 207 208, 209
Over-compounded Machines, Automatic Regulation of. By H. Ward Leonard. (Communication) 313
Overhead Electric Construction, A Perfect. By Charles H. Smith. (American Street Railway Association.) 220
Ozone, Fahrig's Electrostatic Process for the Manufacture of. Illustrated 109, 110, 111

Packard Lamp. Illustrated 24, 25
Packard Motors and Dynamos. Illustrated 201
Pacific Coast, Electrical Work on the 297
Pacific Coast, Electrical Development on the. Illustrated 171
Pacific Coast, Electric Railways on the. Illustrated 133, 134
Pacific Cable, Under the 51
Paris Telephone Fire Alarm Service, New. Illustrated 60
Pattee's New Lamp-Hour Recorder. Illustrated 116
Patents, Electrical. (United States) 14, 28 42, 56, 70, 84, 96, 108. 120, 132, 144, 156, 168, 180, 192, 204, 216, 232, 244, 256, 268, 280, 292, 304, 316, 340
Percussion Drill in Theory and Practice, The Electric. By Harry N. Marvin. Illustrated. (American Institute of Electrical Engineers) 91, 92, 93
Pfluger's Line Tightener. Illustrated 337
Photographing Two Thieves by Electricity and the Flash Light. Illustrated ..... 46, 47.
Physiological Effects of Alternating Currents of High Frequency. By Edwin J. Houston. (Franklin Institute) 27
Plier, Safety Side Cutting. Illustrated 116
Poole, C. O. Indications of the Shifting of Neutral Points 312
Porous Battery Cups are made, How. Illustrated .. 33
Postal Telegraph Company's Chicago Office, Fire in the 151
Postal Telegraph, Western Union and 122
Potential Indicator, Galvanometer and. Illustrated... 289
Power for Cotton Mills, Electric 311
Power Transmission Device. Illustrated 22
Power Transmission Plant, Interesting 240
Power Transmission, Electric 148
Power Transmission by Alternating Current. By Gisbert Kapp. Illustrated 137
Power Transmission, The Future of Electric 164
Power Transmitter. Another Close Connected. Illustrated 31
Power, Steam and Electric. By J. J. Wright 25
Preparation for Electrically Utilizing the Power of Niagara. Illustrated 193, 194, 195
Protecting Dynamos. By Foree Bain. Illustrated .. 58
Pulsating Electric Rock Drill. Illustrated 263
Pumping Plant, English Electric. Illustrated 260
Pumping Plant, English Electric. Illustrated 125
Pumps for Mines, Electric. Illustrated 38
Pyrometers, Platinum. Illustrated 125

23449

Rae's New Electric Railway System. Illustrated 284, 285
Railroad Shops. Electricity in..... 81
Railroading in Ohio, Electric..... 89, 112
Railroading, Electricity in..... 66
Railway System, Rae's New Electric. Illustrated. 284 285
Railway Service, Governing Water Wheels in. Illustrated..... 257, 258
Railways, Important Legal Victory for Electric..... 235
Railway Motor, The O. R. F. Illustrated..... 230
Railway, Chicago and St. Louis Electric..... 187
Railway Line Specialties, New. Illustrated..... 188
Railways in Chicago, Electric. 188
Railway Convention at Cleveland, Street..... 212, 213
Railway, Saratoga Springs. Illustrated..... 161
Railway in New England, Electric..... 170
Railway Men, Cleveland Street. Portraits..... 212, 213
Railways in the South, Electric..... 139
Railway of the Future, The. By Oberlin Smith. 139
Railways for Oakland, Cal., Electric..... 140
Railway Convention, Street..... 115
Railway System, Badt's Alternating Current Electric. Illustrated..... 113
Railway System at Little Rock, Ark., Electric Street. Illustrated..... 97, 98, 99, 100, 101
Railway System, Spokane Electric. Illustrated 87, 88
Railway Consolidation in Chicago, Reported Electric. 89
Railways, American Street 75
Railway Problem of Chicago..... 50
Railway, Chicago and North Shore. Illustrated.... 60
Railway, The City and South London Electric.... 38, 39
Railway Service, Heavy Duty Engine for Electric Street. Illustrated..... 24
Railway Motor Tests, Electric. By Prof. George D. Shepardson and Edward P. Burch Illustrated. (American Institute of Electrical Engineers) 36, 37, 38
Ramsey, W. M. Relative Cost of Operation of Horse, Electric and Cable Roads..... 223, 224
Recent Improvements in Electric Traction. By L. H. McIntyre. (New York State Street Railway Association)..... 175, 176
Redman, George A. Portrait..... 115
Relay, Maver's. Illustrated 158
Return Circuit in Railway Work..... 284, 285
Rheostat, Schneider's. Illustrated..... 4
Rheostat. Carpenter Enameled. Illustrated..... 136
Rheostat, A New. Illustrated..... 239
Rhode Island Clam Bake..... 50
Riveting Machine, Electro-hydraulic. Illustrated.... 33
Roberts Insulating Joint, New. Illustrated..... 66
Robinson Truck, The. Illustrated..... 8
Rochester, N. Y., Conduit Plan in..... 161
Rochester, N. Y., Underground Wires for..... 134
Roumania, Telephoning in..... 234
Rudd's Method of Measuring the Strength of Magnets. Illustrated..... 182
Rutherford's Arc Lamp. Illustrated..... 4
Russe'l Automatic Switch. Illustrated 350

Sail-boat, An Electrical..... 11
Saint Cyr Military Academy, Electric Lighting in. Illustrated..... 297
San Francisco, Victory for the Electric Railway at. Illustrated..... 234
Saratoga Springs Railway. Illustrated..... 161
Schneider's Rheostat. Illustrated 4
Search Light on the Steamer Maine, Thomson-Houston Electric. Illustrated..... 173
Search Light Signaling from Mount Washington.... 122
Sechrist Switch, Another Form of. Illustrated..... 10
Shafting Stand, Lane & Bodley's. Illustrated..... 188
Shepardson, Prof. George D. Electric Railway Motor Tests. Illustrated. (American Institute of Electrical Engineers)..... 36, 37, 38
Shock, Death from an Electric..... 63
Short, Prof. Sidney H. Portrait..... 213
Siemens (von), Werner. Portrait..... 311
Siemens & Halske Electrical Machinery. Illustrated 185
Siemens & Halske Company..... 35
Signs, Electrically Illuminated. Illustrated..... 39
Signaling Through Fire Hose, Electric 283
Sims-Edison Torpedo, Baker Submarine Boat and... 17
Slattery, M. M. M. Portrait..... 323
Smith, Charles H. A Perfect Overhead Electric Construction..... 220
Smith Ventilating Fan. Illustrated 152
Smith Oberlin. The Railway of the Future..... 139
Spain, Recent Telegraphers' Strike in..... 66, 67
Spanish Breakwater, Electric Cranes Used in the Construction of a. Illustrated..... 196, 197
Speed of Trains, Ascertaining the. Illustrated..... 61
Spencer Spark Arrester. Illustrated..... 230, 231
Spokane Electric Railway System. Illustrated.... 87, 88
Spokane, Wash. (Correspondence)..... 54, 55
Stampers, Trouble with Electric Letter..... 29, 30
Standard for Electric Steel Railways. By O. T. Crosby and H. L. Bettis (American Street Railway Association)..... 224, 225
Standards, Electrical..... 149
Stanley Transformer, Cornell University Test of a 17,500 Watt. Illustrated..... 172
Stanley-Kelly Alternating Current Motor. Illustrated 74, 75
Starkweather's Boston Car Fender. Illustrated..... 289
Statue of Liberty, Proposed Illumination of the. Illustrated..... 124
Steffen's Tachyscope 200, 201
Steinmetz, Chas P. Effect of Alternating Currents on the Human Body..... 185
St. Louis Electric Motor of Forty Years Ago, A..... 7
St. Louis Electric Club..... 218
St. Louis Electric Railway, Chicago and..... 187
St. Louis, An Electric Club in..... 159, 160
St. Louis Illumination, Electrical Features of the. Illustrated..... 151
St. Louis Fall Festivities, Illumination at..... 136
St. Louis, Electrical Development in..... 66
St. Louis, Mo. (Correspondence)..... 12, 26, 40, 41, 54, 68, 105, 106, 117, 118, 130, 154, 165, 166, 189, 203, 215, 240, 241, 254
Stillwell's Close Heater. Illustrated..... 128
Storage Batteries, Electric Traction by..... 235, 236
Storage Battery Patents, Litigation over..... 200
Stove, New Ahearn Electric. Illustrated..... 253
Strowger Telephone Exchange at Fort Sheridan. Illustrated..... 319
Strowger Telephone Exchange, The Opening of the First. Illustrated..... 245
Strowger Automatic Telephone Exchange Apparatus, The. Illustrated..... 73
Submarine Operations by Electric Light..... 311, 312
Submarine Boat Audace, The Italian. Illustrated.... 63
Submarine Boat and Sims-Edison Torpedo, Baker... 17
Sunbeam Lamp, The Acorn. Illustrated..... 231
Sweden, Electricity in..... 139
Swinburne's Differential Voltmeter. Illustrated 260
Switch, Incandescent Snap. Illustrated..... 312, 313
Switch, Russell Automatic. Illustrated..... 300
Switch, The Iona Snap. Illustrated..... 164
Switch, New Regulating. Illustrated..... 128
Switch, Change Over. Illustrated..... 104
Switch, The Hart & Hegeman. Illustrated..... 65
Switch, Hercules. Illustrated..... 11
Switch, Another Form of Sechrist. Illustrated..... 10
Switch and Fuse Box for Railway Circuits, Combined. Illustrated..... 104
Switches, New Instantaneous. Illustrated..... 104
Switches, C. & C. Illustrated..... 10
Switching Engine, Electric. Illustrated..... 236
Switzerland, Direct Water Driven Dynamos in. Illustrated..... 310

Tachyscope, Steffens'..... 200, 201
Tack Driver, Double Point. Illustrated 128
Tanning, Electrical Method of. Illustrated..... 5
Tax Telegraph Lines, The Right of States to ...257, 258
Taxation of Electrical Manufacturing Corporations.. 293
Telegraph Service at the National Conventions..... 30
Telegraph Set, Portable Combination Telephone and. Illustrated..... 87
Telegraph Key and Sounder, Ludwig's Combination. Illustrated..... 149
Telegraph and Telephone in England..... 161
Telegraph and the People's Party, Government..... 172
Telegraph, Flowers Sent by..... 188
Telegraph Service in New York City, Telephone and 236, 237
Telegraph Lines, The Right of States to Tax....257, 258
Telegraph, Election Returns by Telephone and..... 275
Telegraphers' Strike in Spain, Recent..... 66, 67
Telegraphers, Old Time..... 163
Telegraphers' Strike, Railroad..... 309
Telegraphing by Telephone..... 16
Telegraphing, Cost of Diplomatic..... 184
Telephone Fire Alarm Service, New Paris. Illustrated. 60, 61
Telephone Exchange Apparatus, The Strowger Automatic. Illustrated 73
Telephone and Telegraph Set, Portable Combination. Illustrated..... 87
Telephone Battery, New. Illustrated..... 104
Telephone System, Elihu Thomson's. Illustrated 134, 135
Telephone Girl's Suggestion, A..... 151
Telephone in England, Telegraph and..... 161
Telephone Contracts..... 185
Telephone System, Government Control of the Belgian 189
Telephone Companies, Reproach for the..... 211
Telephone and Telegraph Service in New York City. 236, 237
Telephone Exchange, The Opening of the First Strowger. Illustrated..... 245
Telephone and Telegraph, Election Returns by..... 275
Telephoning, Long Distance..... 209
Telephoning from Chicago to New York 218
Telephoning in Roumania..... 234
Telephoning Under Lake Michigan. Illustrated.... 277
Telltale for Electrolytic Refineries. Illustrated..... 158
Tempering, Electric Forging and..... 18
Tesla Alternating Motor, Operation of the. Illustrated..... 261
Testing Keys, Portable. Illustrated..... 10
Testing Dynamos. By Foree Bain. Illustrated . .. 72
Thermo-electric Generator, Berliner's. Illustrated.. 160
Thermo-Electric Battery, Giraud's. Illustrated..... 199
Thomson's Telephone System, Elihu. Illustrated. 134, 135
Thomson-Houston Search Light on the Steamer Maine. Illustrated..... 173
Thunder Storms in France, Recent. Illustrated 31
Toronto, Convention of Edison Companies at..... 103
Train Signaling, Electric..... 211
Transformers in France, High Tension..... 73, 74
Transmission Device, Power. Illustrated 22
Transmission, Electric Power 148
Transmission, The Future of Electric Power..... 164
Transmission Project, An Idaho Electrical..... 214
Transmission Plant, Interesting Power..... 240
Transmission Scheme, An English..... 331
Trolley, The Improved Love. Illustrated 8, 9
Trolley Wire Hanger. Illustrated..... 19
Trolley Wire Clamp, Another. Illustrated..... 75
Trolley Wire Clamp, Wood's. Illustrated..... 104
Trolley Pole Catcher, Another. Illustrated..... 158
Trouves, Portable Electric Fountain. Illustrated.... 2
Truck, The Robinson. Illustrated..... 8

Underground Wires for Rochester, N. Y..... 134
Unfounded Report, An..... 330

Ventilating Fan, Smith. Illustrated 152
Vibrations by the Aid of Electricity, Magnifying Illustrated..... 21
Victoria, B. C., Electric Plant, Ruins of the. Illustrated..... 159
Volt and Ammeter. Illustrated..... 201
Voltmeter, Swinburne's Differential. Illustrated... 260

Waddell-Entz Electric Exhauster. Illustrated..... 65
Wagner Motor, New. Illustrated..... 214
Walker, Sidney F. What Electricians Mean by "Earth."..... 147, 148
Wall Street, Electrical Talk on..... 213
Washington, Electrical Decoration at 176
Washington Illumination, The. Illustrated..... 187
Washington for Generating Electricity, Utilizing Water Power in. Illustrated..... 261
Water Power Plant, Large Electric..... 50
Water Wheels in Railway Service, Governing. Illustrated..... 257
Water Power in Washington for Generating Electricity, Utilizing. Illustrated 261
Welding, Effects of Electric..... 323
West End Car Stables Burned..... 331
Western Union Building, New York, New Time Ball on the. Illustrated..... 64
Western Union and Postal Telegraph..... 122
Western Union Affairs. 153
Western Union Progress in Chicago. Illustrated. 272, 273
Westinghouse Lamp, New. Illustrated 211
Whaleback Pillsbury, Electric Plant in the. Illustrated..... 325
Whipple, Fred H , Arrested..... 184
Wilder Electric Hotel Call System. Illustrated...87, 88
Williams, James Bowstead, M. D. Oil vs. Air as an Insulating Material..... 277, 288
Willis, M. Compound Winding of Generators from a Practical Standpoint..... 284
Wiping Contact Methods for Current and Potential Measurement. By Benj. F. Thomas. Illustrated. (American Institute of Electrical Engineers) 32
Wiring Computator, New Electric. Illustrated..... 94
Wiremen on a Strike..... 209
Wirt Electrical Indicators. Illustrated..... 300, 301
Wisconsin Electric Club..... 4
Wisconsin Electric Club 219
Wisconsin Electric Club Banquet... 233
Woods, Arthur T., Electric Motors as Substituted for Steam Locomotives 23, 24
Wood's Trolley Wire Clamp. Illustrated..... 104
World's Columbian Exposition (American Street Railway Association)..... 224
World's Fair, Trouble with an Electric Launch at the 9
World's Fair, Electricity at the 16, 31, 45 86, 87, 103, 111, 112, 133, 134, 200, 211, 275, 276, 287
World's Fair, Electricity at the. Illustrated.. ....3, 57, 76, 121, 122, 148, 157, 158, 170, 181, 233 259, 260, 293, 294, 307, 308, 317, 318, 329, 330, 331
World's Fair, Mammoth Dynamos for the. Illustrated..... 183
World's Fair, Chicago, Electrical Features of the Dedication of the, Illustrated. 217, 218, 219, 220, 221
World's Fair, Tower for the. Illustrated..... 308
World's Fair Open Evenings, Keep the..... 251, 252, 253, 258, 259, 271, 272, 282, 283, 299, 323
Wright, J. J., Steam and Electric Power..... 25
Wurts' Method of Arresting Lightning Discharges. Illustrated..... 4

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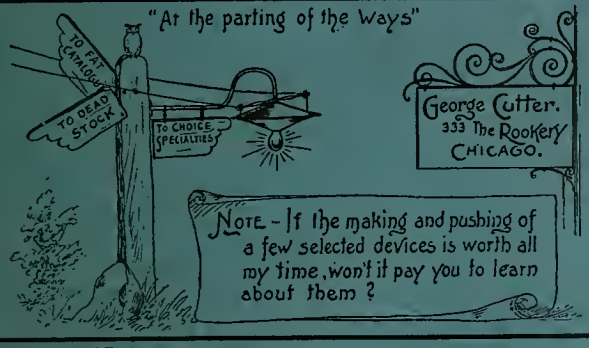

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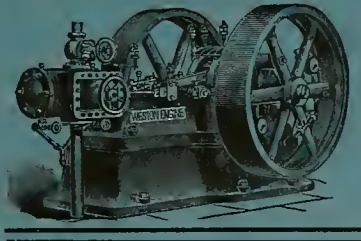

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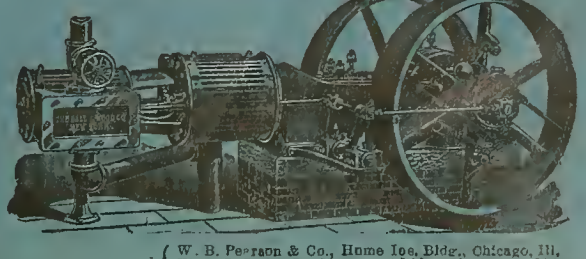

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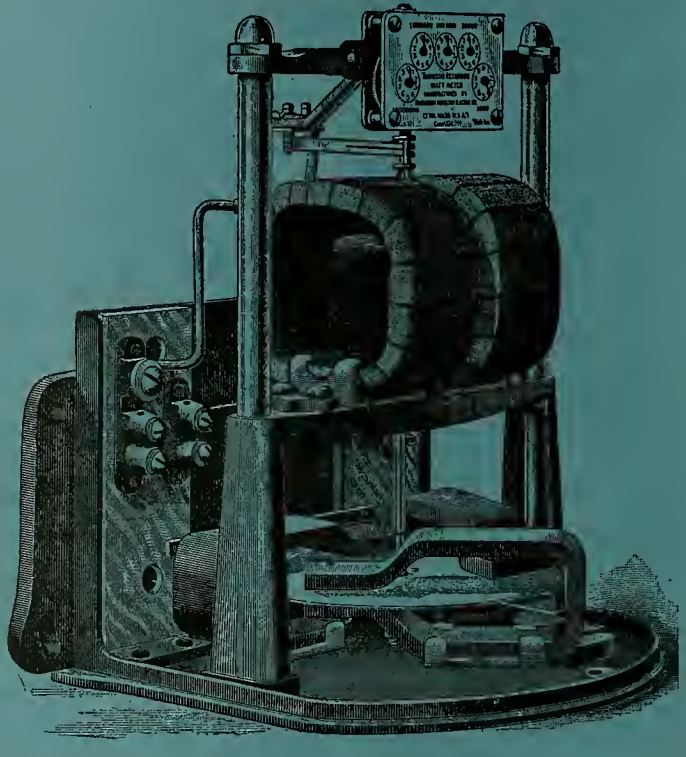

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INDEX AND CLASSIFICATION OF ADVERTISEMENTS.

ALPHABETICAL LIST.

American Desk & Seating Co.. xv
American Engine Co..... xii
Andrae, Julius.....—
Andrews & Co., A. H..... ...—
Babcock & Wilcox Co., The.... i
Baggot, E xiv
Ball Engine Co..... xix
Ball & Wood Co., The i
Beacon Vacuum Pump & Elec. Co i
Becker Mfg. Co., John..... xiii
Beggs, J. E., Mch. & Supply Co. x
Bernstein Electric Co..... .....—
Boston Braid Mfg. Co..... x
Bowers Bros..... xvi
Bristols' Mfg. Co..... ..—
Brookfield, Wm..... xii
Brush Electric Co viii
Bryan, W. H..... xiii
Bryant Electric Co..... xii
Buckeye Electric Co., The..... ix
Butler Hard Rubber Co..... —
"C. & C." Electric Motor Co.. vi
Central Electric Co..... ... v
Chicago Electric Motor Co..... xiii
Chicago Rawhide Mfg. Co..... —
Consol. Elec. Mfg. Co., The..—
Crescent Ins. Wire & Cable Co. xiii
Crocker-Wheeler Electric Co.. xiii
Cushing, F. W..... vii
Cutter, Geo..... i
Cutter Electrical & Mfg. Co... —
Dayton Globe Iron Works Co.. xix
Densmore Typewriter Co..... xii
Detroit Electrical Works..... xxiv
Diamond Electric Mfg. Co.... xii
Dixon Crucible Co., Jos..... xv
Dudley & Co., W. W..... xiii
Duplex Electric Co., Ltd..... —
Eastern Electric Cable Co..... xiii
Easton Electric Co..... x
Edison General Electric Co.....viii
Electric Cons. & Supply Co ... xiv
Electric Engr'g & Supply Co .. ix
Electric Secret Service Co.....xvii
Electrician Pub. Co. .....
Electrical Construction Co.,The. xii
Elec. Eng.& Sup. Co., The....—
"Electrical Progress".....—
Electrical Supply Co., The... xxii
Elektron Mfg. Co..... xix
Emerson Electric Mfg. Co..... ix
Empire China Works.....xviii
Enterprise Electric Co..... xvi
Falls Rivet & Machine Co..... ix
Ferracute Machine Co..... x
For Sale..... x, xii, xiii
Fort Wayne Electric Co..... xxiv
Gravity Purifier Co.....—
Great Western Elec. Supply Co.xvii
Greeley & Co., The E. S.....1
Gregory, Chas. E..... xiii
Hart & Hegeman Mfg. Co..... x
Heisler Electric Co..... —
Hill Clutch Works.....xviii
Hine Eliminator Co.....—
Holmes, Booth & Haydens....xvii
Hunt Machine Co., Rodney... xiv
Ide & Son, A. L..... xiii
Illinois Electric Lamp Co..... xv
India Rubber & Gutta Percha Insulating Co..... xxiii
Institute of Technology..... xiii
Interior Conduit & Insulation Co. x
International Okonite Co..... i
Jewell Belting Co..... i
Johns Mfg. Co., H. W..... x
Kartavert Mfg. Co..... xii
Keller & Degenhardt..... 1
Kelly Brothers .....—
Knapp Electrical Works xxi
Lake, J. H. & D., Co.....—
Lake Erie Engineering Works.xviii
Lane & Bodley Co.....—
La Roche Electric Works.....—
Law Telephone Co..... xiii
Leclanche Battery Co., The....xiv
Lefmann, Julius..... xv
Leffel & Co., Jas..... xviii
Leonard & Co., H. W..... xvi
Link Belt Machinery Co..... xv
Loud, H.M. & Sons Lumber Co.xvii
Lovell Mfg. Co., Ltd..... xiii
Morse & Co., A. M..... xii
Munsell & Co., Eugene.....xiii
Murphy, T. J..... xvi
National Carbon Co..... xiv
National Electric Mfg. Co.... —
New York Insulated Wire Co. xvi
New York & Ohio Co..... 1
Ostrander & Co., W. R..... xix
Page Belting Co..... —
Partrick & Carter Co..... —
Pearson & Co., W. B..... xviii
Pelton Water Wheel Co..... xiv
Perkins Elec. Switch Mfg. Co...ix
Perry & Noyes..... xii
Phoenix Glass Co..... xix
Pierce, Jr., Josiah..... xvi
Pioneer Armature Co..... xiii
Porter-Leavitt Elec. Motor Co. xiii
Powell Co., The Wm..... —
Premier Electric Co., The..... xv
Queen & Co..... xiii
Racine Hardware Mfg. Co.....—
Rae, Frank B..... xv
Railway Equipment Co..... ix
Ries Electric Specialty Co..... x
Rockford Electric Mfg. Co.... xii
Roebling's Sons Co., J. A xv
Rose Elec. Light Supply Co.. xiii
Rose Polytechnic Institute.... xiii
Royal Electric Co.....—
Samson Cordage Works. xii
Sawyer-Man Electric Co..... v
Schindel & Schindel.....—
Schuyler Electric Co.....xviii
Sechrist, Albert..... x
Short Electric Railway Co iv
Shultz Belting Co.....—
Siebert, G..... xiii
Sioux City Elec. Supply Co.... xii
Sioux City Engine Works.... xix
Smith, A. T.....—
Smith, Thos. G. Jr.....—
Somoff, J. L.....—
Sperry Elec. Mining Mach. Co. xvi
Standard Paint Co xiv
Stanley Electric Mfg. Co..... xvi
Star Electrix Co... xv
Stearns Mfg. Co..... xix
Sterling, W. C..... xv
Stilwell & Bierca Mfg. Co. xiv, xv
Sunbeam Incand. Lamp Co ...xxiii
Taylor Engine Co.....—
Thomson-Houston Elec. Co...ii, xx
Union Hardware Co..... xii
U. S. Electric Lighting Co..—
Utica Elec. Mfg. & Supply Co. x
Van Nuis C. S..... i
Vulcanized Fibre Co..... xv
Waddell-Entz Company..... xii
Wannopee Pottery Co..... xv
Wanted..... xiii
Western Electric Co..... x
Westinghouse, Church, Kerr & Co..... iv
Westinghouse Elec. and Mfg Co..xi
Weston Engine Co..... i
Williams Engine Works..... xii
Woodhouse & Rawson, Ltd....—
Worthington, Henry R..... xii

CLASSIFIED LIST.

Annunciators.
Central Electric Co.
Detroit Electrical Works.
Electrical Construction Co., The.
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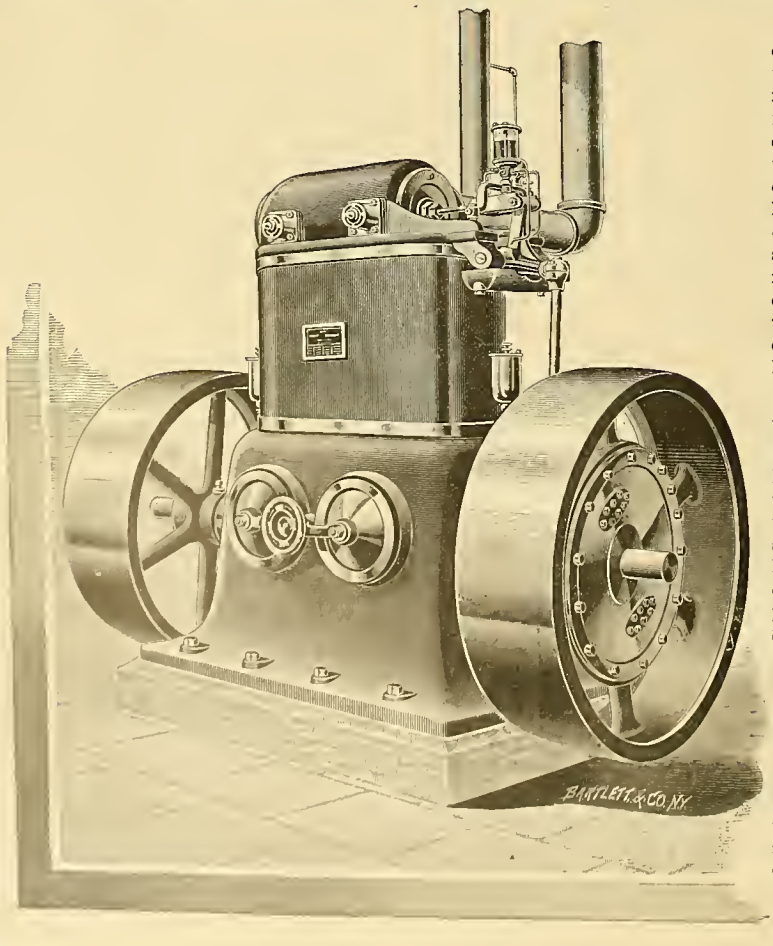

The Compound Engine, when non-condensing, so far from possessing an economy superior to the Simple Engine, has been decisively proven, "much to the disgust of the stockholder," to show normal economy only at or about its rated power, and to fall off in economy faster than a Simple Engine as the load falls off; moreover, very much faster under the extreme light loads that are common in Electrical Generation. This point is at last reluctantly admitted by the more candid builders of such engines, most of whom now advise against compounding for variable loads. The reason is in their inability to divide the load and range of temperature proportionately and automatically between the cylinders at all points of cut-off. Hence, the low-pressure cylinder expands its steam below atmosphere under a moderately early cut-off, thus converting itself into an Air Pump, and becoming a load upon the high-pressure cylinder instead of a co-laborer with it. This point was distinctly foreseen by the designers of the Westinghouse Compound Engine, and an entirely new principle was worked out, making expansion below atmosphere impossible under any load, however light. **For the first time in the history of Steam Engineering, either Simple or Compound, is built an Engine which maintains essentially uniform economy, irrespective of load,** and hence for the first time the Compound Non-condensing Engine has been made practicable. The results, demonstrated by test, show that where an ordinary Compound will range from 25 lbs. to 70 lbs. water per H. P. per hour from full to quarter load, the Westinghouse Compound, between the same limits, will range from 23 lbs. to 29 lbs. We have not deceived ourselves in this matter, and propose that the facts shall be understood. To those interested in the nicer points involved, we will be pleased to send a reprint of the paper read by Mr. F. M. Rites on this subject at the late meeting of the American Society of Mechanical Engineers, at San Francisco.

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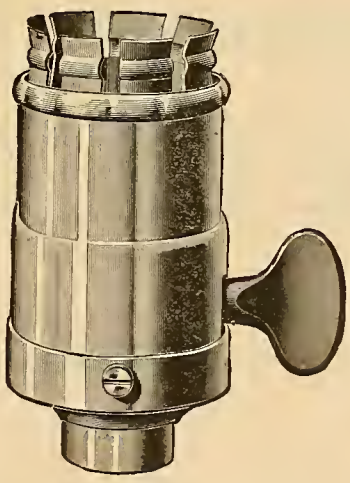

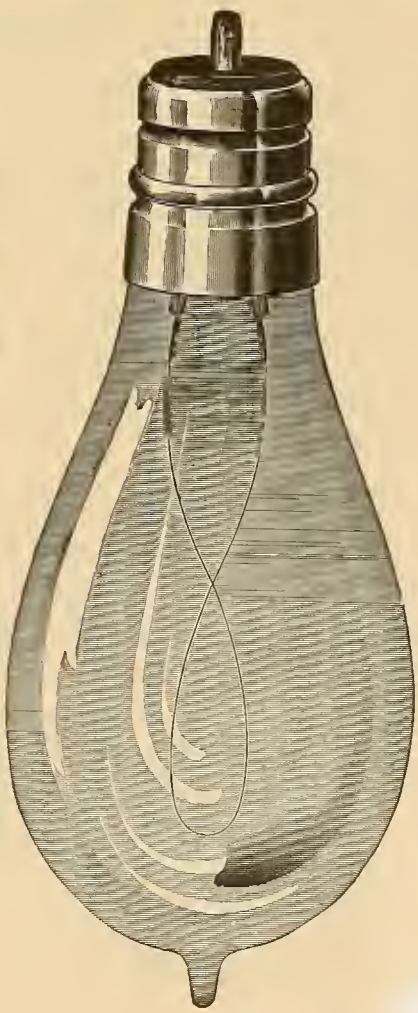

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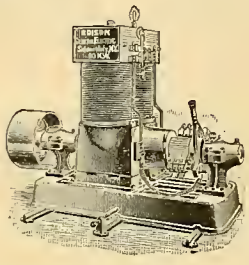

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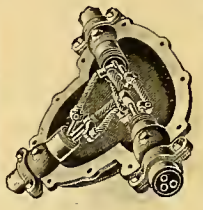

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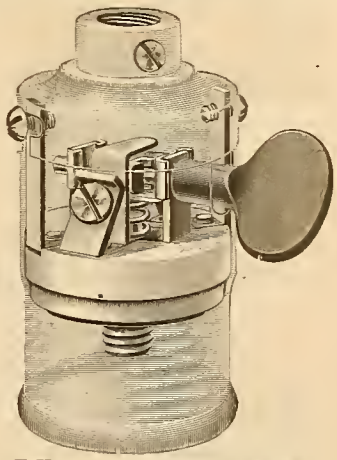
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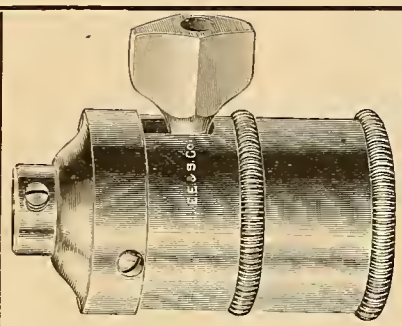

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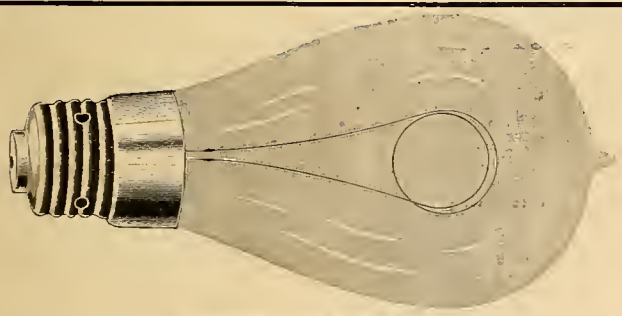

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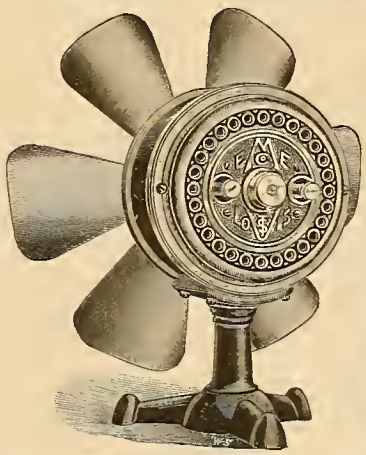

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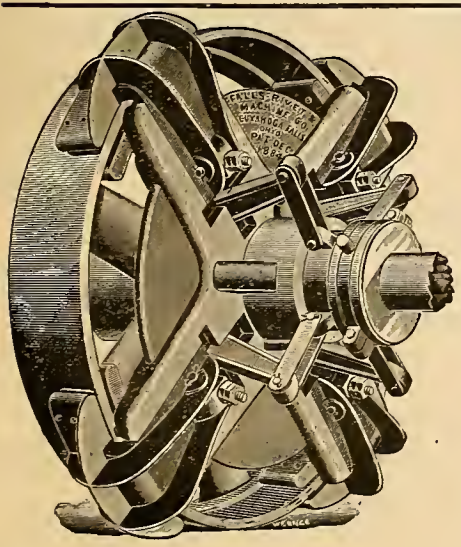

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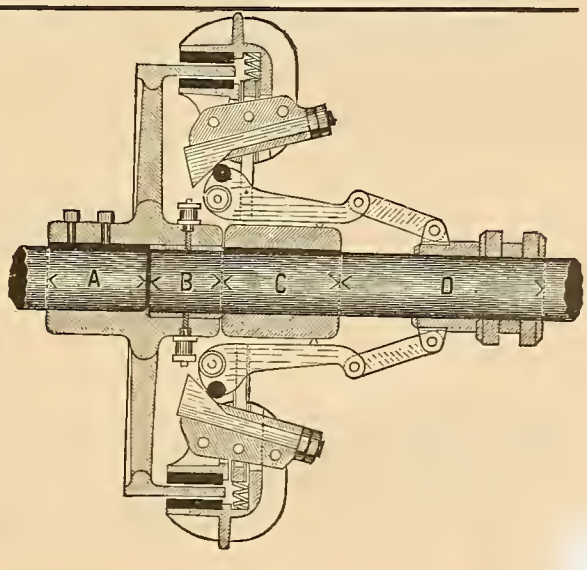

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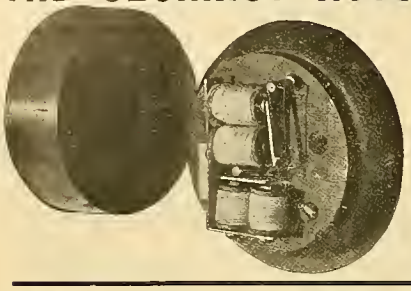

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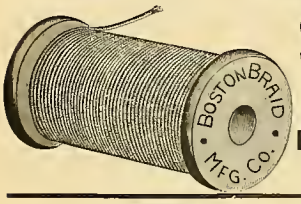

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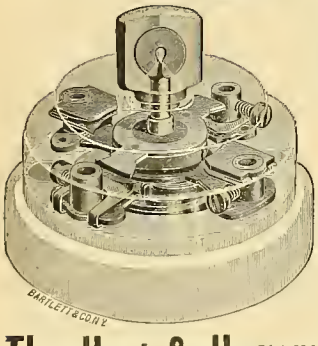

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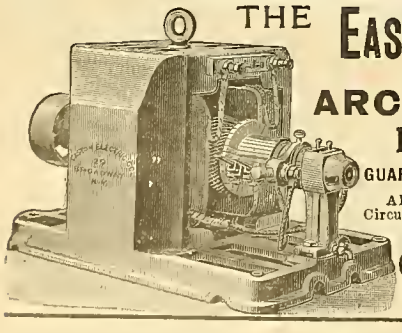

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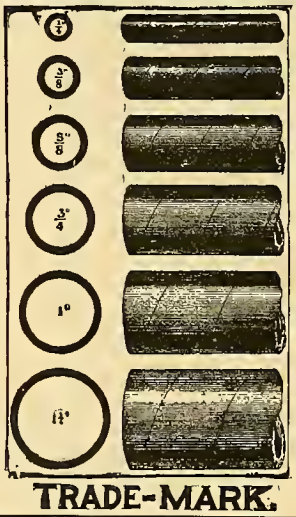

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NOTICE!!!

The Westinghouse Electric & Manufacturing Company will, at its own cost and expense, defend any and all suit or suits that may be instituted by any party against purchasers for the alleged infringement of patents, when such alleged infringement shall consist in the use of apparatus manufactured and sold by it.

We call the attention of users of electric railway and lighting apparatus to the attempts being made by the Edison-Thomson-Houston electric combination, or Trust, to secure, by threat and otherwise, a monopoly of the electric lighting and power business, which they are not entitled to, and cannot secure by means of their patents. If they could succeed in frightening users into entering into contracts binding them to take only the apparatus supplied by the Trust, then such users would be subject to a contract which they might have some difficulty in setting aside.

A proposed contract submitted by the Trust to one of our customers indicates that they intended to bind such customer to use exclusively apparatus manufactured by the Trust, and on such terms and for such prices as the Trust might name from time to time; and it is a fair presumption that the Trust would exact a margin of profit greatly above what is generally considered a fair manufacturing profit, in order to pay dividends on their immense capitalization (fifty million dollars capital stock, ten millions of which is preferred) and the interest on the proposed issue of ten millions of bonds.

The users of electric lighting and power apparatus, however, by refusing to purchase, except upon the terms and conditions on which they ordinarily purchase machinery, i. e., with the right to go into the open market unhampered to purchase their future supplies, or repairs, or alterations (as they should do), will always be free to select the best apparatus and details.

The Westinghouse Electric & Manufacturing Company sells all of its apparatus and makes all of its contracts on the above basis, and has never done otherwise, relying for future sales upon the merit of its apparatus.

We suggest the following as worthy of your careful consideration :

1. Enter into no contract with any electric light or power company except with respect to each purchase, and see that there are no hidden limitations or unreasonable provisions.

2. See that every contract contains a clause substantially as follows, for your protection as to patent matters, which clause is inserted in all of our contracts:

"The company shall at its own cost and expense defend any and all suit or suits that may be instituted by any party against the purchaser for the alleged infringement of a patent or patents, when such alleged infringement shall consist in the use of any apparatus, machinery or device, or parts thereof, manufactured or sold by the company, for which the purchaser shall have made all payments then due, provided that immediate notice of the institution of such suit or suits be given in writing by the purchaser to the company, and that the purchaser shall permit the company, through its counsel, to defend the same, and shall give all needed information, assistance and authority to enable the company to do so, and thereupon, in case of an award of damages in such suit or suits, the company shall pay such award, but the company shall not be bound to defend any such suit or suits, nor to pay any damages therein when the same shall arise by reason of the use of parts not furnished by the company."

3. Bear in mind that the agents of the Trust and its stockholders are numerous, and that specious arguments may be advanced, and threats used, to induce you to bind yourself to purchase apparatus only of the Trust.

4. If users of electric apparatus will act judiciously, then no Trust or Combination can expect to receive a higher price for apparatus than is warranted by fair competition.

When the Westinghouse Electric and Manufacturing Company entered upon the manufacture of railway apparatus, the price charged by the present members of the Trust was about $3,500.00 per car equipment. One-half of the above figure is the asking price to-day, and this reduction has been brought about by competition.

WHAT THE TRUST WOULD CHARGE IF THERE WERE NO COMPETITION.

The members of the Electric Trust (Thomson-Houston, Edison General, Fort Wayne and Brush Companies) made bids for the incandescent lighting of the World's Fair, in each instance amounting to about $1,800,000.00, and they have since offered to do the same work for $550,000.00, the result of our competition.

We invite the co-operation and support of all users of electrical apparatus, who desire to have the benefits of competition.

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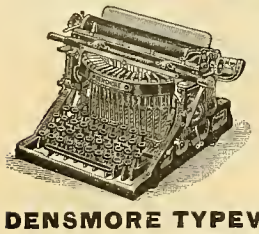

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A board of experts appointed by the government to examine and receive bids on the best machine, unanimously reported that the **Densmore** contained more points of excellence than any other, and that it was the best machine of all.

We will appoint a reliable dealer in unoccupied territory as soon as possible, and in the meantime will ship machines on approval to parties having a good commercial rating.

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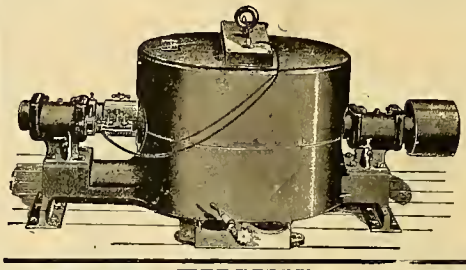

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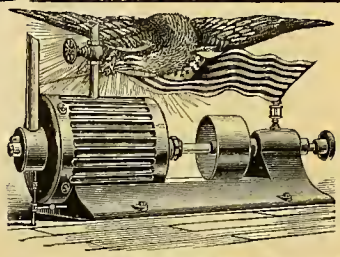

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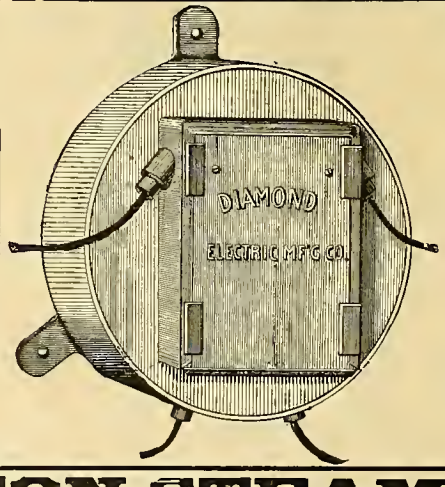

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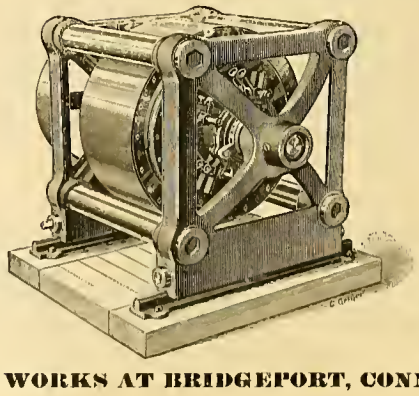

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Western Electrician.

EVERY SATURDAY.

Vol. XI. CHICAGO, JULY 2, 1892. No. 1

Electric Stamp Canceling Machines in the Chicago Postoffice.

Chicago may be the unhappy possessor of a postoffice building that gives signs, from time to time, of an eventual downfall, and the government employes who are engaged in these dark and poorly ventilated offices may complain, and not without cause, of the miserable accomodations. It cannot be said, however, that the local officials are not desirous of improvements. For a long time the postoffice officials have desired a much needed innovation. New York, Washington, Boston and several other cities, east and west, have had electrical stamp canceling machines at work in their postoffices with uniform success. The Chicago office has been pleading for the privilege of being allowed, in this one instance at least, to show the world that it was not behind the times. At last the office's requisition was approved and four electrical canceling machines were shipped.

Heretofore all the letter stamping of the Chicago postoffice has been done by hand, but now the electrical labor-saving machines will handle the letters in a much briefer period and do better work with less experienced manipulators. For two weeks there have been awaiting installation four mysterious machines that have caused much consternation in the hearts of the postoffice stamping boys. On Friday of last week, though, the blow fell, for on that day a successful trial of the Hey & Dolphin, New York, canceling machines was made.

At present there are four machines here and the accompanying cut will show the curious reader how the canceling is done in the World's Fair city's postoffice.

Each machine is capable of canceling 30,000 letters hourly. This will relieve twenty expert stampers for other departments. The help needed to manipulate a canceler will be two boys, not necessarily experts, one to feed, the other to empty the receiver of the machine. These machines are automatic, the boys running them in very much the same manner as they would handle a feed cutter on a farm. The propelling power is obtained from the small 110 volt Diehl electric motors shown in the picture beneath the tables. The letters are bunched, stamps down, on a leather belt. They are carried to rubber rollers, where they are separated automatically, counted, stamped and delivered on a receiver ready for sorting for mailing.

Besides being more rapid, the stamping is more uniform, perfect and clear than by hand work. Any envelope under six inches in width can be used.

The officials in the department think the innovation a valuable one. Not only does the canceler do the work in a better manner and much faster, but it occupies very little space, probably not over three feet square. This is quite an item at present. Other machines will probably follow if the ones on trial meet expectations.

ELECTRIC STAMP CANCELING MACHINES IN THE CHICAGO POSTOFFICE.

Testimonial Banquet to Samuel Insull.

At Delmonico's, New York, on Friday evening, Jun e 24th, a banquet was given to Samuel Insull, late second vice-president of the Edison General Electric and General Electric companies, who is moving to Chicago in order to assume the duties of president of the Chicago Edison company, to which he was elected recently. About forty gentlemen well known in electrical circles sat down to dinner, including T. A. Edison, C. A. Coffin, Major Sherburne Eaton, Capt. Eugene Griffin, Samuel and Joseph Insull, S. D. Greene, O. T. Crosby, J. I. Beggs, C. L. Edgar, R. T. McDonald, C. D. Shain, J. H. Herrick, J. Kelly, John Muir, F. R. Upton, A. S. Bayes, John S. Wise, John Kruesi and E. W. Little. Speeches were made by Messrs. Eaton, Insull, Wise, Johnson, Ord, Lewis, Beggs, Edgar and others. During the evening Mr. Insull was presented a solid silver punch bowl, on which were engraved the names of some fifty donors, including those already mentioned and Henry Villard, Carl Schurz, H. Ward Leonard, F. S. Hastings, C. H. Coster and J. Drexel

Morgan & Co. The evening was a most delightful and interesting one, and the fact that Mr. Insull began his career eleven years ago in this country as private secretary to Mr. Edison, at the very beginning of the modern industries of electric light and power, elicited a number of reminiscences of the early stages of the art. Mr. Insull is to leave New York for Chicago at once to take up his permanent residence in the city which he says is destined to be the best field in the world for a strong and progressive company manufacturing current twenty hours of the day, every day of the year.

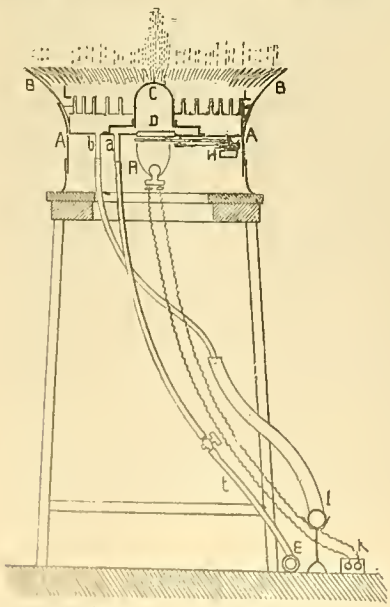
The Electrical "Doctor" at Hot Springs.

Physicians disagree on a great many scientific points, and among the questions that they have been unable to decide satisfactorily is that all-important one relative to the physiological effects of the electric current. According to the quacks all one has to do is to pass the "galvanic" or

THE ELECTRICAL 'DOCTOR" AT HOT SPRINGS.

the "faradic" current through the diseased part and a cure is the inevitable result. It is a curious thing how it is that many otherwise intelligent men will allow the delusive, yet fascinating, word "electric," displayed on a belt in big bright letters, entwined with numerous zigzag representations of lightning flashes, to influence what otherwise appear to be well-balanced minds. Such is the case, however, for the electric belt man still flourishes, and into his already well-filled coffer there seems to flow a never-ending stream of dollars.

A prominent physician of Chicago was recently asked for his opinion as to the use of electricity for medicinal purposes. His answer was evidently an honest one, for he expressed the belief that most physicians in applying electrical treatment worked very much in the dark. He himself he confessed, often worked by "feeling," so to speak; that is, when he thought a patient might be "eased" by an application of the electric current he made the experiment. If the result was a lessening of pain the electricity was turned on again; if the current afforded no relief, another remedy was resorted to. From this it is reasonable to pre-



TROUVE'S PORTABLE ELECTRIC FOUNTAIN.

sume, then, that with one class of learned men electricity is indeed "in its infancy."

However this may be, the scientists still continue to experiment upon the trusting patients, and without a doubt in a number of cases the stimulating effects of a judicious administration of current, aided by a little scientific juggling and a vivid imagination, accomplishes no little good.

An excellent example of the extent to which electricity is applied in a legitimate manner as an aid to other and better understood medicinal agents, is illustrated in the accompanying engraving. The subject of the illustration is an electric bath tub, which, it is said, constitutes an important adjunct to the hot water treatment at Hot Springs, Ark. A representative of the WESTERN ELECTRICIAN had an opportunity to see this device while passing through Hot Springs recently.

It is "Electrician" Johnson, or "Dr. J. W. Johnson," a handsome colored man, who administers the "faradic" and the "galvanic" doses to suffering humanity. One's admiration is excited by the skillful manner in which "Dr. Johnson" handles the innumerable switches and wires, to say nothing of his fluency in the use of medical terms sufficiently impressive to excite the confidence of a patient. The "doctor" was an enthusiast, and most willingly explained how the electric bath was administered. The "instruments," wires, and ammeter, "terminals," sponges, etc., were produced, and "Dr. Johnson" busied himself connecting his "McIntosh" apparatus with the seventy "bat'ries" concealed in the cupboard.

"Dr. Johnson" was now in his element, and proceeded to show how the five nickel plated knobs on the sides of the porcelain lined tub were connected to send out through the heated water the revivifying streams of current that so gladdened the heart of the rheumatic sufferer. But it was not until the lumbago treatment was explained that the climax was reached. Here the "doctor's" talents were exhibited to an advantage. The device has been in successful operation at the Springs for some time.

Trouve's Portable Electric Fountain.

A brilliant feature of the fête of May 14th, at Paris was a group of nine luminous fountains designed by M. Trouve. They are novel in design, and were so constructed that they could readily be moved from one place to another. A general idea of the fountains may be gained from the diagram. In a basin *A* is mounted a bell-glass *C*, in the top of which are nine holes through which as many jets of water may play. Water taken from the city main at *E* runs through a rubber pipe *a* into the bell-glass. The pressure is sufficient to force it through the holes at the top, and the jets fall into the basin *A*, whence the water runs through the discharge pipe *b* into an escape pipe *I*.

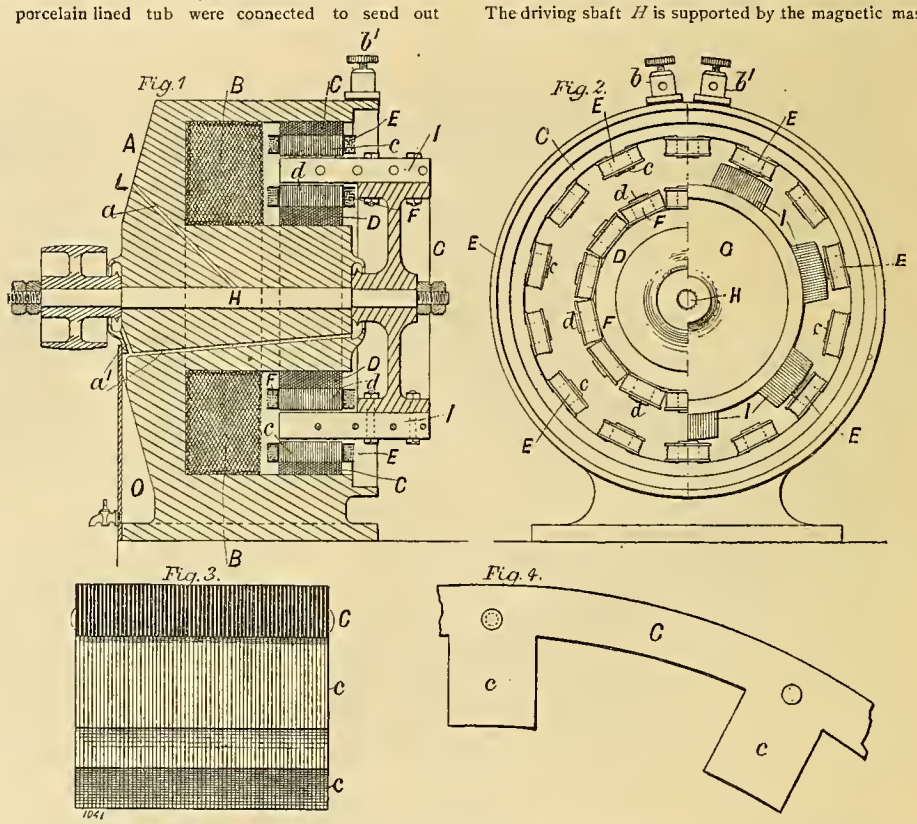
Below the bell-glass is a plate of glass *D* through which rays from an incandescent lamp are reflected parallel and vertically by a parabolic mirror *R*. Current is taken from mains laid in a moulding on the ground, *K*.

Between the mirror and the plate of glass *D* is a glass disk with sectors painted in different colors. It turns slowly being moved by clock work *H* and making a complete turn every three minutes. The revolution of the parti-colored disk causes the jets of water issuing from the bell glass to change constantly in color, and the effect is extremely striking and beautiful. The fountain is appropriately ornamented at the top and is maintained in position by stout supports. The cut is from *Le Genie Civil*.

New English Alternating Dynamo.

A new English alternating machine which has been attracting considerable attention, is illustrated in the accompanying cut. This dynamo, says London *Engineering*, embodies the following advantages: The whole machine is solid and consists of but two castings, iron stampings and coils. Fig. 1 represents a vertical section. The portion marked *A* is a magnetic mass forming an annular space for the inducing coil and inclosing the latter on three sides. *B* is the inducing coil which is surrounded with a mass of magnetic material on its inner and outer circumference and on one of its faces. On the extension of this magnetic mass flat annular laminæ, consisting of soft charcoal iron stampings *C* of the shape shown in Fig. 4, are placed and arranged so as to form a continuation of the field magnet, provided with the necessary polar projections. These laminæ are rigidly fixed to one another and to the field magnet as shown in the figures. Fig. 2 is an end view, the right half being shown with the inductors in position and the left half without them.

The driving shaft *H* is supported by the magnetic mass and carries at one end the inductors *I*, while at the other end is fixed the driving pulley. The shaft is lubricated by means of a longitudinal groove, which is supplied from a lubricator *L* through an oblique passage *a* as shown. The inductors are of approximately equal breadth to the distance from center to center of contiguous pole-pieces *E*. They are subject to great magnet strains, to resist which requires extreme rigidity. They are built of soft iron laminæ, which are rigidly fixed in place by strong bolts and strongly supported by strengthening plates between them. The plates are separated from each other by thin sheets of paper, as is usual, steel sheets being used for the strengthening laminæ The inductor carrier *G* which is of gun-metal is mounted on one end of the driving shaft.



FIGS. 1 TO 4. NEW ENGLISH ALTERNATING DYNAMO.

Current is produced by revolving the magnetic inductors in proximity to the magnet which is provided at both poles with polar projections *c* and *d*, serving as cores for the conductors *E* and *F* in which the current is to be induced, the object of the inductors being to complete the magnetic circuit alternately through each set of polar projections. An even number of polar projections are employed, and the revolving inductors are arranged so, that in proportion as one pole is being demagnetized, the magnetism of the other poles increases, and *vice versa*, thus the total magnetic effect is always approximately constant. The induced current conductor is so arranged that the polar projections which are being magnetized and those which are being demagnetized have a similar inducing action upon it, the magnetising of one set of polar projections thus increasing the effect produced on the same wire by the demagnetization of the other

set of polar projections. The 100-light machine is 15 inches wide, 20 inches long, and 21 inches high over all. Mitis metal is used for the main casting, and is found to have a magnetic conductivity equal to 60 per cent. of steel and wrought iron. The exciting current required on full load is 6 amperes at 50 volts.

Direct Coupled Dynamo and Engine.

Direct coupled dynamo and engine plants are now being introduced to a considerable extent, and in this respect American engineers are following the practice of their English cousins.

DIRECT COUPLED DYNAMO AND ENGINE.

The plant herewith illustrated is the one now in operation at the New York Biscuit company's works on Tenth avenue, New York, and it may be taken as a good example of this tendency.

The building has a frontage of 206 feet on Tenth avenue, and runs back 506 feet on Fifteenth and Sixteenth streets. It is divided by a large court into two separate buildings, for the convenience of vehicles and is six stories high.

The plant is located in the cellar on the Fifteenth street side, occupying a space of 8½ by 15½ feet. The engine is of the Armington & Sims, 9½ by 10 double engine type, coupled direct on separate bases, by means of a Billberg insulated flexible coupling, to a two pole machine of the Billberg standard patent. The dynamo is compound wound for a constant potential at the brushes and has a capacity of 95,000 watts. Under a steam pressure of 100 pounds of steam and making 395 revolutions per minute, the machine supplies current for 1,400 incandescent lamps at 115 volts and six Ward arc lights. A 4 inch Hine eliminator is used in connection with the engine for supplying dry steam. Habirshaw and "E. M. W." wire is used throughout the building.

As will be seen in the accompanying illustration, the carbon brushes are on a brush standard mounted in a lug that is cast with the base of the machine. The brushes are set at a proper point on the commutator and remain constant for all loads, thereby doing away with any quadrants.

The switch-board is 7 by 4 feet, and made of soft green slate furnished by T. J. Murphy, of New York, and is of especial interest in itself, being made in cabinet form so that all wires are accessible at the back by means of a little side door. The board contains 17 distributing switches, one 800 ampere motor switch and one 800 ampere main light switch. The switches are of the Billberg type; the voltmeter is from Queen & Co. The Schuckert ampere meter is used. The switches are supplied with the Billberg patent fuses, each of which consists of strands of German silver wire.

Between 4 and 7 A. M. this plant generates current for a 100 horse power 110 volt motor, shunt wound, the line of shaft being cut off the main line by a Hunter clutch. This motor is used to run 43 dough mixers. Edison lamps, sockets and fixturers are used throughout the entire building. Newton L. Schloss, New York manager for the Thomas H. Dallet company, of Philadelphia, superintended the installation of this plant.

Electricity at the World's Fair.

The accompanying illustration gives a glimpse of the electricity and mining buildings at the World's Fair, made from a photograph taken on June 20th. The former building is shown on the left, and the picture gives a good idea of the ornamental towers of this beautiful structure, although they are still, of course, in an unfinished state. The apsidal projections on the northern end of the building are shown. The more prominent one in the picture, forming the northwestern corner of the building, will be principally devoted to foreign exhibits—notably those of France. In the foreground is the lagoon, while on the extreme left a glimpse of the wooded island is visible, with the great traveler used on the giant trusses of the manufactures building towering above it.

Lightning crippled the temporary lighting and power plant at Jackson Park to a considerable extent last week. The atmospheric electrical disturbance short circuited the armatures of one of the arc light machines and a power generator. To add to the confusion one of the engines broke down, and trouble was also caused by the continuous and heavy rains, which saturated the buildings with water, and at one time flooded the floor. For a time five dynamos out of eight were disabled. A fifty light Standard arc dynamo was procured from down-town, but it was a new machine that had never been tested, and, after running three or four hours, it refused to work. A thirty light machine of the same company's manufacture was then temporarily installed, and at the close of the week this dynamo was working satisfactorily and furnishing current for the arc lamps that were used. At one time the switch-board caught fire, but the flames were extinguished without great difficulty.

ELECTRICITY AT THE WORLD'S FAIR.

Frederick Sargent, mechanical and electrical engineer of the construction department, left for New York on Thursday of last week to confer with the engine builders who are to furnish the engines for the great central station plant.

Up to Saturday of last week no official tests of electric launches had been made at the World's Fair. In addition to the obstructions in the lagoons, alluded to in the last issue of this paper, difficulties were encountered owing to the storms that partly disabled the electrical plant, thus rendering it impossible to get current for charging the cells for two or three days. It is also reported that the compartment containing the motor in one boat became flooded, and that the armature was short circuited in consequence. Both of these accidents served as lessons, however, and it is safe to say that the permanent light and power station will be provided with the best lighting arresters that can be obtained and protected in every possible way against the elements, and also that the electric launches for commercial use will be provided with water-proof motor pits. The high water in the lagoons, with the swift current, also interfered with the trial trips. It is a curious fact that this current is intermittent—that is, it will flow rapidly in one direction for, say, half an hour, and then quickly change and rush toward the opposite point of the compass. A number of observers in an electric launch moored in the basin, near the new iron bridge spanning the canal at the southern ends of the manufactures and electrical buildings, noticed this phenomenon on Friday of last week. Nobody seemed able to account for it.

July 1st is the date set for the beginning of the allotment of space in all the departments of the World's Fair.

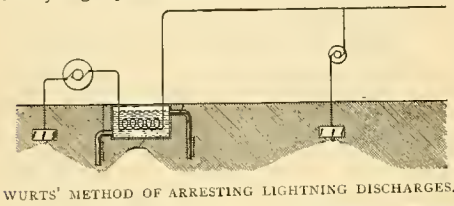
The World's Fair authorities and the Westinghouse people have come to a satisfactory understanding in relation to the bond to be furnished by the company for the faithful performance of its lighting contract. On Saturday of last week it was stated at the office of the committee on grounds and buildings that Mr. Westinghouse had telegraphed that he would appear before the committee on Monday and perfect an arrangement acceptable to the committee. The directors required that Mr. Westinghouse give an individual bond of $500,000, in addition to that of the Lawyers' Surety company, or else that the latter company guarantee its bond by an indemnity bond. The latter condition was complied with.

The Leavenworth, Kan., Coal company is installing electrical machinery in its mine. The vein of coal in the Leavenworth mine is 22 inches in thickness, and all the coal mining in that vicinity has heretofore been done by the miners in a recumbent position, picking the coal from above. The machinery now being placed in position will do the work of 40 miners, while its cost of operation will be slight.

Wurts' Method of Arresting Lightning Discharges.

To ground either one or both sides of a two-wire electric lightning circuit is, generally speaking, not considered to be good practice. Alex. Wurts of Pittsburg has, however, devised an arrangement of the circuit in which one or both sides are in direct connection with the ground, and his claim is that this disposition of the conductors acts to provide reliable and efficient means for preventing injury to electrical apparatus in the circuit from static discharges, which are especially liable to take place during the prevalence of thunder-storms or other atmospheric electrical disturbances.

By passing the main conductor through a conducting medium—such, for instance, as a body of water—and forming a good electrical connection between the earth and the vessel containing the conductor, electric currents of considerable potential may be caused to pass through the conductor without material leakage, even though the other pole of the system be grounded, and yet a sufficiently good conduction to earth will be afforded for currents of very high potential—such, for instance, as atmospheric discharges. It is this fact upon which the Wurts method is based.



WURTS' METHOD OF ARRESTING LIGHTNING DISCHARGES.

The cut will make clear the Wurts arrangement. The main conductor is laid from the generator through a tank containing suitable conducting material—such, for instance, as water. From this on it becomes the line circuit. The portion of the circuit which is contained within the tank is wound into a coil for the purpose of affording as much impedance as practicable to currents of the character of static or lightning or atmospheric discharges. The tank itself is formed with a wall of good conducting material for the purpose of forming as perfect an electrical connection with the earth as possible. It may be connected with water mains and be supplied with water from them. The apparatus supplied with current from this circuit is located beyond the tank, as indicated in the cut, and the circuit connections are continued from the conductor through the machine to the earth.

Rutherford's Arc Lamp.

The mechanism of the peculiar-looking arc lamp illustrated herewith consists essentially of two crossed levers pivoted at their point of intersection. One lever carries or has attached to it on each side of its pivot, a solenoid magnet in the main circuit, and the other lever has two similar magnets included in a shunt circuit to the arc. The cores of each set of magnets are carried by the opposite levers—that is to say, the cores of the shunt magnets are attached to the lever carrying the main solenoids, and the cores of the main solenoid are attached to the lever carrying the shunt solenoid. The carbon electrodes are preferably in the form of disks rotatable on the bearings and carried on the ends of the two levers.

The operation of the lamp is as follows: When no current is flowing the weight of the mechanism holds the edges of the carbons in contact. When the current is turned into the lamp the main magnets become strongly energized, and the pull which they exert on their cores separates the adjacent ends of the levers and establishes the arc between the carbons. When the arc becomes too long, the resistance thus caused forces current to flow through the high resistance shunt magnets, causing them to attract their armatures and draw the adjacent ends of the levers together, thus shortening the arc and making it again normal.

The carbons are described as made in the form of disks, but when so formed means must, of course, be provided for rotating them in order to entirely consume them. Mounted, therefore, upon each lever, there may be a frame carrying a clockwork, which engages with the pinion on a sleeve carrying the carbon disk. This clockwork may be made to rotate the disk as slowly as desired.

N. F. Rutherford of Bathurst, New South Wales, is the inventor of this lamp.

The City & Suburban Railway company of Baltimore has been formed by the consolidation of the Baltimore & Hampden, Union and Highlandtown & Point Breeze Street Railway companies. The new company will control sixty-one miles of track, and will operate the greater part by electricity. The capital stock is $3,000,000.

Modern Views of the Electric Current.[1]

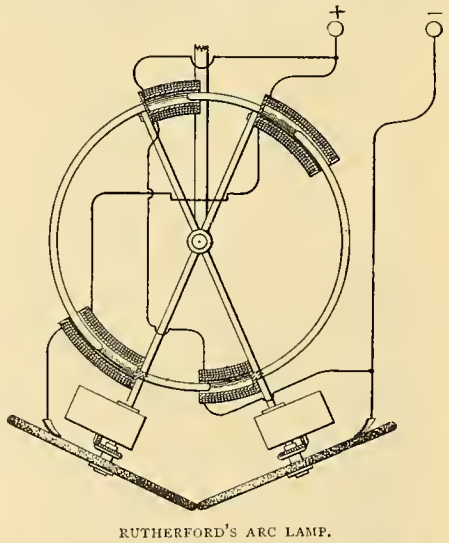
By H. B. Loomis.

The object of this paper is to give a sketch of modern views of the electric current. The subject deserves serious attention. Such work as that of Mr. Tesla threatens at any time to make it part of the stock in trade of the electrical engineer.

It is universally recognized that the analogy between a current of electricity and water flowing in a pipe must not be carried too far. Even the beginner in electricity is brought face to face with a most striking difference between the two. The electric current produces an effect outside of the wire, it acts on a magnetic needle, while the effects of the current of water are confined to the pipe. This difference is fundamental, and is leading to a careful study of the region about the wire, for as the phenomena there are inseparable from the electric current, the medium about the wire must play as important a part as the wire itself.

I shall first state the theory advanced by Profs. Heavyside and Poynting and then give some experiments due to Prof. Hertz in support of it. They claim that the energy is transmitted through the dialectric, and, so to speak, rains down upon the wire and is there absorbed and changed into heat. An electric current flows in the interior of a wire only as the disturbance penetrates from the surface. The laws which govern this penetration are the same as those governing the change in temperature in a conductor of heat. Take an iron bar at 60° and place it in a box which is kept at 70,° the bar is eventually heated to 70° throughout. Again, place it in a box whose temperature is rapidly alternated between 50° and 70°. The surface of the bar follows the fluctuations in temperature, but in the center these changes are slight. Scarcely has it begun to be heated when a cold wave comes and chills it. It is easily seen that if the alterations in temperature are moderately rapid, a thermometer in the center of the bar will not be perceptibly affected. These two cases correspond to continuous and alternating currents respectively. In the first, the tendency is all in the same direction, and the current penetrates to the center of the wire and flows equally throughout the whole cross-section. With a current of a few hundred alternations a second this is no longer the case; most of the disturbance is in the outer layer of the wire. If there are millions of alternations a second, it is only skin deep, the interior of the wire carries no part of the current, and Sir William Thomson has recently shown that the core of the wire is even a positive detriment.

Do the facts agree with the above? Prof. Hertz has established a perfect agreement by a series of beautiful experiments, a few of which I take pleasure in repeating. Let us see clearly what we are to determine. We wish to decide whether rapid electrical oscillations are confined to the surface of a wire; as they pass along it whether the interior knows anything of their passage. If we take a wire and cover part of it with a metal cage and find that the part so covered no longer carries a current, but that it all passes over the cage, we have shown that the interior is free from disturbance. This is exactly what Hertz did. An alternating current is obtained from his famous vibrator and set along a wire. This is broken at one point and



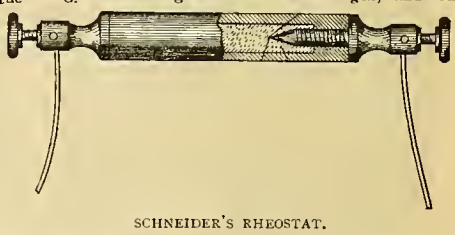
RUTHERFORD'S ARC LAMP.

brass knobs are soldered to the ends forming a spark gap. Three or four inches from the end of the wire, which is connected with the generator, is soldered a circular metallic disk (diameter 4 inches) with its plane at right angles to the wire. Over the other piece of wire, which is preferably insulated, a brass tube is slipped, and to the end near the spark gap is soldered a duplicate of the above disk. Sixteen holes are bored in the edge of these disks equal distant from one another. The other end of the tube is connected with the wire by wrapping it with tin foil. At first the sparks are strong. I insert a wire in corresponding holes of the two disks, immediately the sparking is less vigorous. This is not a matter of resistance. The effect is the same whether the wire is thick or thin. Another wire on the other side of the gap diminishes the sparking still more and when all the wires are in, it is utterly impossible to obtain a spark. Hertz replaced the brass tube by a silvered glass tube, thus obtaining a thin coating of metal, still no spark could be obtained. This was in turn replaced by others having thinner and thinner coatings of metal. At last a point was reached where sparks were obtained, but it was not until the silver was so thin as to be no longer opaque. It was certainly less than $\frac{1}{2500}$ of an inch thick. Imagine this layer drawn closer and closer around the wire until it forms its outer surface, and we see to how slight a depth these rapid oscillations penetrate. Prof. Hertz says: "For the real seat of these waves we ought not to look, therefore, in the wire, but rather to assume that they take place in its neighborhood, and instead of asserting that our waves are propagated in the wire, we should be more accurate in saying that they glide along on the wire."

The fol'owing is condensed from an article by O. Heavyside in the *Electrician* for January, 1885: "The energy is poured out from the battery side-ways into the dielectric at a steady rate. Most of the energy is transmitted nearly parallel to the wire with a slight slant towards the wire in the direction of propagation; thus the energy current meets the wire very obliquely. Now go into the line wire. A tube of energy current arriving at the surface of the wire by a long slant at once turns and goes straight to the axis. In passing from the battery to the wire through the dielectric the energy current is continuous (i. e. suffers no loss); but directly it reaches the conducting matter of the wire, dissipation commences, the energy current begins to fall in strength, and on reaching the axis has fallen to nothing, not a fraction of an erg is transmitted along the wire."

To conclude, we must not take away the idea that the dielectric is everything and the wire nothing. The wire doubtless performs its function. Electricity, whatever it may be, certainly flows in the wire, but the energy is transmitted through the medium surrounding the wire. We do not know what electricity is, we do not know how this energy is transmitted, but we do know the road it travels and that is a great advance towards a complete explanation of the phenomena.

1. Read before the Wisconsin Electric club, Milwaukee, Wis.



SCHNEIDER'S RHEOSTAT.

Schneider's Rheostat.

In this rheostat the resistance proper is a composition which consists, essentially, of a mixture of fat and caustic soda, or fat and any of the other crystal salts of like properties, such as potash, pearlash, alkali, binoxalate of potash, and the like. These ingredients are mixed to the consistency of what is commonly known as soap.

The claim of F. W. A. Schneider of Toronto, Canada, the inventor, is that the fat in this mixture offers a high resistance to the current passing through the composition, the resistance amounting almost to insulation, but when the fatty substance is combined with any of the above crystal salts the salts break up the fatty globules and form a pathway for the current.

Mr. Schneider's states that although it is also possible to use as conductors any of the above crystal salts when moistened by water, the destructive properties of these salts when moistened are so great that they cannot be economically or satisfactorily used separately for such purposes. By combining these crystal salts with a fatty substance, the fatty substance predominating in the combination, the destructive properties of the salts, he finds, are so greatly reduced in force that they are prevented from eating away or destroying any of the parts of the apparatus while they accomplish the desired result.

This composition is usually mixed to the consistency of ordinary soap, so that it can be used in a solidified form, and the danger arising from evaporation, breakage, etc., is entirely avoided.

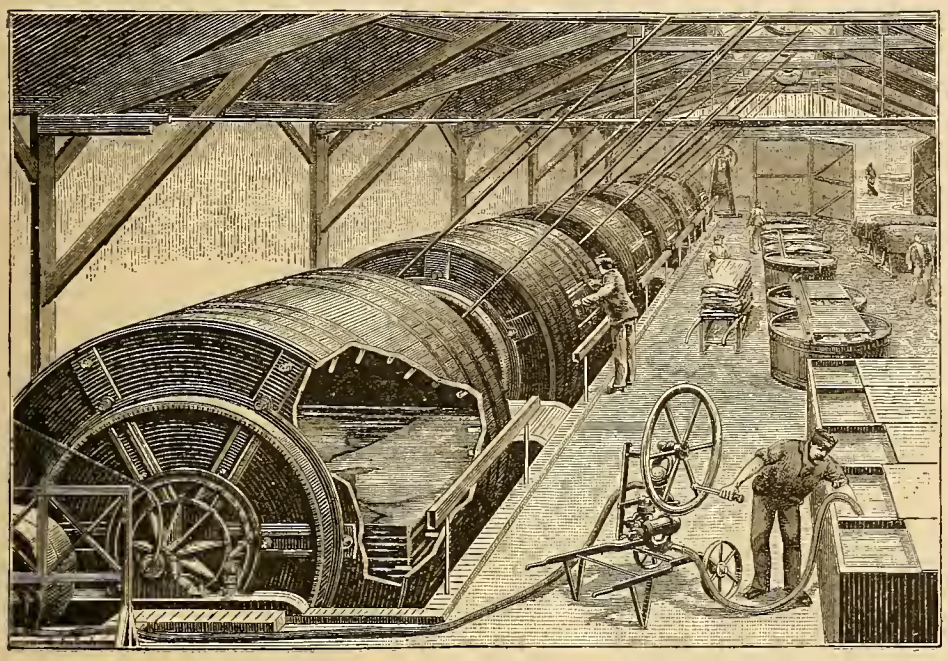
This composition, it is claimed, acts also as a regulator for the current, so that in case the current is at any time increased to a strength that would endanger the instruments, the current during its passage through the composition is so weakened that the danger arising from the increased strength is entirely avoided.

A compact body of this composition one and one-half inch in length by five-sixteenths of an inch in diameter offers, it is stated, a resistance of 28,5000 ohms, and for some unexplainable reason, Mr. Schneider says, its resistance to undulatory or telephonic currents is not sufficient to interfere with the succesful working of the telephone line on which it may be interposed between the working telephone instruments. He finds that the best results are obtained by incasing this composition in an insulating chamber, as indicated in the cut.

At a town meeting held at Groveland, Mass., recently it was unanimously voted to allow the Haverhill & Groveland Street Railway company to use electricity to propel its cars on the highways of the town.

Electrical Method of Tanning.

New processes proposed for shortening the time of tanning skins are not regarded with favor by makers of leather. An authority on the subject writes: "The opinion seems to be established that for thorough tanning of heavy leather a slowly operating influence and consequently long time are essential." There are tanners who regard the electrical process of tanning leather as belonging to the same class as the electric sugar refining system. A French scientific paper, *Le Genie Civil*, in a recent issue devotes considerable space to a description of the Worms and Bale system of electric tanning, and gives it the warmest commendation, stating that when the process was first proposed it regarded it with suspicion, but at the present time it is ready to admit that the new method accomplishes all that its inventors claim for it. The following description is taken from the paper named:



ELECTRICAL METHOD OF TANNING.

Electricity has been of especial value in industries in which chemical processes are employed. The fact that it furnishes oxygen in a nascent state makes electricity an important agent in bleaching and kindred processes. The Hermite process, which has proved so successful, is an instance in point. Following a course of reasoning, analogous to that which led to electric bleaching, Messrs. Worms and Bale designed a system of tanning hides by electricity. That the invention is bound to make a marvelous change in the tanning industry is indicated by the fact that a large steer hide can be tanned in ninety-six hours, while the time required by the old process would not be less than eighteen months. The electrical method, too, makes unnecessary constant attention, and does not create the abominable odor characteristic of a tannery.

In electric tanning it is still the tannin which changes the skin into leather, but electricity in some way accelerates the absorption of the tannin. Numberless attempts have been made to abridge the time by means of electricity, but most of them have been regarded with suspicion. De Meritens has been a believer in the general system, and, in fact, invented a method which has been in use for a long time in a large tannery at St. Petersburg. According to the recent testimony of French experts, none of these electrical systems can compare in point of development and in rapidity of operation with that of Worms and Bale. They tan in a few days at the outside skins which require from thirty-five to sixty days when treated in accordance with other electrical systems.

The principle adopted by Worms and Bale consists in the employment of electricity in combination with a series of rotating drums, in which the skins come in direct contact with the tanning liquor. Some difficulty was experienced in providing a regular and constant flow of current to the revolving drums. The inventors finally attached to the surface of the drums two metallic rings connecting with circular conductors placed within the drums. These conductors receive their current from brushes resting against the rings and connected with the dynamo.

The drum is filled in the following order: Five hundred liters of filtered water for every kilogramme of green skins, one kilogramme of tanning liquor for every kilogramme of skins, and then the skins to be tanned. The door of the drum is put in position and is hermetically sealed. The general arrangement of the plant is shown in Fig. 1, which is a view in the tannery of Brion & Dupre at Paris. Current is turned on and the drum is revolved a certain length of time, according to the kind of skins to be tanned. The schedule is as follows: Cows' skins or steers' skins, 96 hours; horses' skins, pigs' skins and heavy calves' skins, 72 hours; light or medium weight calves' skins, 48 hours.

The operation proceeds almost noiselessly, and no odor is noticeable. At the expiration of the time the revolution of the drum is stopped, the liquor is drawn off and the hides are taken out and stretched. After drying for some hours they are ready for the several processes included in the general name of currying.

Assuming that the process has been abridged to the remarkable extent indicated, what part does electricity play in the operation? A. Rigaud, professor in the chemical laboratory of the Faculty of Sciences in Paris, has studied the question, and a brief resume of his theory is appended. Mechanical motion, caused by rotation of the drums, is entirely insufficient of itself to effect any material shortening of the time, even if there should be added a small quantity of turpentine for removing flesh which may have been left on the skin in the preliminary scarfing. Electricity is certainly a potent agent. Is the effect produced by the elements freed by electrolytic action, ozone for instance? To answer the query it is necessary to refer to what takes place in the tanning process as ordinarily accomplished.

The skin, which is a porous, cellular membrane, must be swelled by the absorption of the tanning liquor. It is gelatinous, and absorbs a solution rapidly or slowly, in accordance with the distention or contraction of the pores. In the old process the skin is thrust in a vat, fermentation causes the pores to distend and absorption takes place.

In the electrical process the skins may be regarded as electrodes, upon which gases are freed, and which are porous and susceptible of absorbing gases resulting from electrolytic action. They are like the plates of an accumulator.

To explain the rapid assimilation of the tanning solution by the skin, it should be remarked that in electrolytic processes a pressure is exerted on the liquid tending from the negative to the positive pole. This pressure is necessary to explain the mechanical transfer of the elements composing the electrolyte. The pressure is very prettily illustrated when a solution is decomposed in a jar divided into two compartments by a porous partition or diaphragm. Rigaud assumes that this osmotic pressure causes the tanning liquor to filter through the skin, which is the porous diaphragm. This is Rigaud's theory, and he deems it sufficient to explain the enormous difference between the time required for tanning by the old and the electrical method.

Worms and Bale's process not only reduces the item of labor in the expense account, but it does away with the fermentation of the tannin and the skin. Originally this action was deemed essential, but at the present day it is proved scientifically that fermentation is injurious to the skin, as it not only causes it to lose weight and strength, but it involves the decomposition of the tanning into gallic acid and glucose, which are in no way useful in the process.

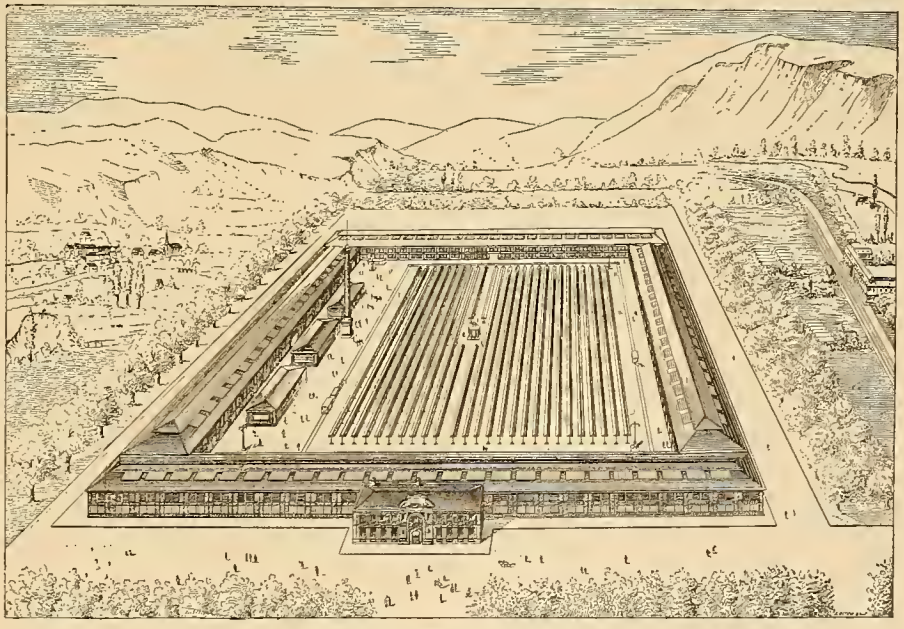
The following table has been prepared, showing the relative periods required for tanning by the electrical process and the old method:

Skin.	Electrical Process.	Old Process.
Light calves' skins	24 to 32 hours.	3 months.
Heavy " "	48 to 60 "	4 to 6 "
Light cows' skins and horse skins	72 "	8 to 10 "
Heavy cows' skins and horse skins	84 to 96 "	10 to 12 "
Heavy steers' skins	96 to 108 "	12 to 15 "

The cost is figured at 4 cents per kilogramme of skin tanned. The weight of the tanned leather is stated to be slightly greater than that of similar skin tanned by the old method.

The cost of a tannery large enough to tan 5,300,000 pounds of skins annually is estimated at $20,000, and its engine power would be from 50 to 60 horse power. The cost of a plant necessary for tanning the same weight of skins by the ordinary method would be five times as great.

The process is used in Paris by Brion & Dupre; in England, by the British Tanning company; in Portugal, Brazil, Madagascar, Venezuela, Republic of Argentine.



ELECTRICAL METHOD OF TANNING.

Finally, it may be stated, that the vice-president of the Hide and Leather Syndicate of Paris has recently reported on the invention, and according to his testimony the quality and strength of leather produced by the new process are satisfactory, and about 6 per cent. more leather is produced from the same weight of green skins than by the old method.

The building of an electrical railroad from Gracey to Cadiz, Ky., is proposed.

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CONTENTS OF THIS NUMBER.

	PAGE
Electric Stamp Canceling Machines in the Chicago Postoffice. Illustrated	1
Testimonial Banquet to Samuel Insull ...	1, 2
The Electrical "Doctor" at Hot Springs. Illustrated	2
Trouve's Portable Electric Fountain. Illustrated	2
New English Alternating Dynamo. Illustrated	2, 3
Direct Coupled Dynamo and Engine. Illustrated	3
Electricity at the World's Fair. Illustrated	3
Wurts' Method of Arresting Lightning Discharges. Illustrated	4
Rutherford's Arc Lamp. Illustrated	4
Modern Views of the Electric Current. By H. B. Loomis. (Wisconsin Electric Club)	4
Schneider's Rheostat. Illustrated	4
Electric Method of Tanning. Illustrated	5
Editorial	6
Appointment of E. E. Keller. With Portrait	7
Grand Rapids Controversy	7
Physiological Effects of Alternating Currents of High Frequency. By Prof. Edwin J. Houston. (Electrical Section, Franklin Institute)	7
A St. Louis Electric Motor of Forty Years Ago	7
The Brown Coal Mining Machine. Illustrated	8
The Robinson Truck. Illustrated	8
The Improved Trolley. Illustrated	8, 9
Trouble With the Electric Launch at the World's Fair	9
The Electric Railway as Applied to Steam Roads. By B. J. Dashiell, Jr. (American Society of Mechanical Engineers)	9, 10
C. & C. Switches Illustrated	10
Another Form of Sechrist Switch. Illustrated	10
Portable Testing Key. Illustrated	10
The Fulmen Lightning Arrester. Illustrated	10, 11
A French Electrical Engineer's Achievement	11
Keller Automatic Current Regulator. Illustrated	11
Hercules Switch. Illustrated	11
His Hair Cut by Electricity	11
An Electrical Sail Boat	11
A Monkey's Predicament	11
Electric Locomotives. (Communication from Silvanus P. Thomson)	11
Patent Litigation. (Communication from the International Ore Separating Company)	12

DEPARTMENTS.

Correspondence	12, 13
New Incorporations	13
Electric Lighting	13
Electric Railways	13
Electric Mining	13
Telephone	13
Telegraph	13
Miscellaneous	13
Trade News	14
Business	14
Electrical Patents	14

SEVERAL of our contemporaries have of late reproduced articles from the WESTERN ELECTRICIAN without proper acknowledgment. In many cases, no doubt, these omissions may be attributed to carelessness on the part of the editors, and in several instances publishers have promptly acknowledged the omission when their attention was called to the matter. Other papers, however, have been guilty of journalistic piracy—they have repeatedly embellished their pages with stolen articles and illustrations from the WESTERN ELECTRICIAN, palming them off on their readers as original matter. To those who persist in this contemptible practice we would say that they are inviting certain exposure. The WESTERN ELECTRICIAN is made up almost entirely of original matter and is copyrighted, and this copyright includes its artistic and special features, all technical articles, special correspondence and news matter. We intend to protect our property and hereafter the copyright will be seriously enforced. It is not, however, our intention to prevent our contemporaries from copying, with proper credit, from the WESTERN ELECTRICIAN, but we shall insist upon that acknowledgment which all decent journals willingly make.

The volume which this number begins will abound in attractive illustrations and exclusive news, and the artistic features which have made the paper so popular will be better than ever before. In this connection it may be said that the WESTERN ELECTRICIAN is more widely quoted in this country and abroad, than any other American electrical journal.

NO American celebration or festal occasion on a large scale appears now to be complete without electrical decorations. These vary from a few incandescent lights in colored globes, spelling out the word "Welcome," perhaps, to the most elaborate designs. Two cases in point where ornamentation of this character will be conspicuous are the coming conclave of the Knights Templar in Denver and the autumn exposition at St. Louis. At both places elaborate preparations are making to secure brilliant artistic effects. But the culmination of all that American skill and taste have thus far been able to achieve in this line will be seen at the great World's Fair of next year, where one of the principal attractions will be the splendor of the electrical embellishments.

ONCE more it can be announced that everything is settled in relation to the Westinghouse contract for incandescent lighting at the World's Fair, and at last it is believed that no further delays will be encountered and that actual operations will be begun at once. On Monday Mr. Westinghouse appeared before the committee on grounds and buildings, and the result of the conference was that the Lawyers' Surety company bond of $500,000 was guaranteed by an indemnity bond signed by August Belmont, Charles Francis Adams, Brayton Ives, Marcellus Hartley and George Westinghouse, Jr. This was accepted as satisfactory to the World's Fair directors. The contract for the wire needed has already been let by the Westinghouse company, and, as stated on another page, Mr. Keller has been appointed superintendent of installation. This gentleman is popular with the members of the electrical fraternity in Chicago, and the appointment is regarded as a good one.

IT appears to have been demonstrated in France that electricity can be profitably employed in the process of tanning hides. An interesting description of the operation is given in this week's paper. It is said that the skins are acted upon something after the manner of the plates in a secondary battery, and that the electrolytic action in some way acts on the pores of the hides and accelerates the absorption of the tannin, thus greatly shortening the process. It is claimed that as good, if not better, leather can be made in from 24 to 32 hours by the aid of electricity as that which required three months by the old method. If time shall prove that the leather thus produced comes up to the expectations of the electrical tanners, a very important addition will be made to the list of industries in which electricity plays a part. In any event, the subject is one deserving the careful attention of American electrical engineers and tanners.

"ELECTRIC BOATS a failure" was the *Chicago Herald's* verdict on a recent test of one of the electric launches at the World's Fair grounds. It is quite easy to conclude, though, from an account of the difficulty presented in another column, that the scribe who writes electrical "specials" for the *Herald* in this case, at least, performed his work mechanically and with no thought for the injustice that was being done. According to the *Herald's* account the battery "flickered out." Now if the explanation made in another column by the maker of the cells be true, and it is most reasonable to presume that it is, it was'nt the battery that "flickered" but it was the motor; it will be seen, further, that even the motor should be free from blame.

The public would not believe that the horse was useless had one of these friends of man been left out-of-doors of a winter's night and had been found frost-bitten in the morning. Why then, should the little launch's electrical equipment be condemned because the motor was left exposed to a night's rain and burned out when run in the morning? It is not necessary to point to the World's Fair engineers such facts as these as they fully appreciate them already, but it is the general public who should read and inwardly digest the explanation of this so-called "failure."

A SAD story is that of the recent wreck on the Pennsylvania railroad at Harrisburg, Pa., and it brings one face to face with the terrible responsibilities of a class of telegraph operators that, as a rule, one seldom hears of. Housed up in the lonely little towers which line the Pennsylvania road are the men that, it may be truly said, hold the most responsible positions of any in the railroad system. Yet these men, upon whose surety of action the lives of hundreds of human beings daily and nightly depend, receive comparatively poor pay and but little recognition. To be sure, it may be said that their work is merely mechanical—to receive orders and obey them—but many times during the year these men are called upon to exercise the finest judgment. One hears a great deal of the responsibilities of railroad presidents, superintendents and other officials, and undoubtedly these gentlemen have many arduous duties to perform and many exceedingly difficult and important questions to decide. The worthy president and superintendent may make, and do make, many mistakes, but it is not often that they come to light. Two and three heads are better than one, and the "responsible" man usually has at his disposal sufficient advice from experienced men to preclude serious errors due to individual failures in judgment. The tower man has no margin whatever; he is a man who must make not a single mistake, for how often does the one mistake end his career. The traveling public should hold the officials of the road responsible, and this they can do by refusing to patronize only such roads as employ competent, painstaking men and pay them good wages. The fault lies largely with the companies whose so-called "economical policy" will not enable them to employ competent and reliable men.

IN view of the interest that has been manifested in the effects of alternating currents upon the human body, the paper presented elsewhere in this issue, by Prof. Edwin J. Houston on "Physiological Effects of Alternating Currents of High Frequency," will be widely read by both the medical and electrical fraternity. Prof. Houston has undoubtedly given the matter much attention. He refers to the experiments of Dr. Tatum with currents of comparatively high frequencies and also to the recent exhibitions of Nikola Tesla with enormously high frequencies as going to demonstrate the fact that while the physiological effects of alternating discharges of but moderate frequencies are more severe then are those of steady currents of the same strength the severity of the physiological effects decreases as the rapidity of alternation increases, until, at extraordinarily high frequencies, all harmful physiological effects practically disappear. When ordinary alternating currents are sent through the human body the physiological effects increase in severity with an increase in the current strength. With current strengths, greatly in excess of those employed in electrotherapy, additional effects are produced, and a tonic contraction of the muscles follow. Moreover, in such cases the severity of the physiological effects is increased by the high potential of the break-induced discharge.

There is another highly interesting point to be considered according to Prof. Houston. This is found in the manner in which according to modern ideas an electric discharge is believed to pass through a conducting path or circuit, viz., that the electric energy is not propagated through the mass of the conductor itself, but rather through the dielectric or other medium lying outside the conductor. In conductors through which alternating currents are passing, the current density is therefore greatest near the surface portions, and in the case of alternations of very high frequency, the central portions of the conductor are entirely free from electric currents, the current being limited to portions near the surface. When, therefore, the human body is subjected to the effects of discharges of alternating currents of enormously high frequencies, the superficial portions only are traversed by the discharges. The more deeply seated vital organs, being thus free from current, such discharges are necessarily harmless.

Appointment of E. E. Keller.

It was announced last week that the Westinghouse Electric & Manufacturing company had appointed E. E. Keller as superintendent of its large installation at the World's Fair. When it is remembered that the Westinghouse company is to wire, furnish current capacity and operate nearly 90,000 incandescent lights at the exposition, the contract price being about $400,000, the importance of the position will be appreciated. The company proposes to put in the largest dynamos ever operated in this country, of eight or ten thousand lights' capacity each, and to make its plant an exhibition of a model alternating central station on a large scale. The superintendency of the installation will therefore be a position of prominence and responsibility, and Mr. Keller is receiving the hearty congratulations of his friends.

E. E. Keller, whose portrait is presented on this page, was born in the city of New York twenty-nine years ago. His boyhood and youth, however, were spent in Rochester, N. Y., where his father, a well known florist, still resides. He was educated in the public schools and University of Rochester and afterward entered the establishment of Yawman & Erbe, optical instrument makers. After this he began to make electricity a special study and accepted a position with G. H. Baxter & Co., of Pittsburg. This firm was merged into the Keystone Construction company, and in 1888 Mr. Keller opened a Chicago office for this company, remaining in charge when the Keystone consolidated with the North American Construction company. During the trials of the Westinghouse company the North American Construction company decided to withdraw from the field of construction work, and enter a different line of business, necessitating the discontinuance of all branch offices. Mr. Keller's office at Chicago was the last of the dozen branches to be closed, and at that time he resigned to take the position of electrical engineer with the Fort Wayne Electric company, at its Chicago office. On June 16, 1891, Mr. Keller was appointed by Chief Barrett electrical engineer in the department of electricity at the World's Columbian Exposition—a position which he resigned recently.

Mr. Keller is regarded as a capable engineer and is exceptionally popular with his acquaintances. He was strongly recommended for his present position by Chief Burnham, Prof. Barrett, Frederick Sargent and others, and his appointment gives general satisfaction to the World's Fair officials.

Grand Rapids Controversy.

The aldermen of Grand Rapids, Mich., recently took it into their heads that the Electric Light & Power company of that city was not furnishing them 2,000 candle power arc lamps. They employed Prof. H. S. Carhart to make a test, and he reported that in many cases he found the difference of potential to be below the 45 or 50 volts usually supposed to be necessary with nine amperes of current. He calculated that about 18 per cent. of the light called for had not been furnished the city. This made the representatives of the company angry, and they declared that Prof. Carhart was "away off" and that he didn't know what he was talking about. Furthermore the amusing charge was made that the whole report was an advertisement for a lecture which Prof. Carhart was to deliver soon. The committee promised to ask the council for an appropriation to have another test made by some other expert.

American Street Railway Association.

The announcement of the special committees of the American Street Railway association for this year has just been made by the secretary. These committees will report at the next convention which will be held at Cleveland, O., in October, and are as follows:

A Model Street Railway Roadbed and Underground Wiring—George W. Baumhoff, general manager of Lindell Railway, St. Louis, Mo.

A Perfect Overhead Electric Construction—Charles H. Smith, superintendent, Troy and Laosingburg Railroad, Troy, N. Y.

Economy of Machine Shops for Electric Street Railways—J. H. Bickford, engineer, Naumkeag street railway, Salem, Mass.

Power-house Engines—T. W. Wrenne, president, United Electric Street Railway, Nashville, Tenn.; L. H. McIntire engineer, Harlem Bridge, Morrisania & Fordham Railway, New York, N. Y; F. S. Pearson, chief engineer, West End Street Railway, Boston, Mass.

Relative Cost of Operation of Horse, Cable and Electric Roads—William McC. Ramsey, electric superintendent, Federal Street & Pleasant Valley Passenger Railway, Pittsburg, Pa.; Frank R. Greene, secretary Chicago City Railway company, Chicago, Ill.; John L. Heins, superintendent, Brooklyn City & Newtown Railroad, Brooklyn, N. Y.

Standard for Electric Street Railways—O. T. Crosby, president, Utica Belt Line Railway company, Utica, N. Y.; H. I. Bettis, assistant treasurer, Atlanta Consolidated Street Railway company, Atlanta, Ga.; Edward E. Higgins, construction engineer, Brooklyn Street Railroad company, Cleveland, O.; Charles W. Wason, general manager, East Cleveland Railroad, Cleveland O.; Julius E. Rugg, superintendent, Citizens' Traction company, Pittsburg, Pa.

It will be noticed that the subject to be investigated by these committees in every instance has some bearing on the application of electricity to street railway work. It may be said that the meeting will be practically an electrical convention.

Physiological Effects of Alternating Currents of High Frequency.[1]

By Prof. Edwin J. Houston.

As is well known, the physiological effects of alternating discharges of but moderate frequencies are more severe than are those of steady currents of the same current strength. As, however, the rapidity of alteration increases, the severity of the physiological effects decreases, until, at extraordinarily high frequencies, all harmful physiological effects practically disappear.

Three varieties of electric discharges or currents are employed in electrotherapy for the treatment of diseased conditions of the body.

E. E. KELLER.

1. The steady, continuous currents produced by voltaic batteries and called in electrotherapeutics galvanic currents.

2. The alternating currents produced by induction coils and called in electrotherapeutics faradic currents.

3. The electrostatic discharges obtained from frictional or influence machines and called in electrotherapeutics Franklinic currents.

As is well known, the physiological effects produced by galvanic currents differ markedly from those produced by faradic currents. The former, unless very powerful, produce on the opening or closing of the circuit a contraction that is of very short duration—in fact almost but momentary; the latter produce a contraction that continues as long as the current is passing. This is generally believed to be due to the fact that the contractions attending the opening and closing of the circuit follow one another so rapidly that the muscles fail to assume the condition of rest and so present the appearance of continuous contraction.

Franklinic currents produce, in general, effects somewhat similar to those of faradic currents.

When alternating currents are sent through the human body the physiological effects increase in severity with an increase in the current strength. With current strengths greatly in excess of those employed in electrotherapy additional effects are produced, and a tonic contraction of the muscles follows. Moreover, in such cases, the severity of the physiological effects is increased by the high potential of the break-induced discharge.

As, however, the rapidity of alternation increases, the severity of the physiological effects decreases until, when enormously high frequencies are reached, the discharges become harmless. These facts have been demonstrated by Dr. Tatum for comparatively high frequencies, and by Nikola Tesla for enormously high frequencies.

In a lecture delivered before the American Institute of Electrical Engineers at Columbia College, New York, on May 20, 1891, Tesla, speaking of these effects says:

"I have found that by using the ordinary low frequencies, the physiological effects of the current required to maintain, at a certain degree of brightness, a tube four feet long, provided at the ends with outside and inside condenser coatings, is so powerful that I think it might produce serious injury to those not accustomed to such shocks; whereas, with 20,000 alternations per second, the tube may be maintained at the same degree of brightness without any effect being felt.

"This is due principally to the fact that a much smaller potential is required to produce the same light effect and also to the higher efficiency in the light production. It is evident that the efficiency in such cases is the greater the higher the frequency, for the quicker the process of charging and discharging the molecules, the less energy will be lost in the form of dark radiation."

The severity of the physiological effects attending any electric discharge through the body must necessarily depend to a considerable extent not only on the quantity of energy present in the discharge, but also on the time in which it is acting.

It has occurred to me that in another circumstance is to be found, perhaps, the principal cause why discharges of enormously high frequency of alternation should be so comparatively harmless. This fact, I think, is to be found in the manner in which, according to our modern ideas, an electric discharge is believed to pass through a conducting path or circuit, viz.: that the electric energy is not propagated through the mass of the conductor itself, but rather through the dielectric or other medium lying outside the conductor; that the electric energy is rained down on the surface of the conductor from the space outside it, and sinks down into the mass of the conductor, the conductor forming a sink or place where the energy can be dissipated.

In the case of a steady, continuous current, the energy sinks or soaks rapidly through the mass of the conductor, so that the electric current, in the language of the old ideas, passes through all portions of the mass of the conductor.

In the case of alternating currents, however, the energy received from a single impulse or electrical movement, by sinking or soaking, moves (say) from the surface of the conductor toward the center, only while such impulse continues; and, when the direction of the impulse changes, moves in the opposite direction, or toward the surface. In conductors through which alternating currents are passing the current density is therefore greatest near the surface portions, and, in the case of alternations of very high frequency, the central portions of the conductor are entirely free from electric currents, the current being limited to portions near the surface.

In the case of the enormously high frequencies employed by Tesla this action was so pronounced that conductors failed completely to conduct.

When, therefore, the human body is subjected to the effects of discharges of alternating currents of enormously high frequencies, the superficial portions only are traversed by the discharges. The more deeply seated vital organs, being thus free from current, such discharges are necessarily harmless.

As the frequency of alternation increases, the body becomes more and more protected, until, when the frequency becomes as great as that of the ether waves, which cause sunlight, they would probably produce on the surface of the body the same genial effects as are produced by the light and heat of the sun, with which they are probably identical.

If these views are correct, it would appear that when the human body is exposed to rapidly alternating discharges, it is subjected at one moment to a discharge that might produce instant death, were it not for the fact that the bolt is practically no sooner hurled at the body than it is hurled away from it.

1. Read before the Electrical Section of the Franklin Institute, May 24, 1892.

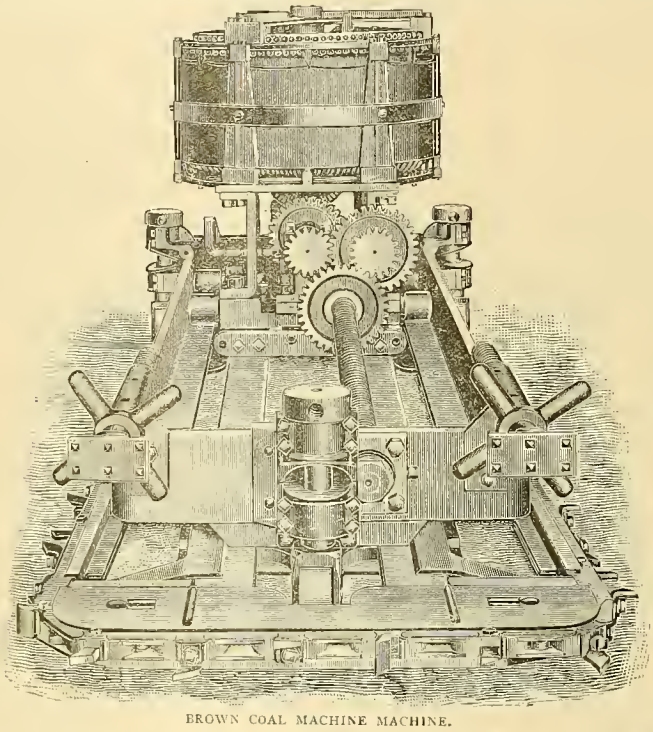
A St. Louis Electric Motor of Forty Years Ago.

Writing to the *St. Louis Globe-Democrat*, Wilson McDonald says: "The thing that strikes the eastern visitor more forcibly than anything else in your city is the vast number of street cars and more especially your electrical motor cars. It may be surprising to some of your electricians who are now posing as original inventors and original promoters, that propelling cars by electric motors was proposed in St. Louis just forty years ago. A motor or machine was made by the late Col. Peter E. Bland, and exhibited by Col. Bland at Dr. McDonogh's Medical College in 1852, if my memory serves me right. It was a wheel about 16 inches in diameter, with armatures on the periphery and a permanent brass hoop around the wheel about the thirty-second of an inch from the armatures. On this stationary hoop were horse shoe magnets, which were supplied with a battery of 'Groves cups.' The magnets were magnetized and demagnetized, so it was claimed, and made to pull and push, and from the construction of the dynamos which we see nowadays, the magnetizing and demagnetizing is accomplished just as it was on the machine made by Col. Bland. There were two men associated with Col. Bland—Henry Stagg and the undersigned—who furnished the funds to build a large car; the car was built by one Wm. Clark. Fortunately or unfortunately, the establishment of Mr. Clark was burned, and with it the property of that early electrical syndicate. But the Bland machine was a perfect success."

The Brown Coal Mining Machine.

About a year ago Captain Samuel S. Brown, of W. H. Brown Sons, Pittsburg, who is known as the coal and railroad king of the Pittsburg district, awakened to a realization that in order to secure the benefit of the most improved mining methods it would be necessary to introduce into his vast mines electrically operated coal mining machines. Not finding at that time on the market a machine that he considered perfectly suitable for cutting the Youghiogheny coal Mr Brown decided to undertake a little engineering work of his own and endeavor to produce an efficient machine for his purpose. Accordingly he enlisted the services of Adam Keil of McKeesport, Pa., as manager, and placed in his hands the entire matter of the practical development of the much desired machine. Mr. Keil immediately entered upon his experiments calling in to aid him in his work Foree Bain, Chicago, and Anthony Westerdahl, draughtsman and machinist, New York. The machine that was designed through the combined efforts of the three gentlemen is shown in the accompanying cut.

The coal mining machine is of the undercutting type.



BROWN COAL MACHINE MACHINE.

A peculiar feature of the operation of the machine is that it advances on its own level making a perfectly smooth floor without any off-sets which are peculiar to some undercutting machines. The particular advantage of this machine will be understood when it is stated in mining parlance that it can cut in a solid 'breast" of coal without "partings" which are necessary where certain other styles of machines are employed.

Referring to the cut it will be seen that this machine consists essentially of two parts, viz., a bed and a movable portion. The last named part of the machine consists of a supporting frame, a motor, sprocket wheel, feed gearing and a chain carrying cutting bits. In operation the bed rests immovable upon the floor of the mine and the portion carrying the motor and cutting chain is fed forward against the coal. The motor running at a speed of only 150 revolutions per minute drives the cutting chain directly through a sprocket wheel attached to the revolving field shaft. There is no immediate gearing beside the sprocket wheel between the motor shaft and the cutting chain; the gearing shown is that of the feeding mechanism. The manufacturers, it should be stated, call particular attention to the fact that the only gearing employed on this machine outside of the sprocket wheel on the armature shaft, is that shown in the cut and employed to drive the feeding nut on the screw.

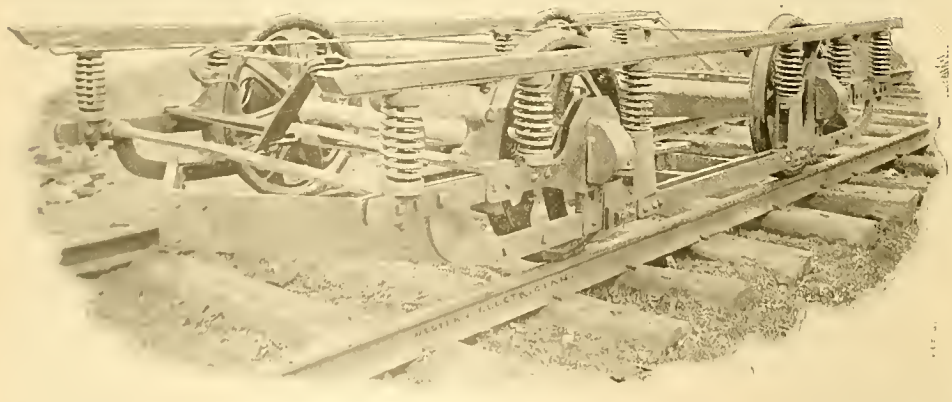
The motor for the Brown coal cutting machine is a 220-volt 15 horse power machine and weighs about 500 pounds. As before stated, it runs at only 150 revolutions per minute. This motor is of the multipolar field type, and the field revolves with its shaft in a vertical position while the armature remains stationary. The dimensions overall of the coal cutter are 8 feet when the machine is closed up, or telescoped as it were, and 30 inches in height. When the cutting mechanism is projected to the fullest extent it will make an undercut 5 feet deep by 3 feet wide by 3 inches high.

As to the operation of the machine it may be said that it has been working in the mines on Youghiogheny coal which next to the lime stone is extremely hard, since the 3d of March last. Cuts by this machine are being made in this grade of coal in the time of two and a half minutes per cut.

It is reported that a factory for the manufacture of these coal cutters will shortly be built in Pittsburg or Chicago.

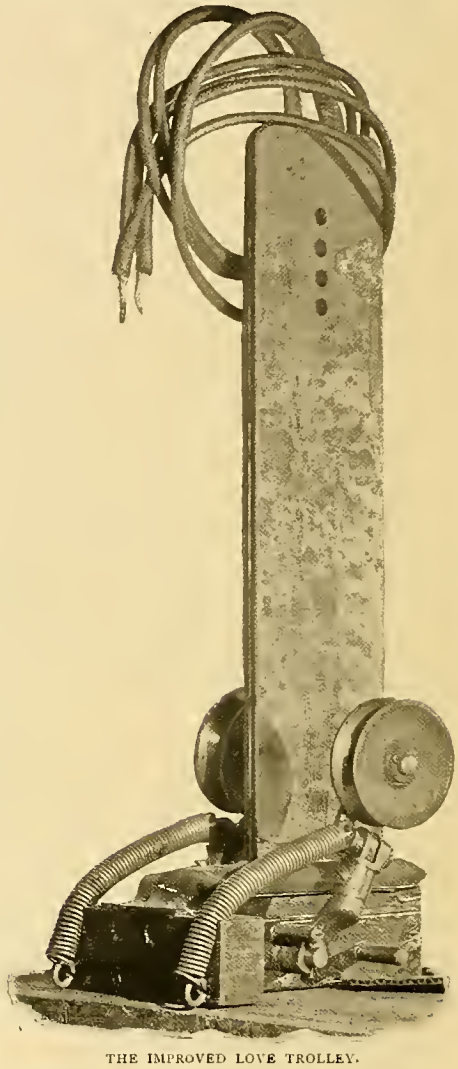
The Robinson Truck.

The truck shown in the accompanying cut has a number of desirable features. It is made entirely of steel, and, with a few exceptions, steel rivets are used. By this construction the use of bolts and nuts, which become loose, is avoided, and consequently the truck is most substantial, and yet has but little weight. The yokes in which the journal boxes ride are made of pressed steel, and there are none of the usual cast iron pedestals. As there is a certain amount of flexibility in these yokes, this construction enables the wheels to pass through curves without noticeable jarring. Attached to the yokes is an equalizing bar, to which is hung the life guard. It will be noted that in each end of this equalizing bar there is a bolt and nut; by removing this bolt the equalizing bars with the guard may be detached and the wheels can then be readily removed without the necessity of jacking up both ends of the car bodily at once. The brake is exceedingly powerful, can be worked from either end, and clutches the four wheels simultaneously. The mechanism of the brake lies close to the bottom of the car body, hence is out of the way of the motors. It can be readily adjusted from the sides by screwing up the turnbuckles, which are within easy reach. It is only necessary to pull out a pin at the top of the brake head to remove the brake shoes, and it has been demonstrated that the shoes can all be changed in about twenty minutes. Six distributing springs are used on a side, giving about 17 feet of spring base to a 16-foot car body. Upon the tops of these springs there rests a continuous bar of steel well braced at four different points; the car body is thus supported the entire length. This arrangement, it is asserted, adds very materially to the life of the car, as through it strains are eliminated. The manufacturer claims that, through the use of this truck, all oscillation and rocking is overcome. A feature of the truck, which will be appreciated by electricians and motor men, is that the design is such that there is an easy access to the motors from the sides.



THE ROBINSON TRUCK.

This truck is manufactured by the Robinson Machine company of Altoona, Pa.



THE IMPROVED LOVE TROLLEY.

The Improved Love Trolley.

Although extremely simple in all its details, it can be be truly said of the Love underground railway conduit system, that no other has of late excited greater curiosity. The Love conduit was constructed in Chicago within the last year, and has been in operation for several months. During this time a number of mechanical defects had, of course, to be remedied, but the fact that the equipment has been accepted by the North Chicago Street Railway company would seem to indicate that the exploiters of the system are making good their expressed determination that there will be one electric railway conduit system at

least which shall not be entered upon the list of failures.

At the start difficulty was experienced with the trolley which ran in the conduit and made contact with the two main copper conductors or trolley wires. In spite of the apparent simplicity of the problem it was found after a number of trials that it was no easy matter to construct a contacting device that would render an efficient service under all circumstances. At the present writing, though, the management of the Love company claims that a trolley has been devised which answers most satisfactorily all requirements. This trolley is clearly represented in the accompanying photographic illustration. The construction is so simple and is so clearly represented that but little explanation is necessary. The two graphite bushed trolley wheels are a little smaller than the ordinary overhead trolley wheels, and the groove in the Love wheel is comparatively shallow. The wheels are carried upon bearings swivelled so as to admit of a limited, but entirely sufficient, universal movement. Where it is desired to have cars run backward as well as forward, another set of springs is attached to the trolley, so as to oppose the set shown in the cut. In relation to the operation of this contacting mechanism, Manager Wheeler says that it gives no trouble even with mud banked up in the space in front between the two springs.

Trouble with an Electric Launch at the World's Fair.

During the last week the Columbia Launch company, Chicago, has had a number of small but nevertheless most vexatious difficulties to contend with in its preparations for the trial of electric launches. It will be remembered that this company is using the American Storage Battery company's cells and that it was the first on the ground with its electric boat. The difficulties were, comparatively speaking, trifling; and under circumstances where competition was not so strong and bitter, the troubles would not be worth mentioning. But the daily papers have taken the matter up and presented such garbled accounts of the preliminary tests that it is only fair to give the electrical company's account of the difficulties encountered.

The *Chicago Herald* of June 25th under the misleading head "Electric Boats a Failure" published the following paragraph relative to the Columbia company's test of the first boat:

The first attempt to use electricity from storage batteries as motive power for boats at the World's Fair proved to be a failure yesterday. One of the little launches owned by Mr. Nixon started out in the test and after making one trip around the lagoon the battery flickered out. Several other launches operated by electrical storage batteries are yet to be tested, but the results are not expected to be different from that of yesterday. The test of these little launches began last Monday. Four companies are in the contest, each claiming to have boats best adapted to the use of visitors at the fair. So far none of them is up to the requirements of the exposition officials.

With the view of giving the readers of the WESTERN ELECTRICIAN opportunity to judge for themselves as to the actual condition of things, a representative called upon President J. B. McDonald of the American Storage Battery company, and from him obtained a most reasonable explanation of the trouble. Those who read the recent article in the WESTERN ELECTRICIAN descriptive of the Columbia company's electric boat will remember that the motor which drives this little vessel is located in the stern, and sets quite low in the boat, and also that the deck of the boat slopes toward the stern. A week ago the storage battery people advised that the launch, which is provided with only a top awning, should be protected by canvas curtains hung at the sides. This the electrical people considered to be necessary for the protection of the motor and cells from the weather. For some reason or other the curtains were not provided, and, as a consequence, during the recent storm the boat was entirely unprotected. The heavy rain, therefore, left a considerable amount of water in the boat, which, owing to the slant of the deck, settled in around the motor at the stern. Manager McDonald states that he went out to the fair grounds one morning and found the motor submerged to such a depth that its armature was partially covered with water.

It is not a difficult matter to see, then, why it was that when Mr. Nixon started out to run the boat on Friday of last week something "flickered out." It was the motor, though, according to Mr. McDonald, and not the battery that did the "flickering," and such a behavior on the part of the motor was not at all strange, as such machines are not built, as a rule, to run under water, or after having been under water.

An electric car at East Liverpool, O., plunged over an embankment on June 19th, and out of thirty-one passengers only three escaped uninjured. The accident is said to have been caused by gravel on the rails.

The Electric Railway as Applied to Steam Roads.[1]

By B. J. DASHIELL, JR.

The intention of the writer is to give some information which will throw light upon the question of high-speed train resistance, deduced from tabulated experiments at such speeds.

The first experiments of note at extremely high railroad speed were made by the Electro-Automatic Transit company, of Baltimore city, in the year 1889, at Laurel, Md., on their circular road, with a 2½-ton car. Some of these experiments were publicly reported by O. T. Crosby, in his paper entitled "Report of High-speed Electric Railway Work."[2] David G. Weems, the originator, contemplated having an automatic mail and express service from one city to another, controlling the cars from central stations located on the line of the road, and which was to be a very complete "block system" in its way. In the early spring of 1888 my services were required by this company, and designs and experimental circular tracks were made and built under my direct supervision. I may here state, for the benefit of some not knowing the circumstances, that the line of road was built for a limited sum of money, and that in some of the experiments, owing to some "fixed ideas," the motors were designed for too high a speed. Both of these obstacles gave us quite a little trouble on the start.

The power house consisted of a 30 foot x 40-foot x 12-foot wood building, costing about $630 to build. It was divided into three rooms—boiler-room, engine and dynamo room, and office. The plant consisted of 125 horse power in two vertical boilers 100 horse power, a Ball high-speed automatic cut off engine running at 300 revolutions per minute and connected direct by a double belt with a No. 20 Edison generator of 50,000 watts' capacity, which supplied the traveling car with energy.

The motor car had a wheel base of 9 feet; four driving wheels, 28 inches diameter, of cast-steel plate web, 1¼-inch flange, and 2¼-inch tread; gauge of track, 28 inches; two axles of 3-inch machinery steel, each carrying a gearless motor of special design, being a two pole machine of the "U" type, and suggested very much in appearance the Sprague street railway motor. During the whole course of experiments no trouble was experienced by the slightest electrical accident. I can well say that this is a record which the street railway people can envy, and will cause confidence in future high-speed work. I am informed that these motors and cars will be placed on exhibition at the World's Fair in Chicago next spring. The extreme length of the car was 21 feet 6 inches, having each end pyramidal; the body width of the car was 24 inches and it was 30 inches deep, thus exposing a sectional area of about 5 square feet to the atmosphere. On the top of the car at each end were placed guide shoes or wheels, which were designed to act as an additional safeguard in passing up against the upper T-rail or conductor and thereby helping to keep the car on the track. Ends of different shape were placed at various times on the cars, as well as flat movable ends, thus getting readings of the extreme air pressure upon the car in its direction of movement. The electric current was taken from the overhead rail by means of a copper strip brush, and then conveyed to the motors, which were connected in multiple at one time and in series at another. The armature was wound with No. 12 B. W. G. copper wire, with 100 sections of two turns per section. Each field coil, of which there were two to each motor, was wound with 120 turns of No. 4 B. W. G. copper wire; the armature section consisted of soft iron wire of about 21 square inches section, and the pole pieces about 40 square inches.

The track was built in a true circle of nearly two miles in circumference, having a gauge of 28 inches, the upper rail being 36 inches from the top of track, and was placed in the center; along each lower rail on the outside was placed a yellow pine guide stringer or guard rail. All rails were electrically bonded. The ohmic resistance of one-half the circular track was about 0.25 ohms.

The super elevation of the external rail varied from 2¾ to 3½ inches, according to the grade and direction in which the car ran. During these experiments we experienced only three derailments, two of which occurred at 45 and 80 miles respectively, and were due to a portion of the road being poorly ballasted. These two derailments were toward the center of the circle, the car leaving the rail only and running along the guard rail. In the third derailment, which was due to not enough elevation in the outer rail at the place of derailment, the car, following the well-known law, went off at a tangent, climbing the guard rail and running along a six-foot fill, and then out in a field a distance of about 1,000 feet from the place of derailment. The car at this place was going at a speed of 115 miles per hour; the highest speed made, as taken by two of the five observers stationed at intervals along the track according to grade, being 118 miles. The longest continuous run was 22 minutes, at various speeds, with a mean of 68 miles per hour; another run of 9½ minutes averaged nearly 80 miles per hour.

Owing to the small cost of track construction, the speed and time standard could not be kept up for any length of time, but no trouble was experienced with the phosphor bronze bearings heating, as the oil was fed by a felt wick, as in standard street car axle journals of the present day, and by a set sight feed oil cup on the top of the journal cap.

Certain values for atmospheric resistance were obtained and which led to more extensive researches[3] by experiments with a "whirling machine" driven from the engine in the power house, and which coincided with the readings obtained with the traveling car. It will be seen that at the extreme low velocities the pressure is much greater than that by the law laid down by text books, and at extreme high engineering velocities it will be found to be much less, but coincided with ordnance practice at low velocities. A speed of 86 miles per hour was made in England with the T. W. Worsdell compound locomotive. The total weight of the engine, tender and train was 695,000 pounds; indicator cards were taken, showing 1068.6 horse power on the level. At a speed of seventy-five miles per hour, on a level, and the same train, the indicator cards showed 1,040 horse power developed. Numerous high speeds of 86 miles per hour have been made in this country, with all of which American engineers are quite familiar.

By careful study the writer has been able to compile a table of train resistances on the level, wherein heavy rails and good track construction were the aim of the railroads making these speeds. The table gives the total resistances at various speeds and various exposed area to the atmosphere per ton of locomotive and train, using Trautwine's table of resistances for curves. Then the total resistances other than those due to the atmosphere were found to be at 120 miles, 20 pounds per ton of moving weight, and at 60 miles 12.8 pounds per ton.

In the English run the total resistance at 86 miles was only about 12 pounds per ton.

The track construction for high speed trains must be the very best that art can make it; the rails should be of very heavy weight, not less than 110 pounds, having carefully made joints, and all rails should be laid with joints halved and not laid opposite. My experience has shown this to be the best for high speeds. All rails should be laid on the best cross-ties of large horizontal or bearing surfaces, and not over 24 inches apart, center to center. The roadbed should be heavily ballasted with different sizes of stone, curves and small radii should not be allowed. It is important that on the outside of each rail a deep guard rail should be laid. The superstructure should be drained well. These are some of the most important features to be looked after in building a roadway for high speed. That the electrical companies see the importance of this class of work in the electrical line, and are gradually working up to it, appears from the fact that in street car service we are getting into large units, and that there are splendid mining locomotives up to 150 horse power, and weighing from 400 to 425 pounds per horse power, and that there are now in course of construction electric locomotives for a standard road. One of these has been in practical operation for some time past.

The following extract is taken from a report of one of the leading electrical companies.

"The continued success of the electric street railway, and the demands made by street railway companies for larger and more powerful motors to handle their cars, has led others interested in transportation to investigate the advantages of electric locomotion, with the result that not a few electric tramways are in operation throughout the country, hauling freight in our mills, factories, mines, etc. In this department of work, also, there has been a constant demand for more powerful machines, so that where the electric locomotive formerly hauled a few bails of cotton it is now called upon to handle a fair sized train.

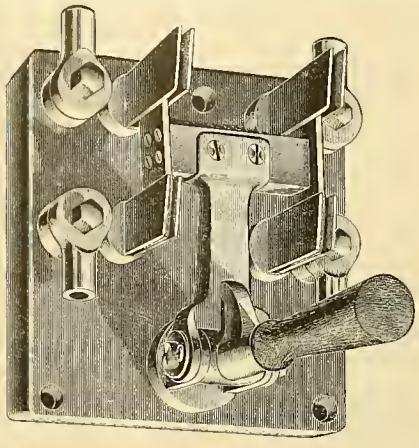
In compliance with the demands of this nature, one of the companies sometime ago, constructed an electric locomotive designed to obviate the necessity of employing a steam locomotive, and it may, indeed, be said to represent the first large freight locomotive displacing steam on a standard guage railroad. The locomotive is at present running at Whitinsville, Mass., carrying merchandise from the railway freight station to the works of the Whitinsville Machine company's plant, a distance of 1½ miles. The power is furnished by a large generator located at the machine works, and conveyed over a trolley wire, from which it is taken by means of a universal trolley bar attached to the locomotive. The truck is built in a square form in three castings, having also a platform for carrying loads and cow-catchers and draw-bars at each end. The motor employed is one of what is called the "G" type of the Thomson-Houston Electric company; the power is communicated from the armature to the rear axle by means of the double reduction gearing, and from the rear axle to the forward one by means of the parallel rods. It will be well to state here, that it is planned that all future freight locomotives should have the single reduction type of motors. The motor consists of wrought iron field magnets which are bolted to a magnetic yoke of mitis iron. One of these yokes carries the bearings which support that end of the motor on the axle, while the other yoke is spring supported from the other axle. This keeps the gear always in line and meshing correctly with each other and at the same time provides considerable spring support for the motor, which in designing slow-speed locomotives should be looked carefully into, as well as in locomotives for extreme high speed. This is a matter of no small moment in designing such work. The gearing consists of aluminum bronze pinions and mitis iron spur gear wheels. This gearing runs in gear cases, in which a plentiful supply of grease is placed. This decreases the noise and friction, thus increasing the life of the gears very materially. On the intermediate shaft is heavily keyed a mitis-iron break drum, which is covered with wood lagging. It is embraced by two half bands of steel, tightened upon it by means of the brake drum lever, situated in the operating stand or cab.

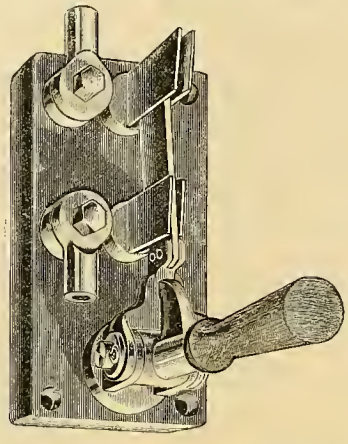
The wheels are 42 inches in diameter, and are heavily steel tired. The frame consists of two heavy side plates in which are located the main axle bearing. Two heavy cast-iron plates, in which are cast the cow-catchers, are bolted to the side plates by means of heavy through bolts, which are a driving fit in reamed holes. These end plates carry the heavy spring draw-bars and bumpers.

1. Paper Read before American Society of Mechanical Engineers.
2. American Institute of Electrical Engineers, February 24, 1891.
3. "An Experimental Study of Atmospheric Resistance," by O. T. Crosby. A paper read before the West Point branch of the United States Military Service Institute, 1890.

The operating platform or cab is located at one end of the main platform, and is made of piped framework and covered with a protecting roof. On this platform is located the lever for operating the controlling mechanism, the brake and the double acting sand boxes. The universal trolley bar also extends upward from the locomotive at this point.

The controlling mechanism consists of two large rheostats of the Thomson-Houston railway type. These are





C. & C. SWITCHES.

so arranged with their contact shoes that no reversing switch is needed. The operator stands so that he always faces the direction in which the locomotive is to go, and being in this position, he pushes the controlling lever from him to make the locomotive go forward, and pulls it towards him, past its vertical line, to make it go backward. A positive center notch or lock is provided, so that in turning the current off there is no danger of passing the neutral point on the rheostat, and so reversing the locomotive with the current on. When the operator stands in the above mentioned position he pushes the brake lever from him in order to apply the brake. The steel bands are so arranged on the brake drum that the friction tend to tighten them up more upon the wood lagging, and so assist the operator in braking the train.

The following data give the details of construction of this locomotive, the construction of which has been under the direct supervision of the engineers at the works of the builders.

Wheel base, 6 feet 4 inches.
Diameter of wheels, 42 inches.
Speed reduction between armature and axle, 1 to 25.
Gage 4 feet 8½ inches standard.
Measured height above rail platform, 4 feet 4 inches.
Greatest length of locomotive at cow-catcher, 15 feet 6½ inches.
Greatest length of platform, 12 feet 7¼ inches.
Greatest width of platform, 7 feet 1 inch.
Weight of complete locomotive, less trolley pole, 42,525 pounds.
Approximate weight of motor, 5400 pounds.

As in street railway work, a combined main switch, lightning arrester and fuse box is placed on the locomotive and within easy reach of the engine driver, so that he can instantly shut the current off from the locomotive by a slight movement of the hand.

The construction of the motor is of the most rigid and waterproof character, the field spools having their wire enclosed entirely, sewed up in canvas cases which are covered with a heavy coating of water proof paint.

The locomotive which weighs 42 525 pounds or about twenty-one tons, was designed to operate at 500 volts and

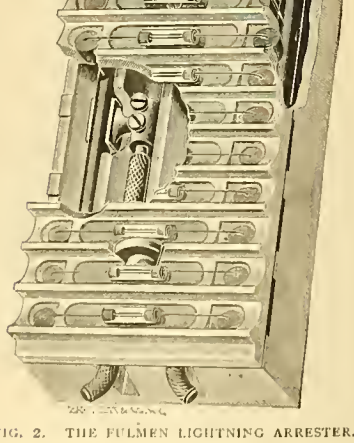


FIG. 2. THE FULMEN LIGHTNING ARRESTER.

to develop 100 horse power at the draw bar. This enables it to pull a train of six to twelve heavily loaded cars, or an aggregate load of 300 to 500 tons, at a speed of five miles per hour on a level with ease.

St. Louis enjoys the distinction of being the first city in the world to put in operation special electric cars devoted to postal and express suburban service. These cars are used on the St Louis Suburban road, and do both a city and country business in handling mail matter. The route extends from Sixth to Locust streets, St. Louis to Florrissant, St. Louis county, a distance of sixteen miles from the city, and the mail car supplies the above places as well as all the intermediate postoffices, as on our steam railroads. The car is 34 feet long, 8 feet 4 inches wide, and 11 feet 4 inches high, and has two four-wheeled bogie trucks mounted with two standard railway motors. The total weight of the car is 16,000 pounds. It not only carries the mail, but baggage, express packages and dairy product; it makes two trips per day per car.

It is encouraging to see the attitude that quite a number of our present leading steam railroads have taken in reference to installing a road with electric locomotives. The Northern Pacific and Wisconsin Central's names have been mentioned quite freely.

Dr. Wellington Adams and others of St. Louis operating under the name of the Chicago and St. Louis Railroad company, propose building an electric railroad between Chicago, Ill., and St. Louis, Mo., a distant of 250 miles, and maintain a speed of 100 miles per hour with their trains. This work will be placed under the direct supervision of the most competent engineers in this line of work of the present day.

It is proposed to operate this road at night, by the "block system through lights" as proposed by the Weems company in their future road.

In conclusion it is hoped that information given in this paper will be of interest. The question of resistances making up the total train resistances has been an open question; it is needless to say that nearly all formulae based upon past experiments, when applied to cases different from those on which such formulae was constructed, and contained in our text-books, do not show the true value of such resistances.

PORTABLE TESTING KEYS.

The question of atmospheric resistance, when applied to a moving train at various speeds is one which has been an unsettled question in the minds of all that have thoroughly studied past experiments in this direction.

C. & C. Switches.

The accompanying cuts represents the single and double pole switches recently placed upon the market by the C. & C. Electric Motor company, New York. The plain switches designed by this company have the same general appearance, the only important difference being the omission of the soap-spring in the plain switch, while the handle lever and knife lever are replaced by a single casting.

Many specifications for electric lighting plants now call for marble or slate switch-boards instead of the wood board. The switches designed for wood boards have been made to do service on the marble, but they do not make a handsome appearance. The switches illustrated herewith were designed especially for this class of work and have been provided with ample contact surface and a quick break movement. The connections are made from the back of the switch-board, but the contact binding posts are made extra long, so that the switches may be fitted to a switch-board of any thickness.

On switches provided with fuse blocks and mounted on slate bases, the distance between the fuse terminals is enough to render the fuse perfectly reliable and prevent arcing. This feature is specially desirable in switches used on 500 volt circuits.

Another Form of Sechrist Switch.

In the last issue of the WESTERN ELECTRICIAN Albert Sechrist's method of controlling electric lamps was described. With this system of lighting a person may have absolute control of any or all of the lights from any part of the house; that is, one may pass through the house in any direction without the necessity of ever being in the dark. By simply touching a button here or there, one is enabled to turn on the lights ahead of him or extinguish lamps the light from which is no longer needed. The same lamps, also, may be controlled from different points, and this feature makes the system useful as a burglar alarm.

The mechanism of the Sechrist system consists in the simple combination of an automatic switch and push buttons, together with an ordinary battery or shunt off the electric light circuit. The accompanying cut shows another form of the Sechrist switch. This design is practically the same as that of the switch heretofore represented, and is one of a

ANOTHER FORM OF SECHRIST SWITCH.

variety that will be turned out at Mr. Sechrist's works in Denver, Colo.

The operation of the switch is simple. By touching, say, the white button, one electro-magnet attracts the armature, which closes and locks in place the electric light switch. A push on the black button brings into play the other electro-magnet, and the action of this last named magnet serves to unlock and open the switch.

Portable Testing Keys.

While practically speaking all galvanometer and other electrical keys are portable, in that they can be carried about, yet a short circuit or a contact key that can be thrust into one's pocket will commend itself for convenience to those engaged in outside work. Queen & Co. of Philadelphia are now introducing such a device and the accompanying cut illustrates it. The new form of key is made of hard rubber, polished, with brass connections, and platinum contacts. The key measures 5½ inches, and weighs not over 5 ounces. Three forms of the device are now made, viz., single contact, double contact, and short circuit.

The Fulmen Lightning Arrester.

The device consists of a magazine of inexpensive discharge plates so arranged that upon the destruction of one set each successive set will become automatically connected to receive the lightning discharge.

A porcelain base with four channels, two to receive the wire terminals which connect the carbon rods in the remaining two channels, the one to line and the other to ground, constitutes the stationary part of the apparatus.

A corrugated cover of porcelain, containing a series of

FIG. 1. THE FULMEN LIGHTNING ARRESTER.

fuse arresters, is attached to the base by a lug and spring bolt, so that the two are held rigidly together, but can be quickly detached for reloading.

The arrester proper is shown in Fig. 1, and consists of two small brass wires 2½ inches long, their inner ends lapping each other a short distance and separated by a space one-twentieth of an inch. These form the discharge plates of the arrester, and are held in position and kept clean and dry by being sealed into a small glass tube. Two soft rubber plugs serve to attach the arrester to the porcelain cover, Fig. 2, and the outer ends of the wires are so knotted and cut to length that, with the cover in position, they approach but do not touch the carbon rods which form the line and ground terminals.

To bring the fuse arrester into operative position, a

wedge-shaped piece of carbon is brought against each end of the top fuse, at the same time making connection with the carbon rods. In this position the arrester offers a free passage to earth for lightning discharge, but will not ground the normal current.

In operation the arc caused by the lightning discharge starts a short circuit, which immediately consumes the wire and allows the two carbon wedges to drop and adjust themselves to the next arrester.

As indicated in Fig. 2 there are fuses for ten consecutive discharges. The fuses are replaced, with the cover detached, so as to avoid a possibility of shock from contact with the wires.

This device is handled by C. S. Van Nuis, New York.

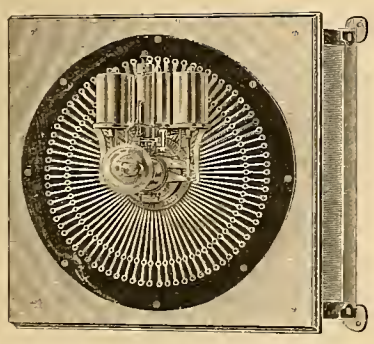
A French Electrical Engineer's Achievement.

The electrical engineers of Paris include one man who has recently made his name famous in Europe by the feat of fighting four duels in forty minutes. This person is M. Roulez, and the Paris correspondent of the London *Telegraph* describes him as "an electrical engineer and an able inventor," 57 years old. It appears that M. Roulez, while chatting with one of the dancers at the Grand Opera House in Paris a short time ago, between the acts of "Salambo," was insulted by three young bloods, who saw fit to make a jest of his age. An altercation and a general scuffle ensued, the upshot of which was the arrangement of three duels with swords. Each of the young men was badly wounded, and one of the seconds who insisted on fighting also received a deep thrust in the neck. The correspondent, in describing this remarkable scene, says: "The four-fold victor was loudly applauded by the group of persons who had gathered round the spot, and the acclamations became more boisterous when M. Roulez still stood his ground, waiting calmly to give a taste of his steel to anybody else who might be inclined to try conclusions with him. His seconds, however, had by this time arrived at a sense of their duty, and prevented him from accepting any more challenges." This elderly electrical engineer is now the lion of Paris, and is hailed as a second D'Artagnan.

Keller Automatic Current Regulator.

The device illustrated in the accompanying cut is adapted for use on constant potential systems of electrical distribution. It is designed to be placed on the resistance box of an ordinary shunt or compound wound dynamo to perform automatically the same office that a man would by hand, i. e., it varies the resistance in the field circuit of the dynamo, and consequently operates to maintain a constant pressure.

This regulator consists essentially of a rheostat face with segments and brush as shown in the cut, two solenoids, a voltmeter and a resistance spool, and a lamp is placed in the center for light and resistance. The small tube in front contains a voltmeter, consisting of a finger bearing two platinum contact points and arranged to swing from side to side according to the pressure. On swinging to one side the pointer closes a circuit with one



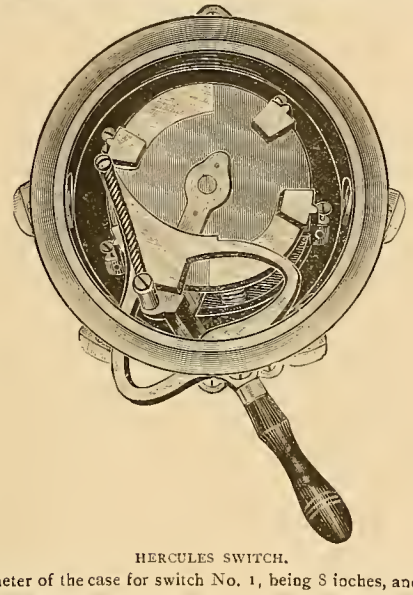
KELLER AUTOMATIC CURRENT REGULATOR.

of the solenoids which acts to move the brush over the segments, and then it recoils ready for another stroke; a contact on the other side moves the brush in the opposite direction. The voltmeter is very sensitive, and will respond to a change in pressure of a small fraction of a volt. The device is usually connected to the center of distribution of the system. It is applicable to the alternating system by connecting it to the field of the exciter. By a change in the winding, also, it can be used to operate the switches for charging and discharging storage batteries while they are used to supplement the dynamos in a direct current system. In a station where several dynamos are worked in parallel, the regulator can be applied to one only, and this one machine will, it is claimed, regulate the whole system.

The Keller regulator is manufactured by the Canton Electrical company, Canton, O.

Hercules Switch.

This switch has double contacts, is quick acting and can be used either on an arc or constant potential circuit. Made with heavy binding posts and contacts, mounted on a slate base, and enclosed in a water-tight iron case, currents from 25 to 100 amperes on high voltage currents can be safely handled with this switch. The "make or break" of contacts is not dependent on a slow or fast movement of the operator's hand, the switch being automatic in its action. The case is provided with porcelain bushings for the protection of wires entering and leaving the box. The di-



HERCULES SWITCH.

ameter of the case for switch No. 1, being 8 inches, and of switch No 2, six inches makes it a most compact article. This switch is manufactured by the Utica Electrical Manufacturing & Supply company, Utica, N. Y.

His Hair Cut by Lightning.

The central figure of an interesting story presented in the *Chicago Blade* is a telegrapher named Bogardus. "Bogy," as he is called for short, is known in the telegraph profession from Boston to San Francisco and from New Orleans to Toronto. He possesses a roving disposition, a love for good old Bourbon whisky, and a mind that is blank as to the value of money. The following occurred in the days when "Bogy" was in his prime:

He had recently been "fired" from the New York offices, and for bread and butter had drifted out on to a railroad centering in Pittsburg to sober up and get a new start. He was always careful of his personal appearance, and, while he could shave himself, the cutting of his own hair was an impossibility. Pittsburg, some thirty miles from the little station he was at, was the nearest place wherein he could have the tonsorial feat performed. To go to the city meant another spree and consequent discharge, and "Bogy" knew this too well. But his hair grew, the weather became hot, and he fretted and fumed. The comments of the railroad men didn't add to his comfort.

Late one afternoon, after a very hot day, a thunder storm of remarkable intensity came up, and the lightning played hide-and-seek among the relays, sounders and switch-board in "Bogy's" little 10 by 10 office. Every minute the storm increased in intensity, and the electrical display was grandly sublime. As the cracks of the bolts on the switch-board became more frequent and the flashes more luminous, "Bogy," not a bit frightened, concluded to put the cut-out plug in the switch-board and therefore save his instruments from burning up in case the lightning became too strong.

On the instant he applied the plug a bolt of lightning struck a telegraph pole about fifty feet from the office and the surplus electricity came in the switch-board over the wire and "Bogy's" head was wrapped in flame. The shock threw him on the floor, and for a moment stunned him. Shaking himself together he got upon his feet and, feeling no pain, he congratulated himself upon his lucky escape. There was a peculiar odor in the little room that "Bogy" could not clearly account for, but concluded it came from the burned silk and wax that made up the covering for the office wires.

He had just succeeded in putting his office to rights and had returned to it, after making a temporary connection where the bolt had struck, when a train drew up for orders.

"Je-e-rusalem!" shouted the conductor, as he saw "Bogy." "Where's your hair?"

"Bogy," in affright, clapped his hands to his head, and, with a startled ejaculation, rushed for the little mirror hanging in a rear corner of the office. One look was enough. "Bogy" hadn't as much hair as a month-old baby, and, strange to relate, the electric flame had not seared his scalp in the slightest. The knock-down blow old Jupiter had given him had driven the thought of his hair for the moment out of his mind, and until the conductor's surprised cry had reached him he thought his hair still needed cutting.

A Monkey's Predicament.

The Springfield, Mass., *Union* relates an amusing mishap that befell an Italian organ grinder's monkey in that city. The owner of the animal sought to increase his income by diverting the passengers in an electric car during a wait at the end of the route. Jocko was rewarded with four pennies, and after making a very pretty bow he put the money in his mouth and jumped on the iron guard gate. He was there only an instant, but long enough for some one to connect a live wire with the iron gate and send a current of electricity into the thoroughly mystified and screeching monkey. With the first shock the "monk" let go of the gate with his paws, but clung on with his tail, until finally he could not clear himself. He dropped his pennies and apparently took to swearing in his own tongue, while his master, unable to pull him loose, went through the war dance of the Mafia in a very picturesque manner. The circuit was finally broken, and the twain quickly made their disappearance.

An Electrical Sail-boat.

At the new electric launch works, Eel Pie Island Twickenham, an electrically propelled gig is being laid down, says the *Electrical Engineer* of London. The boat is to be built in bright cedar, and is designed to have a mean speed of 6½ to 7 miles an hour with one charge of about five to seven hours' duration. She will be fitted with awning, cushions, electric light, electric bell, gun-metal rowlocks, and sculls, and with a balance lug sail forward and a jib-headed mizzen aft. The accumulators will be sealed and placed below the water-line, forming ballast and giving great stability for sailing. This boat, therefore, can be rowed, sailed, or electrically propelled at pleasure. She is being built to the order of F. W. Hagelmann, and will conveniently accommodate six passengers.

COMMUNICATIONS.

Electric Locomotives.

To the Editor of the WESTERN ELECTRICIAN:

May I ask space to correct a passage in the newly published fourth edition of my "Dynamo-Electric Machinery?" On page 616 occurs the statement, altogether incorrect as I now find, that the original locomotives of the City & South London electric railway "are now being replaced" by others. My sincere apology is due for any inconvenience or annoyance caused to Mather & Platt (limited) by such a statement. It should be pointed out that all the fourteen original locomotives constructed by Mather & Platt are still running, and have run, in the aggregate, more than 500,000 miles, and have provided for a traffic of more than 7,000 000 persons. The two locomotives supplied by Messrs. Siemens do not replace but merely supplement the original locomotives, and the rolling stock will shortly be still further increased, as I now learn, by another locomotive now being constructed by Mather & Platt. I am, sir, yours faithfully,

SILVANUS P. THOMPSON.

LONDON, June 14, 1892.

Patent Litigation.

To the Editor of the WESTERN ELECTRICIAN:

Several of the technical journals have recently published notices emanated, evidently, from the Magnetic Separator company, of New York, stating that a suit has been entered in the United States Court for the district of New Jersey against the International Ore Separating company, of No. 1 Broadway, New York, for infringement of patents. We will be greatly favored if you will publish in your columns the following true statement of the matter:—

We wish to say on behalf of the International Ore Separating company that this statement that suit has been brought against it by the Magnetic Separator company, or by any other person, firm or corporation is unqualifiedly false.

The International Ore Separating company operates under patents assigned to it, which infringes no other patents whatsoever, while eminent counsel have repeatedly advised that the claims of the patents of the Magnetic Separator company are invalid, and this the International Ore Separating company stands ready to prove before any court of law of equity.

The special features of these separators are absolutely new—the spirally wound drums of small diameter, the special forms of magnet with consequent poles, the method of transference from drum to magnets, the combination with these of a belt and rollers, together with the method of operation under the surface of water, are all completely protected by United States and foreign patents, and any infringement of these will be promptly prosecuted.

INTERNATIONAL ORE SEPARATING CO.
Harvey S. Chase, Treasurer.

NEW YORK, June 18, 1892.

An ingenious device is now in use in Boston for shutting off electric currents without injury to the dynamo when the wires get crossed or there is overheating from any cause. The apparatus consists of four needles so arranged that when the voltage of the wire is increased abnormally one of the needles will emit sparks and burn a thread which releases a spring that cuts out the current.

CORRESPONDENCE.

New York Notes.

NEW YORK, June 25.—The news of the week relative to happenings among things electrical cannot be called exciting. It gives me pleasure, though, to chronicle the fact that there now exists throughout the eastern territory a most healthy business feeling. On every hand the electrical people report "good business," "factory running overtime," etc., and such cheering words, coming as they do in the summer season, when every one feels most severely the heat, may be considered as indicative of a good summer and fall trade.

History repeats itself, it has been said, and it is not unlikely that before long Brooklyn will witness a telephone-versus-electric-railway fight. Subscribers to the telephone service are beginning to complain about the presence of the trolley wire, and the matter is soon to be brought to the attention of the new Railway Commission. The interference in some cases is said to be so great that the telephone cannot be used at all. The greatest trouble just now is with instruments in the South Brooklyn section, and the trolley roads on Ninth street and Hamilton avenue are responsible for it. "We have not yet decided what to do about it," said General Manager Sargent of the telephone company the other day, "but we shall either complain to the Subway commission or sue the railroad companies."

There were two conflagrations in the Edison building last week. The woodwork in the executive offices of the company, on the seventh floor of the building, which runs from Broad street to New, caught fire about 2 o'clock Tuesday morning. The building is fire-proof and the flames were confined to the offices in which they originated. The loss was estimated, however, at $8,000 and was covered by insurance.

The discovery of a second fire in the building has led to the suspicion that an attempt is being made to injure the General Electric company, or to destroy its plans. Friday morning just after midnight greater damage by the second fire was done in the record-room. Here were stored innumerable plans and specifications. When the clerk reached the place at the opening of business the papers were found on the floor charred and useless. The papers were invaluable for the purposes of the company. The officers of the company are utterly at a loss to account for the fire. They had not yet finished investigating that of Tuesday morning when the second followed. There is no gas in the building, and the electricity is turned off every night. It was said that the fires had the appearance of being of incendiary origin. A thorough investigation will be made.

It seems that there are a number of ways through which one can be affected by an electric current. Death, though, is usually caused by what physicians might describe as an 'overdose of ethereal vibrations," and one doesn't often hear of cases in which the homeopathic small dose treatment proves fatal, especially in administering electric current. Dr. Dana of this city, however, has just reported a singular case. Arthur J. Yea died recently of nervous apoplexy. The deceased was an electrical workman, and was in the habit of testing wires by applying them to his tongue. After a thorough examination of the man's nervous system, Dr. Dana came to the conclusion that death was caused by taking too much electricity internally. Yea was 27 years of age and never showed any signs of ill effects from the practice of applying electricity to his tongue.

W. F. O.

New England Notes.

BOSTON, June 25.—Leon Dion of Natick, who recently projected a new system of electrical propulsion for street cars, has succeeded in interesting a number of prominent Boston capitalists in his inventions and a company has been formed with a capital stock of $1,000,000 to put the system in operation. Dion's patents, it is claimed, do away with the overhead trolley, but just what ground they cover is not divulged. The syndicate controlling the patents includes ex-Gov. Oliver Ames, Fred. L. Ames, Oakes A. Ames, Col. Levi R. Green and Capt. Robert Tarr. Officers have been elected as follows: Oliver Ames, president; Edwin T. Atkins, treasurer; Col. Green, general manager. They will soon open offices in the Exchange building.

Work on the three new buildings of the Thomson-Houston Company at Lynn is progressing rapidly. The contract for the roofing has just been let. The buildings comprise about 110,000 square feet.

The Freeman Holland company, electrical engineers at 18 Harrison avenue, Boston, has been trying to settle with its creditors on a basis it proposed, but has been unable to do so. Now a petition in insolvency has been brought against it.

The main office of the Thomson-Houston International Electric company is to be removed from Boston to New York. It will be located in the Edison building on Broad street.

Some electric lighting plants have been recently installed in Lowell in which secondary batteries are charged from a trolley wire. An ingenious regulator automatically controls the rate of charge and discharge by cutting resistance in and out. Fifty-six cells are said to be used.

The New England Bell Telephone company has extended its lines from Livermore Falls, Me., to Farmington, giving Rangeley Lake tourists direct communication with the cities.

A syndicate of which Hon. W. A. Russell of Lawrence, Mass., is the head, has purchased the Garvins Falls property at South Concord, N. H., and expects in about two months to supply Concord with electric power from this plant.

At the annual meeting of the Erie & Southwestern Telephone & Telegraph company, Levi Sprague of Lowell, Mass., was elected president and C. J. Glidden of the same city, secretary and treasurer.

It is expected that the proposed electric road from Weymouth to Brockton will be in operation by September 1st. There is some hitch over the franchise, but if it is granted a man stands ready to complete the work in thirty-five days. The power is to be furnished by the Abington & Brockton Electric company.

President Choate of the Old Colony railroad is said to be again considering the use of electricity on his road. Legislative authority has been secured.

M. G. Starrett, chief electrical engineer of the Brooklyn, N. Y., street railway, was in Boston last week.

Prof. A. E. Dolbear in his new book attempts to explain the nature of electricity. "I do not know how other scientists will look upon it," says he, "but it satisfies me."

The *Boston Daily Globe* is using electrical ventilators in its editorial rooms. The *Globe* is the only newspaper in Boston with electric motors attached to its big "Jumbo" presses which can be used in case of any accident to the steam power.

J. C. E.

St. Louis, Mo.

ST. LOUIS, June 25.—The question of rapid transit is receiving attention in this city, as in all other large American centers to day, but it is believed that St. Louis is in far better position to meet the demand of its people than other cities of the first class. Extension and developments of the old lines, as well as the establishment of new systems, are being pushed with characteristic enterprise.

The Grand Avenue Railway company has a bill before the city council, granting it the right to construct an electric railway along Grand avenue through the entire city, from the water tower to the River de Peres, a distance of twelve miles. This road would, undoubtedly, be a paying one, and there is a general demand that the bill be passed. The council is slow to act upon it, as the bill is understood to be actively opposed by other lines with which it might compete in certain limited districts. The facilities for cross-town travel are now very limited.

The ordinance granting the Forest Park & Clayton Railway company the privilege of building and operating an electric road has passed both branches of the city legislature, and now needs only the signature of the mayor to become a law. The projectors of the enterprise are local capitalists, and it is understood that the road will be built at once.

Work is progressing rapidly on the grading of West St. Louis avenue, preparatory to the extension of the Cass Avenue railway. This line, together with the Northern Central and Union lines, about thirty miles of single track altogether, will be equipped with electrical apparatus at once, $1,800,000 worth of bonds having been negotiated for the purpose. Capt. Robert McCulloch, general manager, and Winthrop Bartlett, engineer, recently visited Chicago, Milwaukee, Boston, and other large cities to inspect the latest and most improved types of apparatus and equipment. The combined power station will be of 2,500 horse power to begin with.

The Edward Thomas Electric Railway company, to which the city of Belleville, Ill., granted a franchise some seven weeks ago, has filed its bond of $20,000 that the road will be built in compliance with the terms of the ordinance. It is stated that the road will be extended to and through East St. Louis, and over the big bridge into the heart of the city of St. Louis. Belleville and St. Louis capitalists are interested in the project.

The St. Louis & Suburban Electric Railway company, which recently abandoned its cable system and substituted electricity, sustained serious loss in the burning of its car sheds on the night of the 13th inst. The buildings were located at De Hodiamont, on the Wabash railway, just outside of the city limits, some eight miles from the company's down-town terminus. Thirty motor cars and thirty-two trailers were destroyed, together with the building, and paint and repair shops. The loss aggregates $200,000, largely covered by insurance. As the cars destroyed represented only about half of the company's car equipment, its service has not been seriously crippled. The power house, although situated but thirty-five feet away, was saved. Thirty new motor cars, having double trucks, have been ordered of the St. Louis Car company.

A. H. Reece, manager of the mountain district of the General Electric company, Denver, Colo., spent several days in St. Louis this week. He is en route from New York to Denver.

The South Side Park has been equipped with arc and incandescent lights, and racing is conducted there every night. Large crowds attend, and the illumination is entirely satisfactory.

The mammoth incandescent station of the Missouri Electric Light & Power company, at Twentieth street and Lucas avenue, is being enlarged by the addition of 500 horse power of Babcock & Wilcox water tube boilers.

The power circuits operated from the various central stations are being extensively patronized. The Municipal Electric Light & Power company alone has started over 200 fan motors within the last three weeks.

The contract for the building of the Union Trust company's fifteen story building on the northwest corner of Seventh and Olive streets has been to given the Probst Construction company of Chicago. The building will be wired throughout, but it has not yet been determined whether or not an isolated lighting plant will be put in. Should this plant be put in it will be one of the largest in this city.

A collision occurred at the Union Depot yards on the night of the 17th inst., resulting in the wrecking of the Twelfth street bridge and the interruption of the through service of the Union Depot electric lines, which serve the entire southwestern section of the city. A temporary footbridge has been erected, and passengers are now transferred.

Dr. Wellington Adams, projector and promoter of the "Electrical Express" line between St. Louis and Chicago, returned from the East on Saturday.

James Campbell, president of the Benton Bellefontaine Street railway, who was recently seriously injured at the new electrical power house, has recovered.

The St. Louis & Surburban railway is now operating its Forest Park extension. Plans are now completed and material ordered for a loop inside the park, where there will be erected a $25,000 depot.

Winthrop Bartlett, the engineer in charge of the construction of the Missouri, and St. Louis and Surburban electric railway, has been appointed engineer of the consolidated Cass ave., Union and Northern Central lines, and is now busily engaged preparing plans for the change from horse to electricity. The combined power house will be located on the corner of North Market street and Prairie avenue.

Frank H. Pond, president of the Pond Engineering company has just returned from an eastern trip.

Contracts for the lighting plant of the handsome new Famous building on Broadway and Morgan street, has been placed. The Western Electric company will furnish the arc apparatus, the National Electric Manufacturing company the incandescent, and the Russell company the engines.

Preparations are being made for active work on the plant of the Webster Grove, Mo., Electric Light company. National transformer apparatus will be used. Jessie A. Vail, St. Louis representative of the Hamilton Corliss engine, has been awarded the contract for the complete steam plant.

Henry C. Scott, manager of gas and electric plants at Corondelet, Wichita, Waco, and Fort Worth, has just returned from an extended trip of inspection of his properties.

The Benton-Bellefontaine railway company is ready to start up its second Corliss engine, which is belted directly to two 350 horse power Thompson-Houston generators. The new plant is operating nicely, but a connection is still maintained with the Municipal Electric Light and Power company's station, where a reserve engine and generator are ready for service when desired.

Owing to the burning out of an armature and further fact that the building will soon be vacated, the public school board decided not to resume the operation of the incandescent plant in the Polytechnic building. A connection has therefore been made with the mains of the Missouri Electric Light and Power company.

The recent high water in the Mississippi river, the high-

est since 1858, at one time threatened serious disturbance to the large electric light and power interests in St. Louis. Many of the railways coming into the city from the Illinois coal mines were under water, and it was feared that a coal famine might result. Fortunately there was no serious damage in this direction, although the coal dealers holding contracts were forced to many shifts to keep up the supply.

The Laclede Gas Light company's electric light station, on the river front at the foot of Mound street, was only kept in operation by unceasing vigilance, and the use of extra pumps. The arc lights on the river front were all more or less demoralized. The electric light station at Venice, Ill,, opposite North St. Louis, was forced to suspend operations for an indefinite period.

The Liadell Railway company, operating thirty-eight miles of track by electricity, will build a large car shed extending from Newstead to Fairfax avenue on Taylor. The Detroit Bridge company will build the iron roof. The present buildings on Vandeventer and Finney avenues will be abandoned.

W. C. B.

PERSONAL.

P. H. Hover, the Chicago representative for the Standard Paint company, is now in New York.

Mr. Cummings of Cummings & McCoy, electrical engineers, Detroit, was in Chicago on Monday.

George F. Green of Kalamazoo, Mich., who claimed to be the inventor of the electric railway system, is dead.

Dan. C. Hemingway, of the Hemingway Glass Works, was in Chicago last week, taking in the Derby on Saturday.

H. A. Cleverly, of the Cleverly Electrical Works, Philadelphia, was a visitor last week at the New York office of the WESTERN ELECTRICIAN.

Col. L. W. Burnham, president of the Electric Gas Lighting company, Boston, spent several days last week at the Chicago headquarters of his company. Col. Burnham has just returned from a very successful business trip to the Pacific coast, and is now *en route* to his home in Boston.

B J. Arnold, consulting engineer of the western department of the General Electric company, has been appointed consulting engineer of the World's Fair intramural railway. Mr. Arnold will design the power station for the intramural lines and the work of installation will be done under his supervision.

NEW INCORPORATIONS.

People's Light & Power company, Aspen, Colo.; capital stock, $200,000; supplying electric light and power to the citizens of Aspen, Colo.

Marlin Oil company, Marlin, Tex.; capital stock, $100,000; to supply light, heat and electric power to the town of Marlin; J. A. Martin, Marlin, Tex.

Security Insulator company, Elizabeth, N. J.; capital stock, $10,000; to manufacture electrical supplies and to sell the same; Gerber & Morman, Elizabeth, N. J.

Central Light & Power company, Peoria, Ill.; capital stock, $200,000; to furnish electric light, power and heat, steam power and heating; J. N. Ward, Peoria, Ill.

Bacon-Tyler company, Berwick, Me.; capital stock, $250,000; to manufacture and deal in mechanical, electrical and other devices; Harry V. Moore, Berwick, Me.

Normal Electric Light & Power company, Normal, Ill.; capital stock, $25,000; to establish a water system and furnish electric light and power; W. H. Schireman, Normal, Ill.

Compound Electric Motor & Dynamo company, Chicago, Ill.; capital stock, $500,000; to manufacture and sell electric motors and dynamos; F. E. Turner, 916 Unity building, Chicago, Ill.

American Electric Rock Drill company, Jersey City, N. J.; capital stock, $250,000; to manufacture and operate rock drills, etc; C. E. Burke, 186 Remsen Street, Brooklyn, N. Y.

Gray European Telautograph company, Chicago, Ill. capital stock, $100,000; to buy. sell and manufacture telautographs and other electrical devices; C. P. Treat, 1106 Rookery, Chicago, Ill.

Marietta Electric Light, Heat & Power company, Marietta, Pa.; capital stock, $1,000; supplying light, heat and power by means of electricity to the public in Marietta, Pa.; D. B. Case, Marietta, Pa.

North Kankakee Electric Light and Railway company; Kankakee, Ills.; capital stock, $30,000; to furnish electric light, build, own and operate electric street railway; Edward E. Day, Kankakee, Ill.

ELECTRIC LIGHTING.

Wyandotte, Mich., proposes to establish a municipal electric lighting plant.

The Charleston, S. C., Light & Power company has increased its capital stock $50,000 and will improve its plant.

The Mobile Electric Light & Power company has contracted with the Westinghouse Electric & Manufacturing company for machinery of 3,000 light capacity.

Howell Cobb has contracted with D. A. Tompkins of the Westinghouse Electric & Manufacturing company to put an electric plant in his new hotel at Hendersonville, N. C.

D. A. Tompkins and J. R. Garden of the Westinghouse Electric & Manufacturing company have purchased the Marshall, Texas, gas and electric plant and will consolidate and rehabilitate the plants.

The Tampa, Fla., Street Railway & Power company, a newly organized concern, has purchased the Tampa Electric company's electric light business, and will erect an entirely new plant. The new company has a capital stock of $1,000,000.

The Wolverine Electric Light company of Holland, Mich., claims that the recent election by which it was decided to bond the city for an electric light plant was not legal, and it has served an injunction on the city council to prevent it from putting in the plant.

An agreement between the lamp committee of the common council and the electric light companies of Rochester, N. Y., has been reached. By the terms of the contract each arc light will cost the city 25 cents per night for the next five years. The contract contains a clause which provides that the companies must put their wires in certain specified territory under ground within sixty days after receiving written notice from the council to do so. There are at present on the streets of Rochester 482 gas lamps, 932 Brush arc lights, 383 Rochester arc lights (United States system), 157 Edison arc lights and 593 Edison incandescent lights. The total cost for street light last year was $160,285.

John C. Atwood, a stockholder and vice-president of the St. Louis Electric Light & Power company, has filed an application for a writ of mandamus to compel the secretary and treasurer of the company to allow him to examine the books. The petitioner alleges that the company claims to have made a large amount of money beside its expenses, and to have increased its capital stock from $8,000 to $30,000, and from $30,000 to $75,000. Atwood further alleges that the books of the company are in charge of the secretary, who has refused, it is alleged, to allow the petitioner to inspect them. The object of desiring to inspect the books, it is alleged, is to ascertain how the surplus earnings of the company are disposed of, and by whom the money to increase the capital was paid.

The Cicero, Ill., Light, Heat & Power company is rapidly pushing work on its plant, and by July 15th everything will be in running order and ready for business. The plant is located at Ridgeland, a Chicago suburb, and the power house will be a brick and stone structure, 40 by 120 feet, and contain a 500 horse power engine. At present the company has fifteen miles of poles set in Austin and the wires strung. Work is now being pushed at the south end of the town, and as soon as possible the Grant Locomotive Works, Martin Park, Hawthorne, Clyde, La Vergne, Berwyn, Ridgeland and South Ridgeland will be similarly equipped. The company has a ten-year contract with Cicero and a franchise for thirty years. It will be able to furnish 250 arc lights and such power for manufacturing as may be required in the district embraced by the franchise.

ELECTRIC RAILWAYS.

The General Electric company is said to be negotiating for the purchase of controlling interests in street railways of Atlanta, Mobile and New Orleans.

The Chattanooga Electric Railway company is said to be arranging for an expenditure of about $300,000 in the improvement and extension of its lines. It is proposed to build the St. Elmo branch to Blowing Springs and complete other lines.

The Order of Electric Traimen, a new society for the benefit of men employed in the electric street railway service, has been incorporated in Nebraska. The incorporators hope to make the organization national. It is a secret order and fashioned after that of the Brotherhood of Locomotive Engineers.

It is said that bonds to the amount of $1,800,000 have been sold, the proceeds to be used for electric street railroad construction in St. Louis. The contracts for the work are about to be let. The purpose is to convert the Northern, Central, Union, Cass Avenue and Citizens' street roads into a single electric system.

The *Elektrotechnische Zeitschrift* of Berlin published in its issue of June 10th an illustrated account of the new overhead trolley electric railway in Bremen, said to be the first of the kind in Germany. The line has been in operation since May 1st, and is about three and a half miles long. The power house is equipped with American machinery, including McIntosh & Seymour and Armington & Sims engines, Babcock & Wilcox boilers, Thomson-Houston multipolar generators and arc machines and Worthington pumps.

Cincinnati, Cleveland and Beaver Falls, Pa., capitalists have purchased a controlling interest in the capital stock of the Wheeling Railway company and the Citizens' Railway company, of Wheeling, W. Va., for $90,000. The two lines have been operated jointly and comprise twenty miles of electric lines, connecting Wheeling with the suburbs of Benwood, Bellaire, Martin's Ferry, Ætnaville and Bridgeport, and traversing the city of Wheeling. For lack of capital the roads and equipment have depreciated, and the transfer was made to bring more capital into the system. The capital stock will be increased to $250,000 and a complete Thomson-Houston system put in, including new cars and trolley wires. The track is to be relaid with heavier rails and the service generally improved.

ELECTRIC MINING.

The Sheep Mountain Tunnel & Mining company, near Crystal, Colo., contemplates erecting an electric plant for power and light in order to push ahead developments faster than by hand work.

The Rochester Consolidated Mining company of Rochester, N. Y., owning property located in the Soeffles section of Ouray county, Colo., contemplates the erection of an electric plant on its property during the present year, the water power for which has already been secured.

The Alaska Mining company, whose property is located at Pike City, Sierra county, Cal., is arranging to install an electric plant to do the pumping and hoisting. It is intended to obtain water power from the Middle Yuba river with which to drive the dynamos by the use of Pelton wheels. Some years ago the Alaska mine was a large gold producer, but there was such a heavy body of water to contend with that the cost of keeping it under control was enormous and the company gave up the contest. By the use of electric power it is estimated that the cost of pumping will be greatly reduced and that the mine can be again placed on a profitable working basis.

TELEGRAPH.

Cable dispatches state that nearly all the telegraph operators in Spain struck on June 21st. The men were dissatisfied with their hours of labor and with their wages. The action of the operators in leaving their keys created great confusion in governmental and business circles. The military telegraph operators were pressed into service to handle the wires of the city. A settlement was reached when the government promised to attend to the telegraphers' demands, and Senor Silva, Minister of the Interior, resigned to facilitate the settlement.

The United States survey steamer Thetis arrived at Honolulu on May 20th from Hilo, where she ended the survey for the cable to connect San Francisco and the Hawaiian Islands. The course to Hilo comprised 2,060 miles, as surveyed by the Thetis, with 300 soundings, against the survey of the Albatross of 2,150 miles and 250 soundings. The soundings were made at intervals of two, ten and sometimes one mile apart. The deepest was 3,228 fathoms, about 245 miles northeast of Hilo, and the shoalest was 976 fathoms, at a point about 350 miles from Point Conception. The route traversed by the Thetis is considered by the officers as the most practicable yet surveyed.

TELEPHONE.

A new telephone exchange is to be built in Decatur, Ill.

The bill appropriating $150,000 for establishing telephonic communication between Alpena, Mich., and Thunder Bay and Middle Island, in Lake Huron, and for the display of weather signals from the life saving stations at these points has passed the House of Representatives. The bill will now go to the Senate, and there is every probability of its passage as both Senators McMillen and Stockbridge are favorable to the measure.

It is estimated that there were 1,500 cases of damages to the the telephone system of this city as a result of the storm Thursday afternoon, says the *Chicago Tribune* of June 25th. "One hundred and fifty transmitters were ruined owing to the excessive charges of electricity received from the atmosphere. Such an electric storm has not been known for years. The operating room at the main office was not unlike Dante's vision of the Satanic realm. Forked lightning played around the switchboards and every telephone drop came down as though each patron was calling for a number. The operators were frightened and sprang from their seats when the electric storm burst in its fury about 3:30 P. M. The officers of the company made a tour of the office rooms and assured the girls that there was no danger. The force was so demoralized that it was difficult to restore anything like order. Every precaution known was taken to prevent accident."

MISCELLANEOUS.

The English mint possesses an electrically operated machine for counting coins.

The Waukegan, Ill., *Patriot* has a grievance, and it voices it as follows: "If the electric light company has taken any steps (as promised) to lessen the outrageous noise made by that high speed engine of theirs we now fail to detect it. Come, Mike, do muzzle the monster."

The Hemingray Glass Works at Muncie, Ind., burned Saturday night, June 18th, resulting in almost a total loss. Owing to the great risk and the high rate charged, but a small amount of insurance was carried. It is understood that temporary buildings will be erected and work resumed at once.

Charles E. Fulton was engineer of the heating and electric light plant at Newberry Memorial Chapel, Detroit. On February 12th last he was taken to a hospital with a broken leg. His wife then took his place at the engine. She had never studied the business, but made a success of it, and has become so proficient in handling the machinery she has become quite famous in the vicinity of the chapel as the "woman engineer."

Early in May the fort of Woo-Choo-Diang, in the province of Kiang-See, was struck by lightning and destroyed. The commanding officer of the garrison could not, of course, prevent the lightning striking the fort, but, as is always the custom in Chinese administration of affairs, somebody had to be held responsible and punished for the occasion of the catastrophe, and hence the board appointed to investigate the affair has recommended that

the commanding officer neglected to take certain precautions which might have averted the disaster, and therefore he should be dismissed from the imperial military service. Also his superior officer, the brigadier-general of the district, should receive a slight punishment and degradation in rank.

TRADE NEWS.

The New England Switch company of Bridgeport, Conn., is working upon a number of electrical novelties which it expects to place on the market in the near future.

The Knapp Electrical Works, general western agents for the Safety Insulated Wire & Cable company, are busily engaged in filling the order from the World's Columbian Exposition for the arc light wires. They report the Safety compan's factory as running at night to keep up with the orders. They have under way, about 160,000 feet of lead cable, to be used in the South Park electric lighting plant, Chicago.

Albert Sechrist of the firm of Albert Sechrist & Co., Denver, Colo., was in Chicago recently en route to New York. Mr. Sechrist makes a specialty of incandescent light installations in private residences, and has already equipped a large number of the finest houses in Denver with a new controlling switch that he has recently patented. He was on his way east with the view of introducing the system in Chicago and New York.

The Okonite company, New York, is to be congratulated upon the continuous success of its high grade wire, the sales for the past week through the hands of the Central Electric company, Chicago, general western agents amounting to upwards of 1,000,000 feet. One single order amounted to 225,000 feet. The large stock held by the Central of all sizes of wires, coupled with the unexcelled quality of the product is perhaps a reason for the favor with which the wire is regarded.

A company having for its sole object the repair and refitting of armatures and fields, operating under the name of the Pioneer Armature company, has recently been organized in Chicago by A. C. Ault and F. S. Kline. Mr. Ault is a practical machinist, and has held for several years a prominent position with the Jenney company at Indianapolis, and later with the Kester company at Terre Haute, while Mr. Kline is an electrician, and has had an experience of equal value with the Fort Wayne-Jenney company and the Royal company, at Peoria. These gentlemen are well acquainted with the different electric light and street railway systems, and, with a shop specially arranged for the work, are prepared to take a damaged armature or field and in a few hours' time have it ready for service.

The Hine Eliminator company, of New York, reports that the heat and humidity have in no way effected the active demand for its goods. Among the recent shipments of eliminators the company mentions three to the Pennsylvania Steel company Stellton, Pa., Thomson-Houston company, San Francisco; Los Angeles, Cal., Electric railway company; Telephone building, San Francisco; California & Nevada Ice company, San Francisco; Central Iron Works, Harrisburg, Pa.; Brooklyn Cooperage company, three; John L Mitchell, Milwaukee, Wis: Philadelphia Engineering Works, Philadelphia; Central Electric Light & Power company, Chicago. All these eliminators are to be used for separating water from the the steam used in high speed engines. A number of these orders are duplicates.

The Underwood Manufacturing company of Tolland, Conn., sole manufacturer of the patent cotton leather belting, has issued a very neat pamphlet, which contains, among other things, a telegraphic cipher code, to be used only for ordering belting specialties. The Underwood company also illustrates its "V" or angular belt, which is especially adapted to take the place of flat or round belts. It is claimed that by the use of this style of belt slipping is entirely avoided, as the greater the tension on the belt the tighter it wedges itself into the grooved pulley. This company is very busy, also, filling orders for cotton leather belting and for its patent solid round belting, which is made from the best oak-tanned leather, the outside plies being without joints, and the whole securely fastened together with the standard screw. The officers of this company are: President, F. H. Underwood; treasurer, E. S. Agard; secretary, C. A. Hawkins; superintendent, J. E. Underwood.

BUSINESS.

The Cleverly Electrical Works, Philadelphia, Pa., are very busy at present manufacturing electrical supplies for eastern and western concerns.

The steady demand for high class engines still continues. The Ball Engine company, Erie, Pa., reports shipments in the last four weeks that aggregate 3 590 horse power.

The Knapp Electrical Works, Chicago, report trade particularly good for this season of the year. Among their late sales of annunciators, is the machine just placed in the Great Northern Hotel, Chicago. They are also building an annunciator for the Pfister hotel in Milwaukee, and another for a large hotel building at St. Joseph, Mich.

Curtis & Curtis of Bridgeport, Conn., manufacturers of the Forbes patent stocks and dies pipe cutting and threading machinery, have just received word from the United States government that their heavy power pipe cutting and threading machines have been chosen in competition with all other makes for use in the Navy yard at Boston. These machines have a range of from 2½ to 8 inches.

The Central Electric company, Chicago, reports having sold during the past week 150,000 feet of assorted sizes of interior conduit, with elbows, junction boxes and couplings. The Central Electric company is the general western agent for the Interior Conduit & Insulation company, New York, manufacturers of this tubing, and carries a large stock of it on hand at all times, which enables it to fill orders promptly, to meet the growing demand of the business. The Central Electric company is also selling large quantities of incandescent circuit switches, and key and keyless sockets, always keeping a very large stock of these on hand, so as not to delay customers in filling orders.

Jupiter Pluvius has been having a rare good time in and about Chicago during the last thirty days, and to keep up the interest he has used electricity with a lavish hand, seeming to know that the storage battery of Nature was brim-full, so to speak. But the way he swished his thunder and bolts around was a caution to central station men. The weather bureau reports that the showers and electrical disturbances of the last few days have no precedent in the history of this locality. Many suburban lighting stations suffered more or less, and others would have come to grief had they not have been protected with reliable fuse wire and links. The Electrical Supply company, corner Michigan avenue and Randolph street, Chicago, has been in receipt of numerous orders, accompanied by good words, in connection with its supplies in this line.

Most of the early failures in electrical machinery were undoubtedly due to cheap and inferior construction. Now, though the industry has passed from this pioneer stage, work is being carried on as thoroughly in this line as in other departments of engineering work. The Crooker-Wheeler Electric company, New York, therefore with a knowledge of the value of substantial and reliable construction, is just now pushing a line of motors and special power machinery which, it is believed, is made just as machines should be—that is, the machines are designed to wear and do their work satisfactorily for a long time. Among the many valuable testimonials which this company has printed in its new catalogue, in connection with illustrations of its celebrated motors, is the following, which suggestion is quite true: "Our Crocker-Wheeler one horse power is, so far, very satisfactory indeed. We think it ought to be called the 'Kodak,' for we turn the button and it does the rest." During the last two weeks the company has sold in New York alone over 400 Crocker-Wheeler fan motors for incandescent circuits.

There is at present building in New England a large number of new steam engines for use by electric light and power plants all over the country. The Providence Steam Engine company, Providence, R. I., is filling a large portion of these orders. The company has recently doubled its floor space to keep up with the orders from these sources, and is now erecting new engines as follows: One tandem compound condensing engine 500 horse power, for the Richmond Va., Railway & Electric company; one 250 and one 500 horse power tandem compound condensing for the United States Electric Lighting company, Washington, D. C.; one 500 horse power cross compound engine for the Salem Electric Light company, Salem, Mass.; one pair of 500 horse power tandem compounds for the Thomson-Houston Electric company, for its North New York station; two 600 horse engines for the Malden Mass., Electric Light company. The Providence company has also just completed and put into operation two 200 horse power engines for the Peninsula Electric Light & Power company of Newport News, Va., and one 450 horse power for the Manufacturers' Electric company of Philadelphia.

After much trying delay the Railway Equipment company, successor to the Electric Merchandise company, Chicago, is ready to welcome its patrons to its elegant quarters in the Pullman building. The rooms have been in the hands of the decorator and finisher for several weeks, and everything possible has been done to make them beautiful and comfortable. The offices front upon Michigan avenue, and are on the ground floor. To the left of the entrance is what might be called the visitor's parlor, a space enclosed by a neat railing and containing table and chairs for the comfort and convenience of callers. The general manager's office is also in front and just back of the visitor's parlor, and is well lighted and ventilated by one of the large windows on Michigan avenue. At the rear of the general manager's office is that of the secretary and treasurer. Next in order upon the right is the book keeping department. Enclosed by the counting room equipment is a neat space for the use of the stenographers. The purchasing agent of the company occupies the rear of the main office on the left, where he is conveniently near the store rooms and shipping department. A youthful usher at a desk to the right of the doorway is always "at your service." The same side of the office furnishes enclosed desk room for the salesmen, and also space for a large show board, upon which are exhibited all the various parts used in electric railway construction. If one desires to see quantity rather than to examine as to quality, a door at the farther end of the offices admits him to a store room where bins and shelves filled with the many devices handled by the house line the walls. The rooms are well lighted by electricity throughout, and will make a delightful home for the new company. Moving into such commodious and pleasant quarters is the natural outcome of the growth of this company's business and a witness of its popularity with the trade. Three years ago, under another name but with the same general manager in charge, this concern started a unique business—the handling exclusively of electric railway supplies. Less than a year ago its quarters were found insufficient, and were doubled; again it became necessary to better its facilities. A great majority of the electric railways of this country are its regular customers. Irrespective of the pushing qualities of the company, its prosperity is undoubtedly largely due to its honest intention to furnish the best possible quality of material to purchasers. All friends of the Railway Equipment company and of its general manager, W. R. Mason, will without doubt be glad to extend congratulations upon the company's bright prospects and the appearance of its new home.

ELECTRICAL PATENTS.

Issued June 21, 1892.

477,206 Electric Alarm Clock. Benjamin Franklin, Chicago, Ill.

477,212. Means for Preventing Collision on Railways. Heinrich G. Held, Zwolle, Netherlands.

477,214 Electric Controlling Apparatus for Fire Alarms. George Knowles Jr., Milwaukee, Wis

477,218. Cable Junction Box. John D. McLeod, Milwaukee, Wis.

477,219. Carbon Rod Contact for Arc Lamps. Charles McNellis, Chicago, Ill.

477,220 Process of Recovering Tin from Scrap. John J. Naef, Paterson, N. J.

477,221. Electric Arc Lamp. Lemon Parker, St. Louis, Mo.

When the upper carbon is consumed it is automatically discharged and replaced by a fresh carbon.

477,223 Means for Operating Ammeters and Other Electrical Apparatus. Herbert M. Pilkington and Roger S. White, Brooklyn, N. Y.

477,247. Rheostat. George K. Cummings, Chicago, Ill.

The conductors are imbedded in electrical insulating material while the same is in a plastic condition.

477,250. Distribution of Rotary Electric Currents. Alard E Du Bois-Reymond, Berlin, Germany.

This invention consists in a system of distribution of multiphase currents whereby the currents transmitted may be used conjunctively to operate motors or singly to operate lamps.

477,273. Electric Arc Lamp. Norman F. Rutherford, Bathurst, New South Wales.

Two crossed levers are pivoted at their point of intersection. One lever carries series solenoids and the other carries shunt solenoids. The plungers of the solenoids are carried upon the opposite levers. The carbon electrodes are rotatable disks.

477,282. Recording Compass. John J. Townsend. Portsmouth, Va.

477,283. Automatic Recording Compass. John J. Townsend, Portsmouth, Va.

477,284. Automatic Course, Speed and Time Recorder. for Vessels. John J. Townsend, Portsmouth, Va.

477,301 Electric Jail. Perley Hale, Chicago, Ill., and Charles H. Sparks, St. Louis, Mo.

In this invention circuits are so arranged that by breaking bars or gratings an alarm is sounded.

477,315. Thermotic Circuit Closer. Walter H. Tapley, Chicago, Ill.

477,350 Process of Electroplating with Alloys. Edward T. Barrowe, Portland, Me.

477,374. Electrical Switch. Charles J. Klein. New York, N. Y.

477,383. Printing Telegraph. Charles J. Reed, Orange, N. J.

A telegraph circuit is combined with type writing machines so so that an operator at one point may produce type written messages at a distant point, the keys being depressed by the attraction of electro-magnets.

477,384. Printing Telegraph. Charles J. Reed, Orange, N. J.

477,407. Incandescent Electric Lamp Socket. Jacob S. Gibbs, Hartford, Conn.

477,409. Electric Switch. Edwin T. Greenfield, New York, N. Y.

477,427. Electric Arc Lamp. Frederick V. Maquaire, Paris, France. Filed Aug. 30, 1890. Serial No. 361,867. (No model.) Patented in France April 19, 1888, No. 190,085; in Belgium July 11, 1888, No. 82,525; in England July 13, 1888, No. 10,209; in Germany, July 21, 1888, No. 46,359; in Spain Sept. 28, 1888, No. 8,526; in Italy, Sept. 30, 1888, XLVII, 204, and in Austria-Hungary Jan. 2, 1889, No. 37,660 No. 61,245.

477,483. Electric Motor. Frederick Yeiser, Tampa, Fla.

477,579. Test Circuit for Multiple Switch Boards. Charles E. Scribner, Chicago, Ill.

477,595. Electric Switch. Jesse L. Hinds. Syracuse, N. Y.

477,612. Electric Switch. Eugene A. Snow, Syracuse. N. Y.

477,613. Combined Weighing, Lifting, Measuring and Electric Machine. August Sundh, Yonkers, N. Y.

477,616. Electric Annunciator Drop. James C. Warner, Chicago, Ill.

The invention involves means for preventing inductive effects between the coils of different magnets, and means for making the action of the annunciator sensitive.

477,627. Electric Embossing Stamp. Charles E. Carpenter, Minneapolis, Minn.

477,628. Electric Heater. Charles E. Carpenter, Minneapolis, Minn.

The invention has for its object to utilize a portion of the secondary circuit of a transformer for evolving heat upon the passage of a current of varying intensity through the primary circuit.

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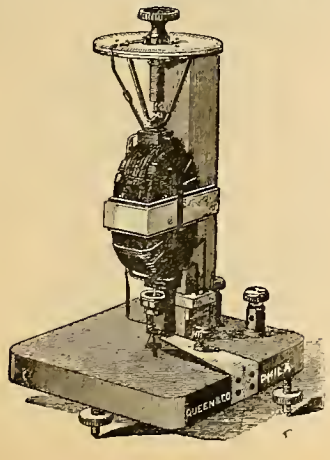

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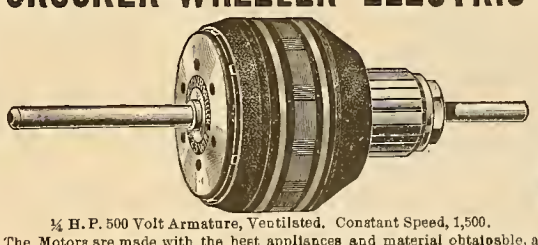

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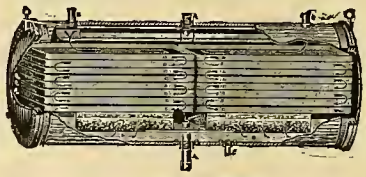

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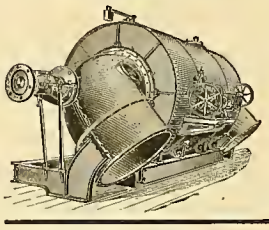

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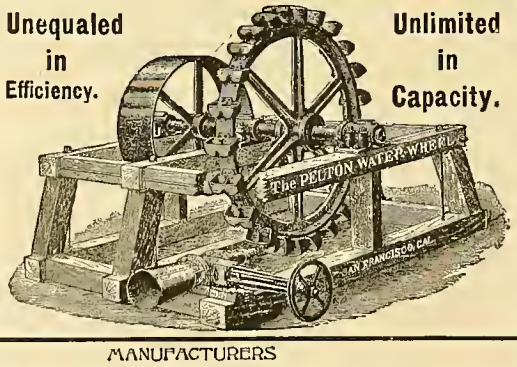

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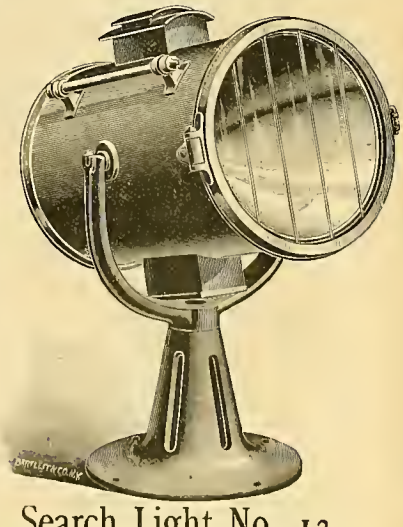

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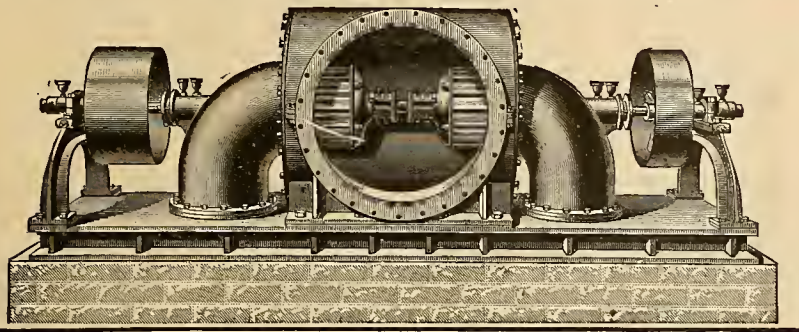

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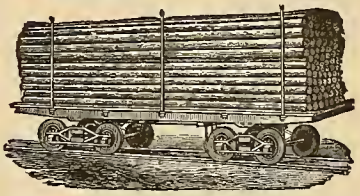

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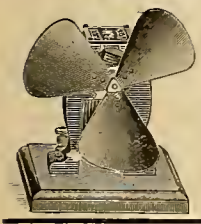

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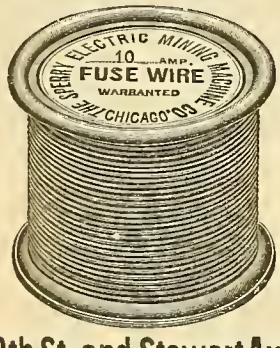

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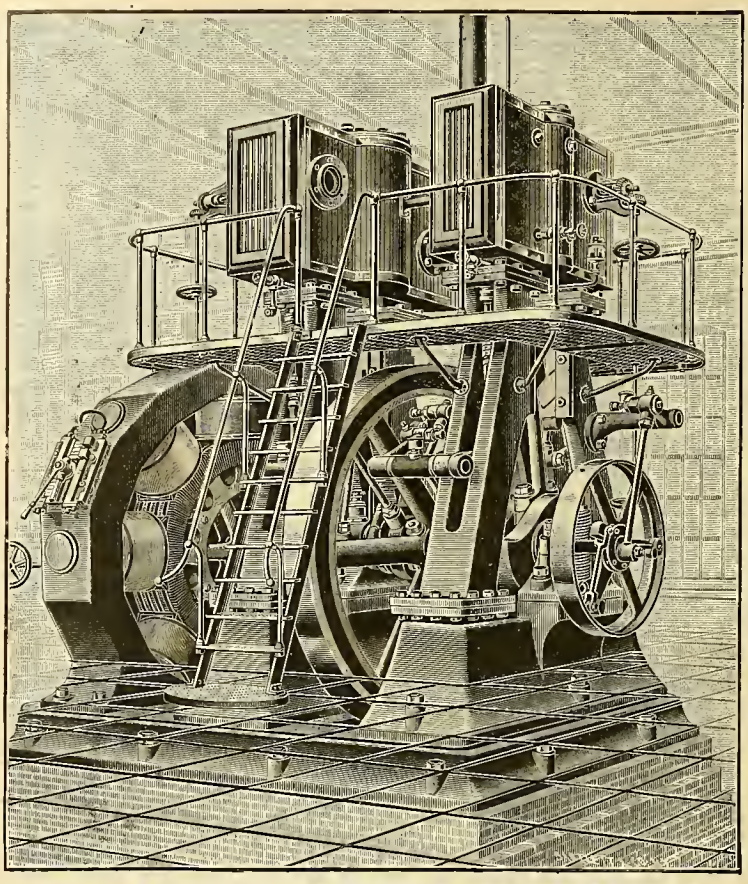

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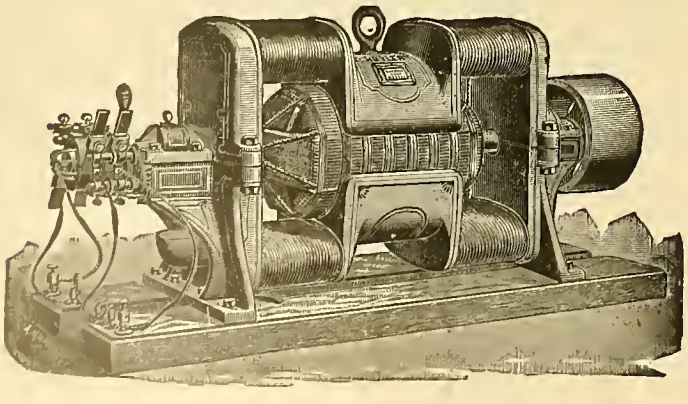

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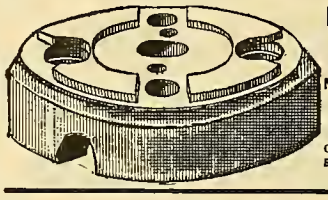

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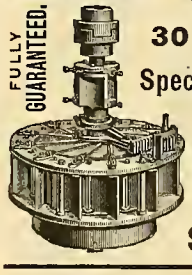

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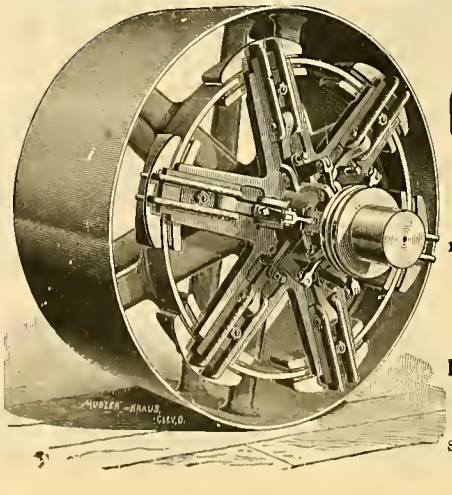

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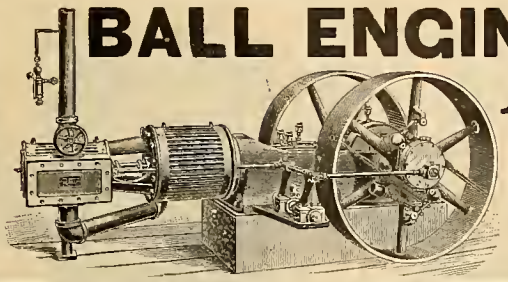

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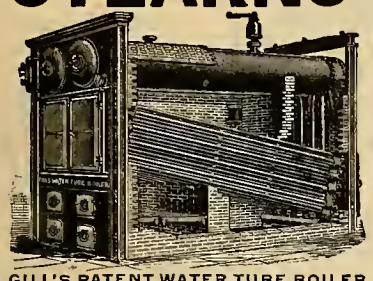

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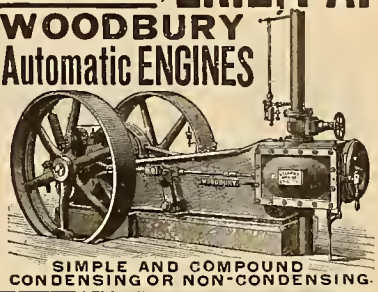

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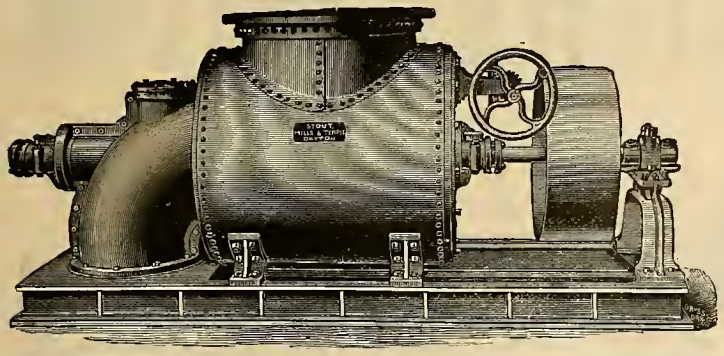

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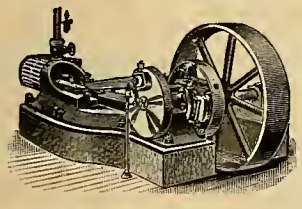

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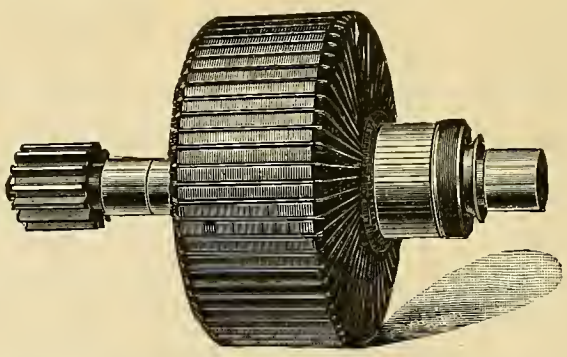

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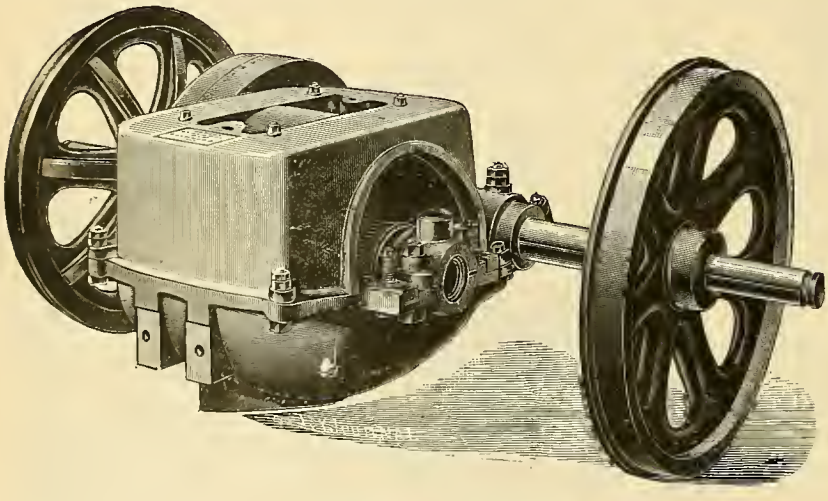

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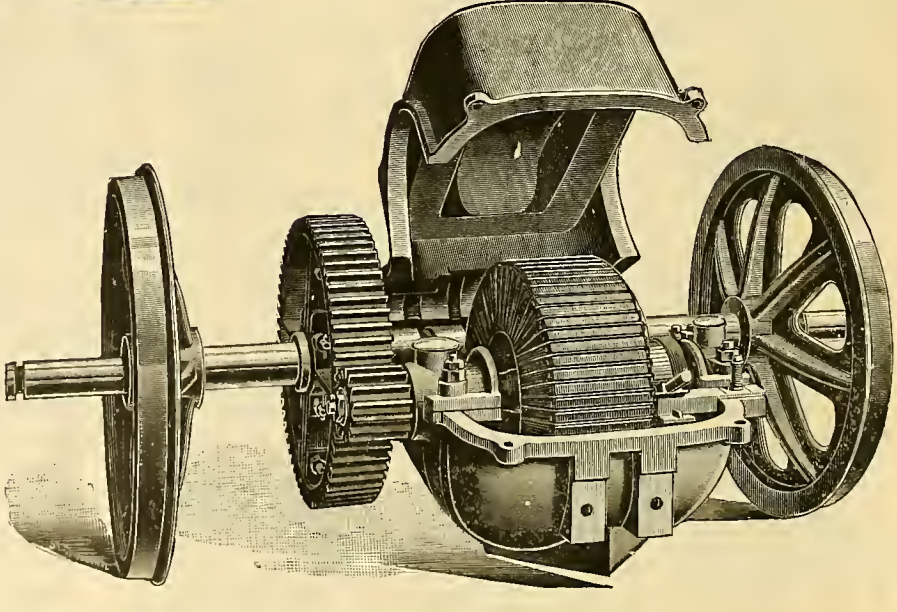

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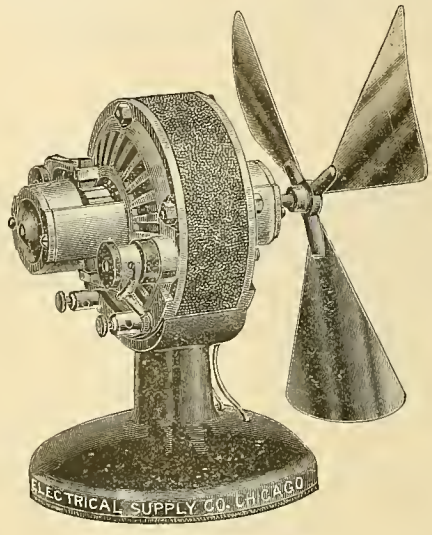

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Softly shining white
Whence are you from?
My dainty sprite?
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P. S.—"This is konfidenshul, on the ded quiet."

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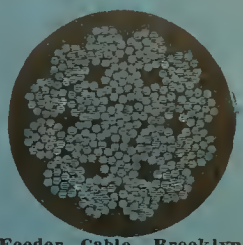
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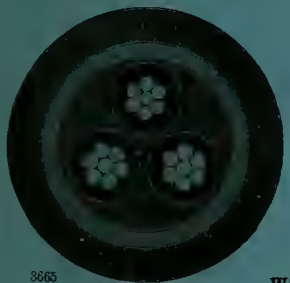
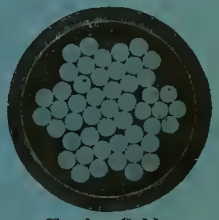

3665 Feeder Core.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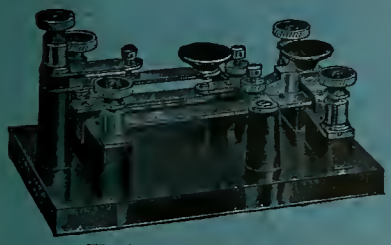

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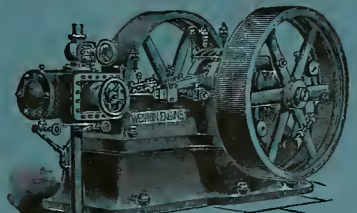

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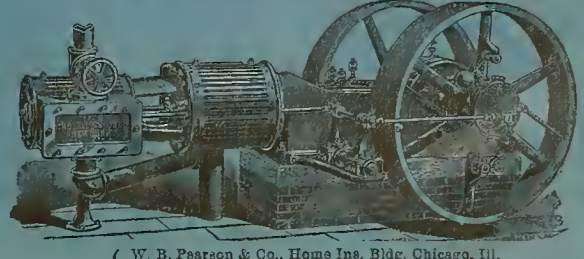

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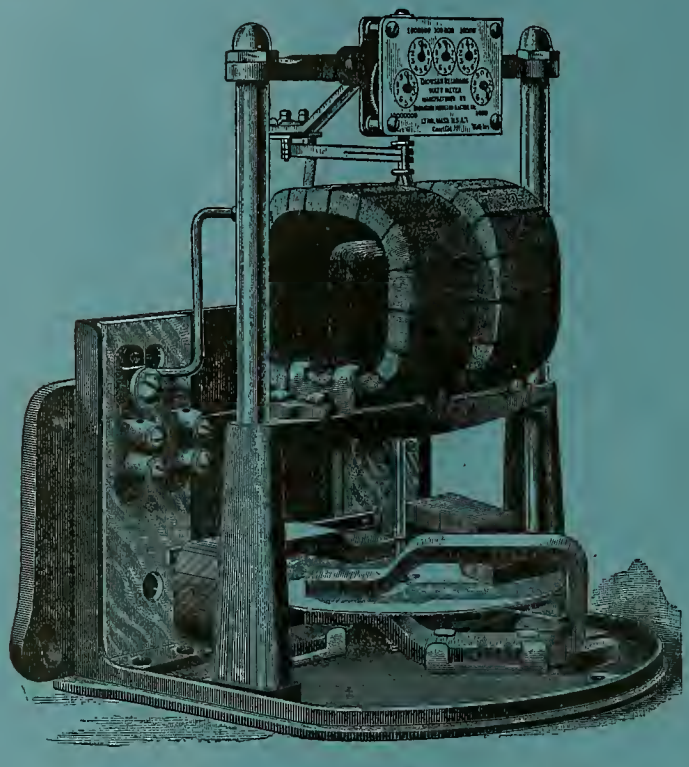

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INDEX AND CLASSIFICATION OF ADVERTISEMENTS.

ALPHABETICAL LIST.

American Battery Co..... v
American Desk & Seating Co..—
American Engine Co..... xiv
Andrae, Julius..... xiv
Andrews & Co., A. H..... ... xv
Babcock & Wilcox Co., The.... i
Baggot, E xvi
Ball Engine Co..... xxi
Ball & Wood Co., The l
Beacon Vacuum Pump & Elec. Co i
Becker Mfg. Co., John.....—
Beggs, J. E., Mch. & Supply Co. xii
Bernstein Electric Co..... iv
Boston Braid Mfg. Co..... xvi
Bowers Bros..... xviii
Bristols' Mfg. Co..... i
Brookfield, Wm..... xiv
Brush Electric Co viii
Bryan, W. H..... xv
Bryant Electric Co.....—
Buckeye Electric Co., The..... xi
Butler Hard Rubber Co..... xviii
"C. & C." Electric Motor Co.. vi
Central Electric Co..... v
Chicago Electric Motor Co.....—
Chicago Rawhide Mfg. Co..... xx
Consol. Elec. Mfg. Co., The.. i
Crescent Ins. Wire & Cable Co. xv
Crocker-Wheeler Electric Co.. xv
Cushing, F. W..... vii
Cutter, Geo.....—
Cutter Electrical & Mfg. Co... xvii
Dayton Globe Iron Works Co.. xxi
Densmore Typewriter Co.....—
Detroit Electrical Works..... xxvi
Diamond Electric Mfg. Co....—
Dixon Crucible Co., Jos..... xvii
Dudley & Co., W. W..... xv
Duplex Electric Co., Ltd..... xiv
Eastern Electric Cable Co..... xv
Easton Electric Co.....—
Edison General Electric Co.....viii
Electric Cons. & Supply Co...xviii
Electric Engr'g & Supply Co .. xi
Electric Secret Service Co..... xi
Electrician Pub. Co. xx
Electrical Construction Co., The. xiv
Elec. Eng. & Sup. Co., The.. ix, xv
"Electrical Progress"..... xv
Electrical Supply Co., The... xxiv
Elektron Mfg. Co.....—
Emerson Electric Mfg. Co..... xi
Empire China Works..... xvi
Enterprise Electric Co..... xix
Falls Rivet & Machine Co..... xi
Ferracute Machine Co..... —
For Sale.....xii, xiv, xv
Fort Wayne Electric Co..... xxvi
Gravity Purifier Co..... xvii
Great Western Elec. Supply Co. x
Greeley & Co., The E. S..... l
Gregory, Chas. E..... xv
Hart & Hegeman Mfg. Co..... xii
Heisler Electric Co..... x
Hill Clutch Works.....—
Hine Eliminator Co..... xiv
Holmes, Booth & Haydens.... xix
Illinois Electric Lamp Co..... xvii
India Rubber & G. P. Ins. Co. xxv
Institute of Technology..... xv
Interior Conduit & Insulation Co. xii
International Okonite Co..... i
Jewell Belting Co..... i
Johns Mfg. Co., H. W.....—
Kartavert Mfg. Co..... xii
Keller & Degenhardt..... l
Kelly Brothers xviii
Knapp Electrical Works xxiii
Lake, J. H. & D., Co..... xii
Lake Erie Engineering Works. xx
Lane & Bodley Co.....xviii
La Roche Electric Works..... xxi
Law Telephone Co..... xv
Leclanche Battery Co., The....xix
Lefmann, Julius..... xiv
Leffel & Co., Jas..... xvi
Leonard & Co., H. W..... xix
Link Belt Machinery Co..... xvii
Loud, H. M. & Sons Lumber Co. xvi
Lovell Mfg. Co., Ltd..... xv
Morse & Co., A. M.....xxi
Munsell & Co., Eugene..... xv
Murphy, T. J.....—
National Carbon Co..... xvi
National Electric Mfg. Co.... ix
New York Insulated Wire Co. xii
New York & Ohio Co..... l
Ostrander & Co., W. R..... xxi
Page Belting Co..... xviii
Partrick & Carter Co..... xvi
Pearson & Co., W. B..... xx
Pelton Water Wheel Co xvi
Perkins Elec. Switch Mfg. Co.—
Perry & Noyes.....xiv
Phoenix Glass Co.....—
Pierce, Jr., Josiah. xviii
Pioneer Armature Co..... xv
Porter-Leavitt Elec. Motor Co.—
Powell Co., The Wm..... xvii
Premier Electric Co., The.....—
Queen & Co..... xv
Racine Hardware Mfg. Co..... xiv
Rae, Frank B xv
Railway Equipment Co..... xi
Ries Electric Specialty Co..... xii
Rockford Electric Mfg. Co....—
Roebling's Sons Co., J. A ....—
Rose Elec. Light Supply Co.. —
Rose Polytechnic Institute....—
Royal Electric Co..... xiv
Samson Cordage Works. xiv
Sawyer-Man Electric Co.....xiii
Schindel & Schindel..... xvi
Schuyler Electric Co..... x
Sechrist, Albert.....xii
Short Electric Railway Co lv
Shultz Belting Co..... xx
Siehert, G..... xv
Sioux City Engine Works.... xxi
Smith, A. T..... xv
Smith, Thos. G. Jr..... xvii
Somoff, J. L.....xvii
Sperry Elec. Mining Mach. Co.xviii
Standard Paint Co xv
Stanley Electric Mfg. Co.....—
Star Electrix Co... xvi
Stearns Mfg. Co..... ... xxi
Sterling, W. C.....xvii
Stilwell & Bierce Mfg. Co. xvi, xvii
Sunbeam Incand. Lamp Co ... xxv
Taylor Engine Co..... xxi
Thomson-Houston Elec. Co..ii, xxii
Union Hardware Co.....xiv
U. S. Electric Lighting Co.. xiii
Utica Elec. Mfg. & Supply Co. xii
Van Nuis C. S.....—
Vulcanized Fibre Co.....xvii
Waddell-Entz Company..... xiv
Wannopee Pottery Co.....xviii
Wanted..... xv
Western Electric Co..... xii
Westinghouse, Church, Kerr & Co..... xix
Westinghouse Elec. and Mfg Co—
Weston Engine Co..... i
Williams Engine Works..... .xxi
Woodhouse & Rawson, Ltd.... xix
Worthington, Henry R.....—

CLASSIFIED LIST.

Annunciators.
Central Electric Co.
Detroit Electrical Works.
Electrical Supply Co., The.
Great Western Elec. Supply Co.
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Detroit Electrical Works.
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Electrical Eng. & Supply Co.
Electrical Supply Co., The.
Enterprise Electric Co.
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Knapp Electrical Works.
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Cushing, F. W.
Edison General Electric Co.
Electric Engineering & Supply Co.
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Crescent Ins. Wire & Cable Co.
Cushing, F. W.
Cutter, Geo.
Detroit Electrical Works.
Eastern Electric Cable Co.
Edison General Electric Co.
Electrical Supply Co., The.
Enterprise Electric Co.
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Bernstein Electric Co.
Buckeye Electric Co.
Central Electric Co.
Cutter Electrical & Mfg. Co.
Edison General Electric Co.
Electrical Supply Co., The.
Great Western Elec. Supply Co.
Illinois Electric Lamp Co.
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New York and Ohio Co.
Sawyer-Man Electric Co.
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Magnet Wire.
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Detroit Electrical Works.
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Bowers Bros.
Johns Mfg. Co., H. W.
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Mine Signals, Electric.
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Mining Apparatus, Electric.
Edison General Electric Co.
Thomson-Houston Electric Co.
Sperry Elec. Mining Machine Co.
Westinghouse Electric & Mfg. Co.

Motors.
Brush Electric Co.
"C. & C." Electric Motor Co.
Crocker-Wheeler Electric Co.
Chicago Electric Motor Co.
Detroit Electrical Works.
Easton Electric Co.
Edison General Electric Co.
Electrical Eng. & Supply Co.
Emerson Electric Mfg. Co.
La Roche Electric Works.
Lovell Mfg. Co., Ltd.
Porter-Leavitt Electric Motor Co.
Premier Electric Co.
Rockford Electric Manufacturing Co.
Royal Electric Co.
Thomson-Houston Electric Co.
Waddell-Entz Company.
Westinghouse Electric & Mfg Co.

Name Plates.
Becker Mfg. Co., John.

Office Furniture.
American Desk & Seating Co.
Andrews & Co., A. H.

Oil Cups.
Powell Co., The Wm.

Oil Purifiers.
Gravity Purifier Co.

Pins and Brackets.
Central Electric Co.
Electrical Supply Co., The.
Lond, H. M. & Sons' Lumber Co.
Railway Equipment Co.
Schindel & Shindel.
Western Electric Co.

Platinum.
Siehert, G.

Poles.
Electrical Supply Co., The.
Lefmann, Julius.
Lond, H. M. & Sons' Lumber Co.
Railway Equipment Co.
Schindel & Schindel.
Sterling, W. C.

Porcelain.
Wannopee Pottery Co.

Publishers, Electrical.
Electrician Publishing Co.

Push Buttons.
Detroit Electrical Works.
Central Electric Co.
Electrical Supply Co., The.
Knapp Electrical Works.
Union Hardware Co.
Western Electric Co.

Railways, Electric.
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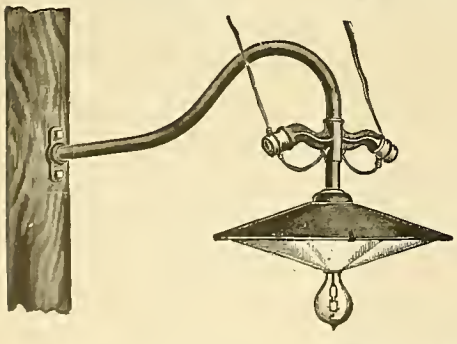

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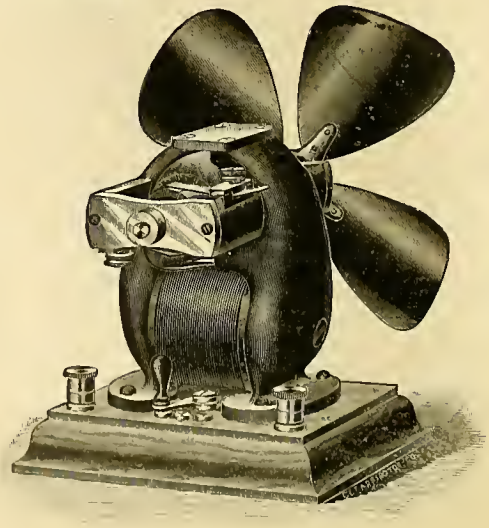

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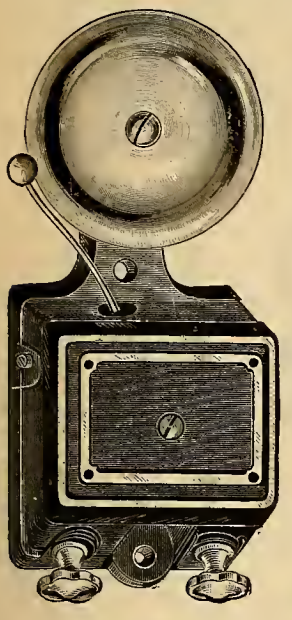

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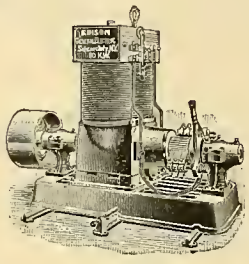

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For the above reasons alone it will pay you to have us bid against the Trust in every case. It means money in your pocket.

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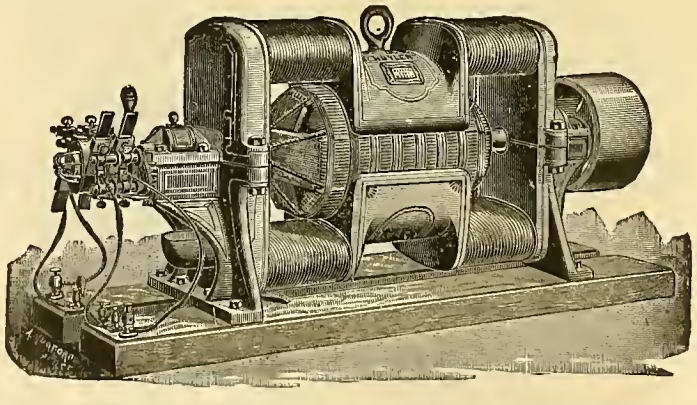

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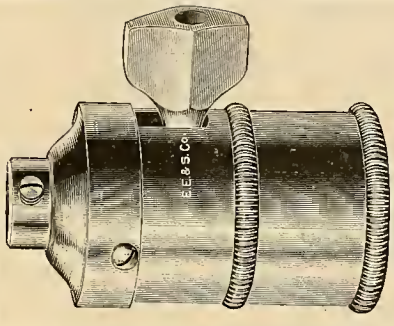

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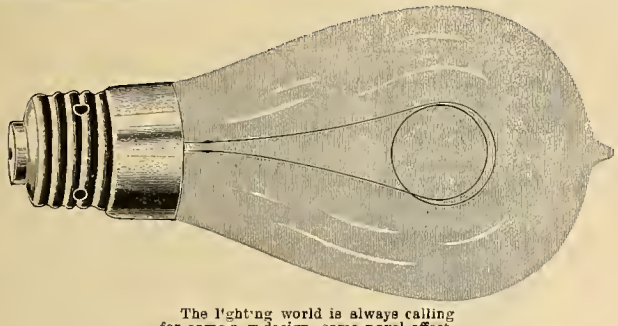

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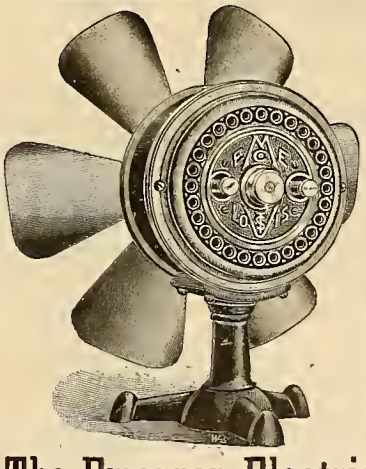

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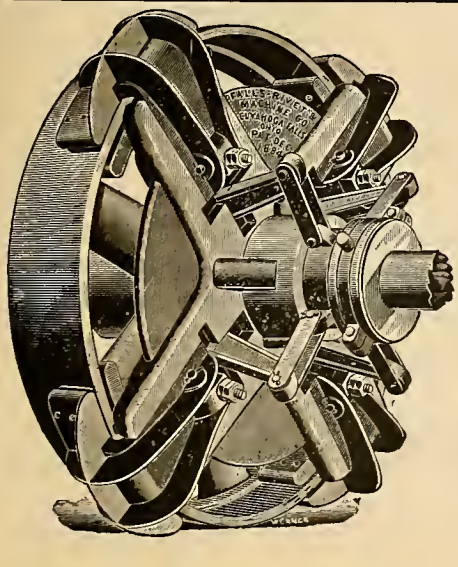

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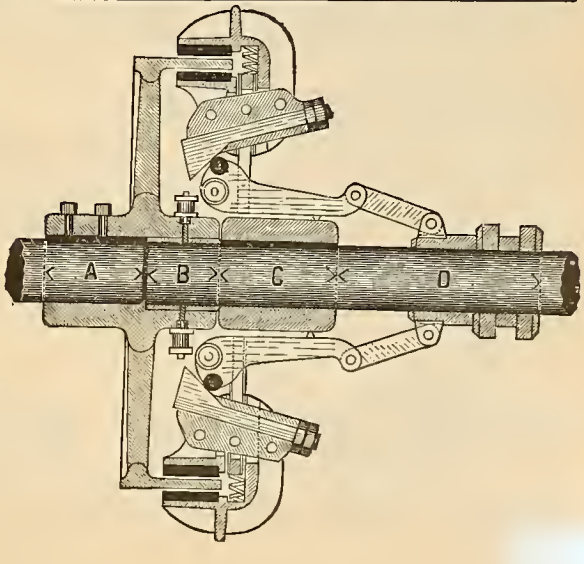

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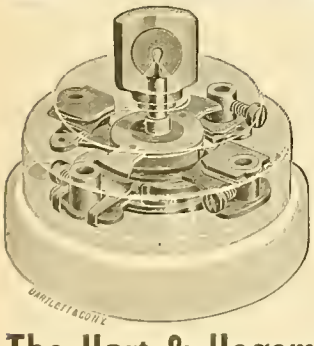

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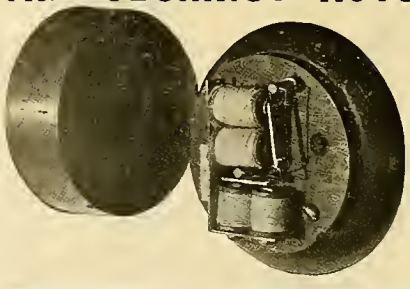

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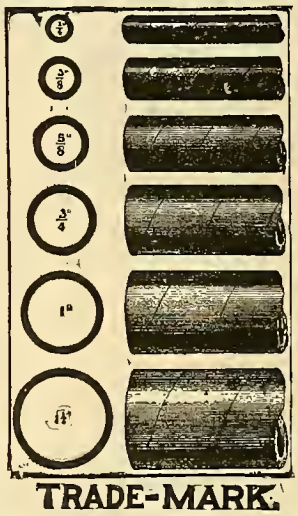

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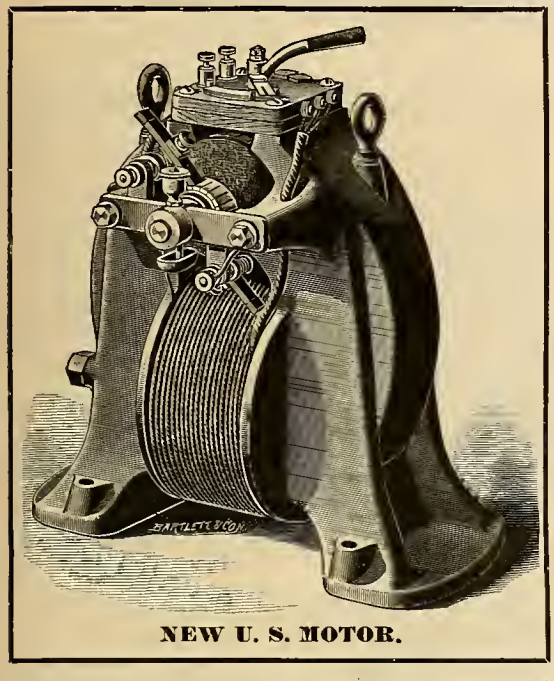

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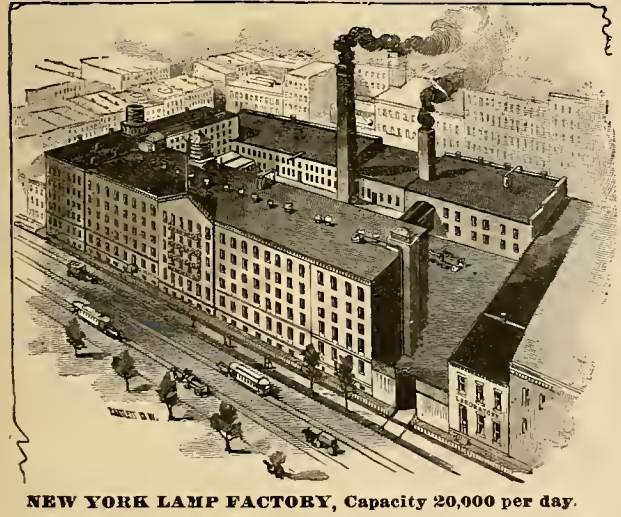

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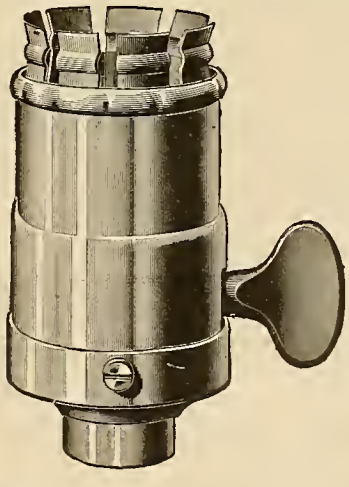

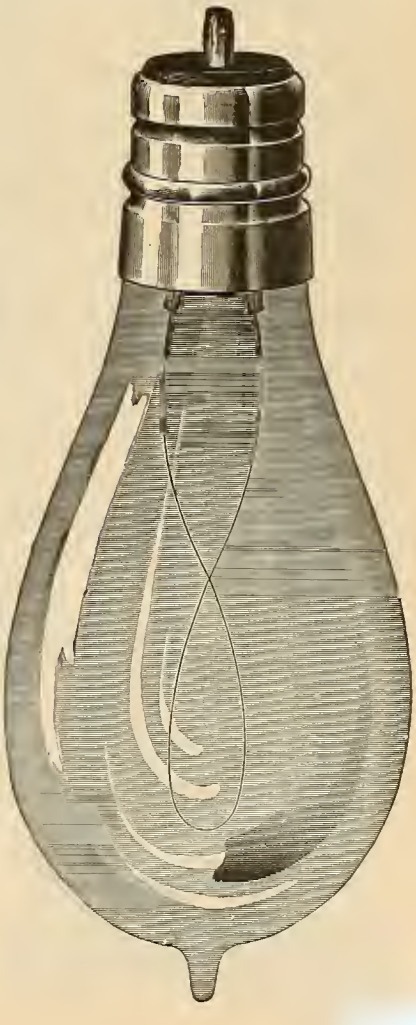

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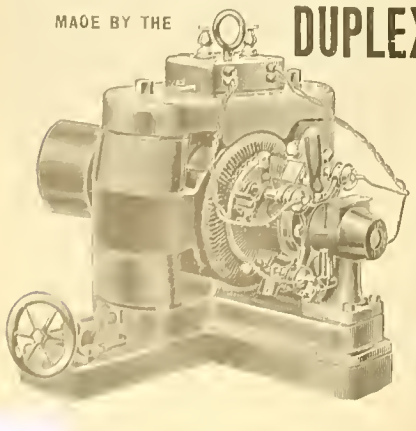

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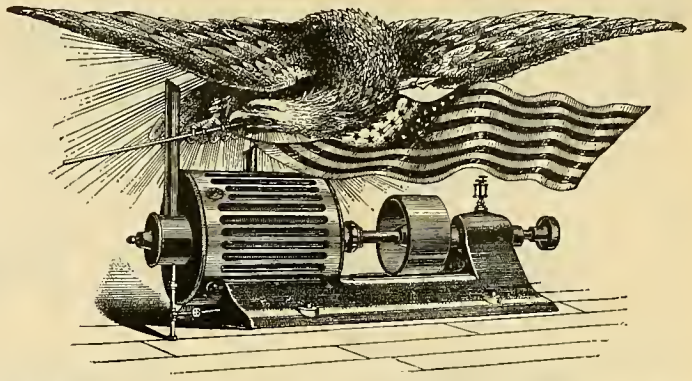

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1000 OR MORE REVOLUTIONS PER MINUTE !

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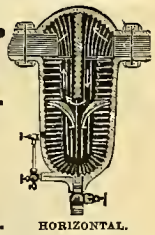

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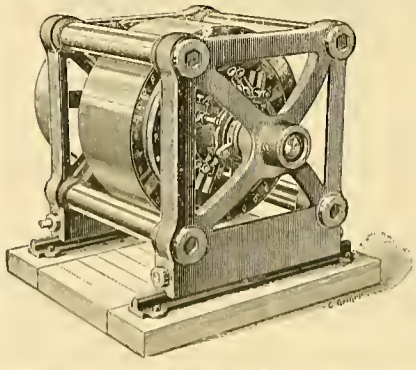

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Western Electrician.

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Vol. XI. CHICAGO, JULY 9, 1892. No. 2

Blowing a Church Organ with Accumulators.

An application of the electric motor as ordinarily connected with the central station wires, to supply power for b'owing a church organ, is no longer looked upon as a very novel installatioo. One seldom hears, however, of an electric motor being employed for this purpose and taking its current from a battery of storage cells. Such a plant, though, as the one referred to is illustrated in the accompanying cuts.

This equipment is doubly interesting from the fact that not only is the storage battery used but the cells receive their charge from a night arc light current; besides this, the one battery furnishes power to blow two organs.

No one knows better than the motor salesman how few have been the cases in which it was possible to obtain current for organ service. The majority of churches are so situated that no current can be obtained in the day time; and but few churches are located in the vicinity of an incandescent electric light plant. Arc light lines are more generally available than incandescent, but as nearly all of these are in operation only at night the current is not available for blowing organs in the day time.

Recognizing that the accumulator offered itself as a means through which this problem of current supply might be solved, the Electro-Dynamic company of Philadelphia devised a system to furnish the motor from a battery to be charged from an arc light line.

The first installation in which this system was employed was in the Bethlehem Presbyterian church at the northeast corner of Broad and Diamond streets, Philadelphia. The apparatus has been in use for two years, and, it is stated, has never in all that time failed to act promptly.

The entire electrical power outfit at the church consists only of the battery and charging switch-board, Fig. 1, the motor, Fig. 2, and the three special switches Figs. 3 and 4, at the organs. Fig. 5 is a diagram of connections.

The one motor operates a bellows that blows the two organs in the church buildings, the large Roosevelt organ in the church proper and a medium size Sunday school organ. The wind chests of the two organs, are connected, the large organ d.iving the blowing and filling the bellows of the second organ. The connection is made by about 150 feet of tubing. The second organ is provided with a valve which prevents a backward flow of the air, shutting entirely before the blow-off point is reached. The motor will blow both organs to their fullest capacity at the same time.

It is worth mentioning here that the plan to connect the two organs to the one bellows was carried out against the protest of all the organ builders who were consulted. When, however, the scheme was put in operation it was generally admitted that no organ could be better blown; both can be played at the same time, and each one has a full supply of wind.

The storage battery and charging switch-board, Fig. 1, are located in the church cellar in a little room partitioned off especially to contain this apparatus. There are in all eighteen cells of the Accumulator company's "15 L" type, and these are connected in series to give a pressure of about 36 volts. These cells have a capacity of 300 ampere hours, and the battery when fully charged is of sufficient capacity to run the motor from 8 to ten hours. It was necessary to provide an automatic switch to connect the battery to the arc circuit. This switch is automatic in both directions, so to speak. It throws the battery off the circuit before the dynamo stops, the switch acting when the 10 ampere current falls to 4 amperes. The object of this is to prevent the battery discharging back through the line. When the system was first put into service it was found that the current from the arc dynamo was not sufficiently regular to keep the battery on the circuit. The current would fall to nearly the zero point several times in the course of an evening, opening the switch and throwing the battery off the circuit. It was necessary, therefore to make the switch return automatically the battery to the circuit whenever the current was restored. This was accomplished by means of a solenoid in the main circuit, so arranged that it pulls the switch back into place. Suitable resistances were inserted and mercury cups so arranged as to keep the main circuit intact and prevent sparking when connection is broken. The double pole non-break switch is used to throw the apparatus in circuit and this can be turned by the sexton at any time in the day so that the battery can be charged at night.

FIG. 1. BLOWING A CHURCH ORGAN WITH ACCUMULATORS.

The charging current is obtained from an arc light station on Diamond street about one mile distant from the church. The dynamo connected with the charging line is of the Thomson-Houston pattern and has capacity for 50 arc lamps. The battery takes about two thirds of the power required for an arc lamp. In practice it has been found that two nights' charging in the week is amply sufficient for the regular church and Sunday school service.

The motor driving the organ bellows is a nominal one horse power machine of the Edeo type, capable of developing two horse power for short periods. It is belted to the shaft of the bellows through a counter shaft and drives the crank shaft at sixty revolutions per minute. This rate of speed meets the maximum demand for wind. The bellows has three leaves; one with two leaves would require a reciprocating motion.

To control the electrical power for the two organs so as to maintain a steady air pressure, there are arranged in connection with the motor circuit and the bellows, three special switches, viz., two starting switches, one of which is shown in Fig. 3, and a governing or regulating switch, Fig. 4. The motor is put in circuit with the battery by means of either of the two starting switches, which are located one beneath each organ. The starting switch is connected with one of the stops on the organ known as the "blower's signal," and it turns on the current through several resistances. The organist pulls out this stop and starts the motor, which, as soon as the bellows is filled, is cut out of the circuit automatically by the regulating switch.

The speed of the motor is controlled by the regulating switch, which is in the basement under the larger organ. This switch is operated through a chain by a weight which rises or falls with the top of the bellows. A contact lever on this switch moves over the several points of a rheostat and puts a greater orless amount of resistance in the motor circuit. As the bellows fills, the motor runs slower until just before reaching the blow-off point the circuit is opened by a mercury switch worked by a solenoid and so constructed as to reduce the spark to a minimum. The fall of the bellows to a predetermined point re-establishes the circuit. This regulation is so perfect, that the top of the bellows has a vertical movement not greater than one inch under the severest demands, and through it is secured very even wind pressure which is most favorable for uniformity of strength and purity of tone in the organ.

The whole apparatus is in charge of the sexton of the church; the organist has nothing to do but pull out the

motor stop, and the motor never fails to respond promptly. The cost of current is but little as compared to the cost of hand blowing, while the convenience is incomparably greater.

For the information relative to this novel and interesting installation the WESTERN ELECTRICIAN is indebted to Superintendent E. A. Scott of the Electro-Dynamic company of Philadelphia, the apparatus having been introduced under Mr. Scott's supervision.

Electricity at the World's Fair.

The contest for the contract of supplying and operating launches to carry passengers on the lagoons of the World's Fair has now narrowed down to four competitors, two of whom have electric boats and two steam. These contest-

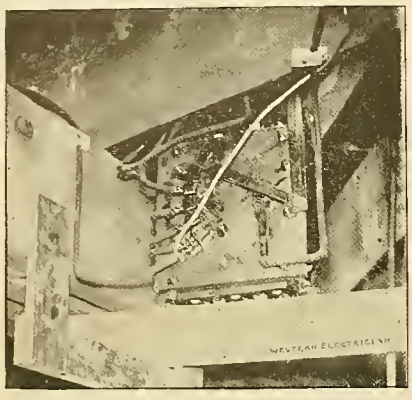


FIG. 3. BLOWING A CHURCH ORGAN WITH ACCUMULATORS.

ants are the Electric Launch & Navigation company of New York, the Columbian Launch company of Chicago, Meeker, Eckhart & Coyne of New York and E. P. Willard & Co. of Chicago. The two former are exploiting electric boats, while the latter two pin their faith to steam launches. All of these boats have been tested officially, and it may be said that all, generally speaking, have satisfactorily complied with the conditions. It is believed, howevever, that, other things being equal, the World's Fair authorities will favor electricity, both on account of the esthetic advantages and the fact that boats of this character are still a comparative novelty in this country, and would prove a great attraction to visitors. It is quite likely, therefore, that the final choice will be made between the two electric boats, which appear to be very evenly matched. There are some supplementary tests to be made, however, particularly in relation to the electric boats, which will be required to make ten-hour runs on two or three consecutive days, and it is probable that the report of the construction department to the committee on grounds and buildings will not be made until some time next week.

The test was made on an indicated course in the basin and outside harbor about four-fifths of a mile long. The boats were required to make the circuit of this course, which was marked by flags, making two landings of a minute and a half's duration each, on each trip. This was kept up for ten hours. Under the general direction of Mr. Sargent the tests were in charge of H. Fitz-John Porter, assisted by Henry G. Field and Mr. Hellstrom. Each competitor was allowed to select the rate which he would deem advisable to operate at should he secure the contract. Other tests in relation to the tilting angle, tactical diameter, time necessary to get under full speed and to come to a dead stop were also made. Bags of sand of 140 pounds' weight each were loaded on the boat to represent the weight of a full complement of passengers. Careful notes were taken of the features of each test, and will be embodied in the report. Mr. Sargent characterizes the newspaper reports of failure of the electric boats as false and misleading, and says that so far the tests have been made without trouble.

On Wednesday of last week the Columbian Launch company's electric boat was tested, and was run for ten hours at a slow rate of speed. This ended the official test, but to satisfy themselves the owners of the boat kept up the trial, and the launch proceeded to make the prescribed course steadily until 8:31 A. M. on Thursday. As the trial began at 8:05 A. M., and 26 minutes was consumed in special tests and stops, this record shows that the Morrison batteries, with one charging, lasted for twenty-four hours—an excellent showing. It is stated that during the time mentioned the boat covered seventy-five miles. Charles Sorley was the electrician in charge, Harold Sturges represented the American Battery company and Charles Norton and Wallace Clark the Columbian Launch company. Mr. Adams represented the Jenney Motor company of Indianapolis, and Mr. Hellstrom watched the test for the exposition authorities. The Electric Launch & Navigation company's boat Electra was tested on Thursday, and the result was very satisfactory. Mr. Reckenzaun was in charge, and the boat was run for ten hours, lacking five minutes, at the rate of about six miles an hour. In that time the voltage only dropped from 60 to 57. Attention was also called to the fact that the end the motor was so cool that the hand could be it borne upon it.

But one bid was received for the lead covered cable for the arc light circuits, and that was opened on July 1st. It was from the Safety Insulated Wire & Cable company of New York, which offered to furnish the cable at the rate of $365 per mile. This includes the use of the conductors, a guaranty to keep them in good repair and the removal after the fair. The bid has been recommended for acceptance by Mr. Sargent. It is from the same company that secured the contract for the rubber covered wire for the arc light circuits.

A feature of the half-mile pier leading out to the steamboat landing in the lake will be a movable sidewalk operated by electricity.

The allotment of space for American exhibitors in the electricity building at the World's Fair will probably be begun this week.

On Tuesday of last week the final papers were signed on the contract for the incandescent lighting at the World's Fair, and at last the matter is settled. Mr. Westinghouse left for Pittsburg in the afternoon, leaving Mr. Keller, the newly appointed superintendent of the installation, in charge of the Chicago end of the work. The details of the plant have not been worked out, but it has been decided to employ 10,000 light alternators wound for a difference of potential of 2,000 volts. The current will be transformed down to 100 volts for the house circuits, and each converter will have a capacity of 200 lights. The Westinghouse company has awarded the contract for the wire needed to the New York Insulated Wire company, which will furnish Grimshaw white core wire. The installation will comprise ten dynamos of 1,000 horse power each. Two of these will be belted directly to the great Reynolds-Corliss engine furnished by E. P. Allis & Co.,

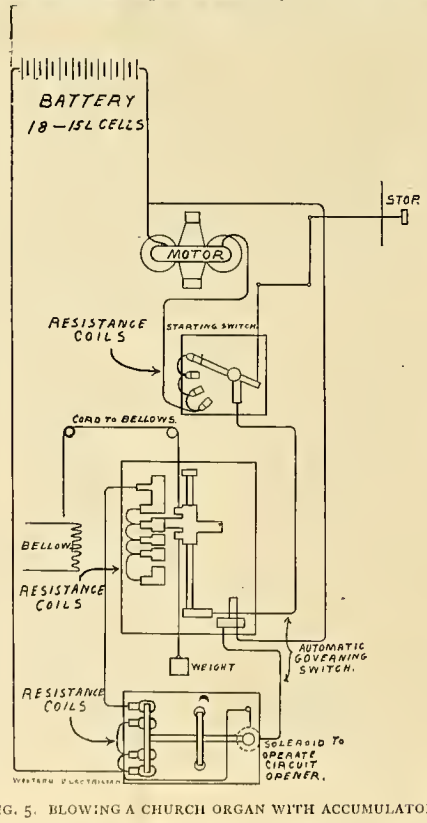


FIG. 5. BLOWING A CHURCH ORGAN WITH ACCUMULATORS.

of Milwaukee; one will be belted to a Fraser & Chalmers 1,000 horse power engine; one to a Buckeye engine of the same capacity, and a fifth to a McIntosh & Seymour engine of equal power. The pulleys on the huge alternators will be nine feet in diameter and will run at the rate of 200 revolutions per minute. The driving belts will be six feet wide. The dynamos will be provided with belt-tightening appliances similar to those used on machines of ordinary size. The engine arrangement as thus far completed leaves five dynamos unprovided for, but the Westinghouse engine company has generously offered to supply engines for all the generators for which the World's Fair authorities are unable to secure power. The company does this on the same basis that the other firms furnish engines—that is, donating the use of the machines free of cost during the period of the World's Fair, provided that they are considered as exhibits. These Westinghouse engines will be directly coupled to the dynamos. A temporary office for E. E. Keller, the superintendent of the installation, is being fitted up in the horticultural building. The work

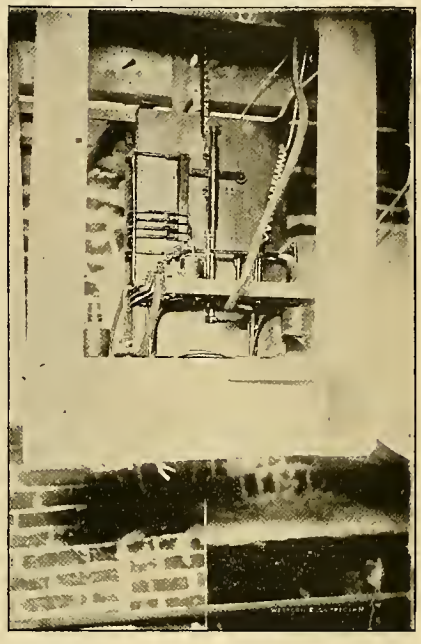


FIG. 4. BLOWING A CHURCH ORGAN WITH ACCUMULATORS.

of laying the ducts for the incandescent wiring will be begun in a week or so.

Engineer Sargent is closing up contracts for exhibits of engines to be used in the electrical service plant, as follows: Russell & Co., Massillon, O., one 500 horse power and one 150 horse power for arc lights; Buckeye Engine company, Salem O., one 300 horse power and four of from 100 to 150 horse power each for arc lights; Sioux City Engine Works, one 750 horse power for arc lights; Stearns Manufacturing company, Erie, Pa., one 500 horse power and one 350 horse power for power generators; Phœnix Iron Works company, Meadville, Pa., one 500 horse power for power generators; E. P. Allis & Co., Milwaukee, one 500 horse power for power, coupled directly to a Westinghouse generator; Fraser & Chalmers, Chicago one 300 horse power for arc lights. In addition to these Mr. Sargent is negotiating with nearly all the other prominent engine builders of the country. The mechanical and electrical engineering department of the World's Fair will be glad to hear from any others who have not yet made definite offers. It can still provide for quite a number of engines ranging from 200 to 300 horse power. Now is the time to communicate with the department, as in a short time it will be too late to make arrangements for the installation of engines as a portion of the service plant.

Telegraphing by Telephone.

Orange was in communication with the rest of the world yesterday by means of the Postal Telegraph wires for the first time in six weeks, says the New York *Sun* of June 27th. Owing to some difficulty about getting wires through East Orange the company brought its line in through West Orange on the old poles of the American Rapid Telegraph company. This was not generally known, but a recent suit over the American Rapid Telegraph company's property brought the matter up The wires were removed, and the Postal has been obliged to put up a new line. During the suspension of telegraphic communication the telephone was used freely, and messages were thus transmitted to Newark and then telegraphed to other places from the main office. Right there a curious question came up. A Newark telegraph operator, wishing to try an experiment, called up Miss Brandenburg, the Orange telegraph operator, and then placing a sounder upon the transmitter of the Newark telephone he clicked off a message. Miss Brandenburg, with her ear at the 'phone in Orange, took down the message. It was a neat way of getting out of the difficulty, but it did not last. The Newark manager of the Telephone company happened to hear about the scheme one day, and he stopped it. He said that the telephone could be used "by mouth only."

The borough of Sharpsburg, Pa., has signed a contract with the Thomson-Houston company for the erection of an incandescent light plant.

Electric Mill Indicator.

The accompanying illustrations show an electrical device employed to indicate when the grinders in flour mills run dry. The feature of this indicator is that the contact points in it are enclosed in an air-tight chamber thus securing reability of action without any great complication.

Fig. 1 represents the apparatus, while Fig. 2 is a sectional view showing the construction of its interior. The device consists of a cast iron ring *c* with adjusting screws

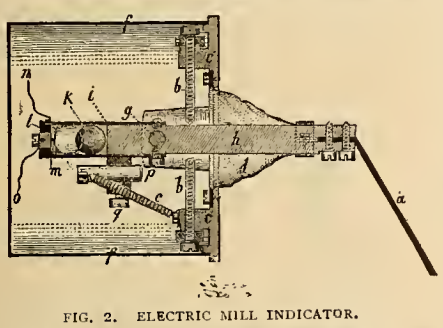


FIG. 2. ELECTRIC MILL INDICATOR.

b b, two spiral springs *e e* and a dust protecting cap *f*, this part is immovable and screwed on to the grain chute above the grinders. The inside or movable part is a lever *h* turning on a shaft *g*. This lever has its one end pointing inside the grain chute where it is flattened out in the shape of a spoon. To its other end is fastened a small cylinder *i* the bottom of which is made of hard rubber and furnished with two electric contacts *l* and *m*; from these contacts wires extend to a battery and alarm bell. Inside of the cylinder *i* is a movable ball *k*. When the grain is flowing through the chute, the weight of the grain keeps the spoon shaped end of the lever down causing the ball in the cylinder to roll to the right; if the flow of grain ceases, the ball presses down the cylinder, rolls to the left and presses the contact springs together. The regulation of the apparatus is easily accomplished through the adjusting screws *b b* and the ball *p*. The cuts are from the *Elektrotechnische Zeitschrift*.

Baker Submarine Boat and Sims-Edison Torpedo.

The Baker submarine boat continues to excite the greatest interest on the part of the ordnance men. A few weeks ago, Commodore Folger, chief of the bureau of ordnance at Washington, D. C., visited Detroit to inspect the novel little craft. The Commodore's opinion of the vessel was published in a recent issue of the WESTERN ELECTRICIAN. Last week W. Scott Sims of New York, arrived in Detroit bent on an errand similar to that of Commodore Folger. Mr. Sims is well known to electrical men through his torpedo work, being the inventor of the Sims-Edison torpedo. Mr. Sims was unfortunate, though, in the choice of the time for his visit, for he found the boat undergoing repairs. A short time ago an accident occurred to the craft's battery; a number of cells exploded and although little damage was done outside of the wrecking of a number of rubber cases it may be some little time before all is in order again. Mr. Sims, therefore, did not have an opportunity to witness a trial of the boat.

In an interview with a representative of the *Detroit Free Press* Mr. Sims spoke most enthusiastically of the manner in which the Baker boat, if it proved thoroughly successful, might be operated in connection with his torpedo. From his conversation as reported in the Detroit paper it would seem that Mr. Baker has every incentive to continue work on his boat. Mr. Sims was reported substantially as follows:

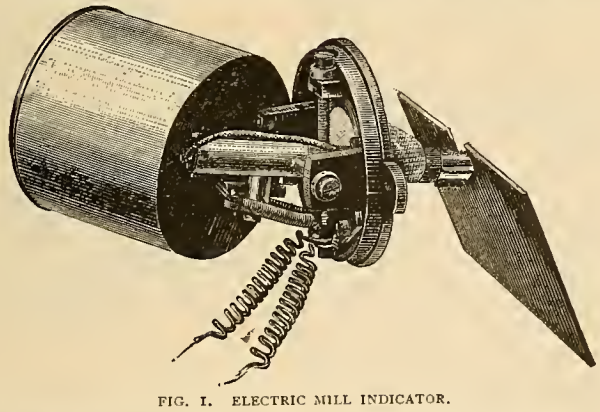


FIG. 1. ELECTRIC MILL INDICATOR.

'Commodore Folger," said Mr. Sims, "is greatly interested in the Baker boat and considers that the conjunction of the submarine craft with my torpedo will furnish all the requirements for a perfect destroyer. The combination furnishes all the deadliness, together with a minimum risk which forms the ideal element of assault.

"The reason why the Baker boat, if successful, will prove to be an invaluable adjunct to naval warfare, is in its ability to dodge around here and there, like a bell-diver, appearing where you least expect to find it and again disappearing when you need it the most. It will constitute a moveable, disappearing station from which my torpedos can be manipulated with terrible effect upon ironclad or battery. With this boat we can take our point of attack anywhere or in any port. The enemy will be powerless to prevent its bidden meanderings under the water, and by means of it a port can be governed perfectly—made impregnable. Through an attack in port by means of the Baker submarine boat and the Sims-Edison torpedos, the most powerful ironclad is rendered useless. The station, which will be Mr. Baker's invention, cannot be fired at, because it can be submerged, and, therefore, no target is offered, while the torpedo boats may be employed to keep away any cruiser to the limit of five miles. Work of destruction can be carried on with it almost without risk.

"I take the livelist interest in the new Detroit craft for the reason that I consider it to be the very first practical solution of submarine navigation. The idea of moving about under the water, like a fish, has some fascinating interest about it, and probably the novelty of the thing has been the means of inducing experiments looking to a successful submarine boat for the past 200 years. The history of these boats has, however, ended in nearly every instance with a tragedy. They have all gone down and could not be made to rise. Machinery has given out when needed; the water used to lower the boats could not be pumped out, even by hand, as has been shown by investigation, and the unfortunate navigators have perished.

"In Mr. Baker's boat, however, I feel confident that the problem has been satisfactorially solved. He has the first boat that has been made to ride on an even keel, its submerging powers depend to a large extent upon its propellers, it is navigable, easily controlled and of a powerful structure.

"Concerning the demands of the government for a submarine boat. Commodore Folger recently said in an interview: 'I consider the principal of the Baker submarine boat at Detroit perfectly feasible. It is already made clear by this boat that an efficient boat can be submerged and kept under perfect control with nothing but a foot of the conning tower above the surface of the water. A Sims torpedo, electrically controlled, could be sent out from such a vessel to a distance of a mile and, directed at night by means of range lanterns, would be more effective than by day. The submerged vessel, equipped with such a torpedo, could remain at a point where she would be completely invisible to an enemy's ship. The submarine boat will be further armed with the submarine gun and projectile, tests of which have already been made with satisfactory results during the past week at Newport. The Navy Department has always been more or less interested in the subject of submarine navigation, and since the failure to secure funds for such work the matter has lain dormant.'

"According to the notion of experts the most desirable qualities to be possessed by a submarine boat while approaching a hostile ship, under way, are speed, certainty of direction, invisibility and safety from the enemy's fire. Within the danger zone a part of the speed of approach may be given up for the sake of obtaining water cover. The successful submarine boat must be able to run at any safe depth, cut off from communication with the atmosphere and affording no view of the object of attack other than through the water. The boat should be capable of making fifteen knots an hour on the surface and a mean speed of eight knots. She should be able to run for thirty hours at full power covered by at least three feet of water. She should carry ninety days' provisions, be able to turn in a circle not greater than twice her length and maintain any desired depth within the limits of crushing power. The shell should be sufficiently strong to withstand a water pressure of 150 feet depth.

"There is no doubt," continued Mr. Sims, "that Mr. Baker's boat has many imperfections, but they are of a nature that can be remedied as experiments continue. The boat has not enough speed at present and in many minor particulars there are alterations to be made. But as an experimental contrivance it is a great success. As soon as repaired the boat will be taken to Newport and placed under the supervision of government officials for experiments. The experiments cannot be conducted at Detroit because this city is too far distant from Washington, and besides there is no apparatus at hand here. Experiments will be made with my torpedo boat in conjunction with Mr. Baker's submarine boat."

Mr. Baker, the inventor of the submarine boat has as yet received no official intelligence concerning the desire of the government to experiment with his boat. He said, though, that it could be towed to New York through the Erie canal.

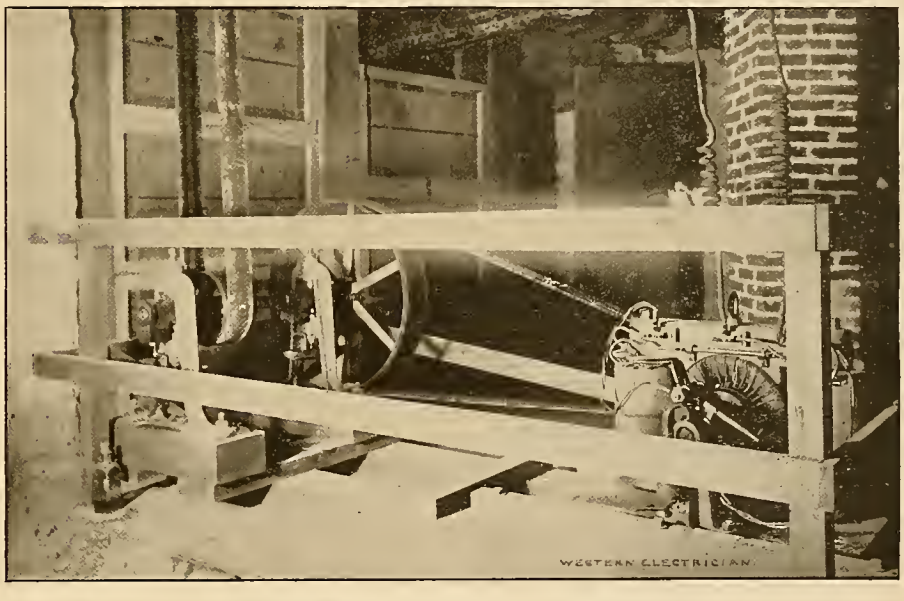


FIG. 2. BLOWING A CHURCH ORGAN WITH ACCUMULATORS.

The following is a recent local item from the *Peoria Herald:* "Thousands of people visited 619 Howett street to behold the wreck the lightning had made. Some of the visitors carried away splinters of the wreck for toothpicks, claiming that the wood had become impregnated with electricity to such an extent that it was a sure cure for toothache and neuralgia."

Electrical Forging and Tempering.

The electric forge herewith illustrated is the invention of E. E. Angell of Boston, and is intended for heating bars of metal for forging, hardening, drawing the temper, or other purposes. The frame consists of a hollow cylinder supported upon four legs and provided at its top and bottom with a series of slots and with external lugs adjacent to the slots. In Figs. 1 and 2 electrodes are indicated by the full lines *B C*, and the dotted lines are pivoted to the lugs, and their long arms extend through the slots to a point near the axis of the cylinder. Other electrode levers, *D E*, are similarly disposed in a horizontal plane All

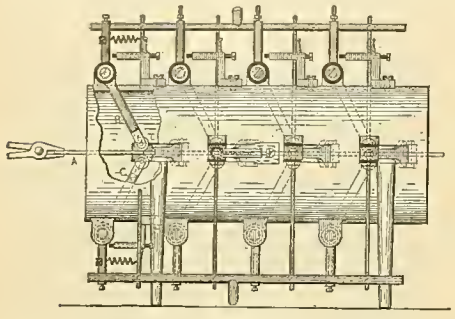


FIG. 1. ELECTRICAL FORGING AND TEMPERING.

the levers are provided at their outer ends with binding posts, and at their inner ends with anti-friction rollers composed of conductive material, the fusing point of which is above that of the bar to be heated. Springs are arranged to bring the inner ends of the levers toward each other for grasping the bar to be heated.

In the use of this apparatus a bar to be heated may be grasped at one end by a pair of tongs and thrust into the forge between the rolls of the first pair of electrodes. The metal of the bar closes the circuit between the rolls and causes a transverse current to pass vertically through the bar. As the bar is thrust farther into the forge it passes between the rolls of the horizontal electrode levers and a transverse current is passed horizontally through the bar. When short bars are to be heated, or a bar is to be heated a short distance at one end, one or two pairs of electrodes only may be utilized, the other electrodes remaining idle; but in heating a long bar the entire series of electrodes may be brought into play. The bar is reciprocated by the operator or by mechanical means while it is between the rolls, so as to distribute the heat throughout its length. The inner arms of the electrode levers are sufficiently inclined to prevent the binding of the rolls upon the rods in withdrawing the bar. The springs cause the electrodes to yield, and automatically adjust themselves to bars of different sizes. If it be desired to pass currents longitudinally through the bar, the wiring to the electrodes may be changed, so that all the vertical electrode levers will be connected with the positive pole and all the horizontal electrode levers with the negative pole.

Fig. 3 shows an electric forge arranged for heating lathe tools, pickaxes, and implements of irregular shape

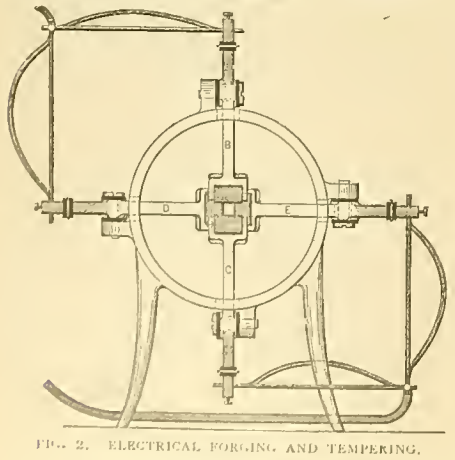


FIG. 2. ELECTRICAL FORGING AND TEMPERING.

for the purpose of hardening, forging or drawing the temper. The general arrangement of the frame and the method of separating it by proper insulating material into two parts are clearly brought out in the cut. Carried upon the free end of an arm pivoted in the forged end for standard is a hub formed with radial arms 1, 2, 3, 4, 5, 6, of highly conductive material. The ends of these arms are formed with contact heads of different shapes for contact with tools of different characters. The tool to be heated, 7, is held in the upper end of standards Then the hand wheel, shown in the right-hand corner, is turned so as to bring the inclined standard to the proper position, when the arm carrying the hub is adjusted to the proper height by the adjusting screw. The electrode wheel is then rotated, so as to bring the electrode arm having the contact head adapted to fit the particular tool to be heated into contact with the tool. This closes the circuit through the tool, which is then heated instantly. The tool is then removed and another put in its place, and the operation is repeated.

The device for heating mandrels, milling cutters, taps, reamers, twist drills and similar articles preparatory to hardening and tempering is also shown. The upper section of the ring shaped electrode support *A*, Fig. 5, is swung back into contact with a stop on the side of the rear standard and a milling cutter, as shown, or other device to be heated, is placed endwise between the electrode spindles, *F* and *G*, Fig. 4. the spindle yielding slightly under the action of springs to permit the adjustment of the

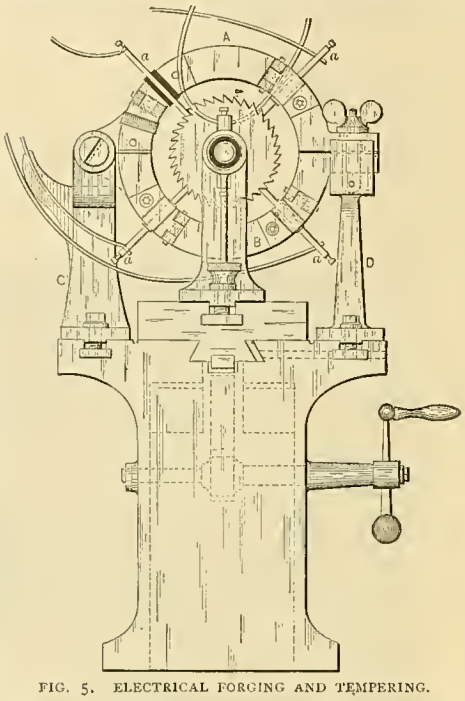


FIG. 5. ELECTRICAL FORGING AND TEMPERING.

article to be heated. The upper section of the ring-shaped holder is then closed and locked. The electrodes *a a* are then adjusted, so that their ends come in contact with the sides of the article to be heated, and clamped in position by means of hinged clamping plates. The electric currents are then switched on and enter the ends of the article through the supporting electrode spindles, *F* and *G*, and pass out laterally or radially through the sides of the article by means of the stationary electrodes *a a* In order to heat the article uniformly throughout its length the operator turns the crank alternately in opposite directions, whereby the carriage carrying the electrode spindles s reciprocated, causing the work to be moved back and forth, and the points of lateral contact of the stationary electrodes to be shifted longitudinally along the work. The direction of the currents may be reversed or shifted.

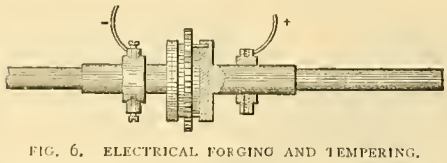


FIG. 6. ELECTRICAL FORGING AND TEMPERING.

To avoid short circuiting of the entire current through either of the branches of the positive cable during the reciprocation of the carriage and the electrode spindles, means are provided for equalizing the distance through which the currents passing through the branches travel. In Fig. 6 a disk-shaped cutter is interposed between the ring-shaped faces of the flat headed electrode spindles. The cuts are reproduced from *Iron Age*.

Electricity in the Jungle.

In the *North American Review* Prof. R. L Garner tells how he expects to visit the wilds of Africa for the purpose of studying the habits and "speech" of the great anthropoid apes. He proposes to take up his abode in the forest, dwelling in a stout but portable steel cage seven feet square and seven feet high. The professor intends to call in the aid of electricity to the fullest extent, and although he leaves unexplained some of the difficulties that will be encountered in doing this, the following extract from his description will be found of interest:

The uses of my cage will be very numerous. It can be erected as easily as a tent, and will be used at night to camp in. It will serve as a house while I may be detained in making terms with the natives or studying their speech; and it will be a fortress in the jungle, where I must spend much of my time in trying to find the secret which I seek. But the use of my cage will not be limited to a mere place of safety from the wild beasts that prowl through the forests at night; it will serve also as a depot for my supplies, and thus save me the trouble and expense of having to find a place of safety for them in case of absence or delay. This structure will be locked se-

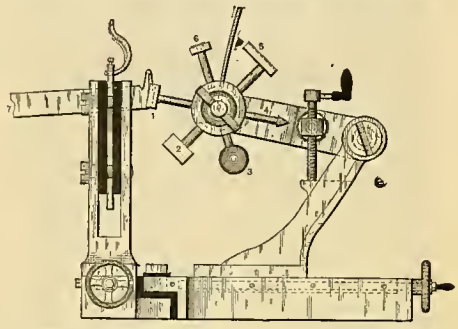


FIG. 3. ELECTRICAL FORGING AND TEMPERING.

curely to the adjacent trees by three strong chains attached to a Y-shaped iron bolted through the top of the cage. It will be provided with a canvas top and gum cloth sides, mounted on rollers like window curtains and easily managed. It will be provided with a soft rubber mat or carpet, which will serve as an insulator when the case is charged with electricity and will also prevent the moisture from rising from the ground beneath the cage, in which I shall have to sleep a great part of the time. It will contain a hammock and a camp chair. Beside these it will be occupied by my phonograph, photographic instruments, telephone and electric battery with which to operate them. A single charge of this electric battery will last for about 300 consecutive hours By the use of a small switch-board I shall be able to fire my flash light at night or to snap my kodak in the daytime, and to operate my telephones if necessary. In case of danger or unexpected attack, by the use of my switch-board and by means of an induction coil, I can charge the entire cage with electricity, developing an alternating current of about 300 volts. In leaving my cage with its contents for any length of time I shall simply charge it in this manner with electricity, in order that in my absence my meddlesome neighbors may be induced to let it alone.

A unique and marvelous experiment among the many which I expect to be able to perform is that of phonographing the sounds of the apes at a distance from my cage, where my phonograph will be located at times. I shall accomplish this by means of the telephones which I am having constructed for the purpose with a water-proof cable wire connected at one end with the diagram of the phonograph, and at the other end (which may be carried any distance, even a mile or more through the forest) connected with a small telephone concealed in a tin horn; all of which will be painted a dingy green in order that it may be concealed in the leaves or hidden in the moss or undergrowth of the forest. In front of this horn will be placed decoys, baits, effigies, mirrors or such other means as may be found necessary to induce the chimpanzees and gorillas to utter their sounds there, which sounds, of course, will be immediately transmitted to and recorded

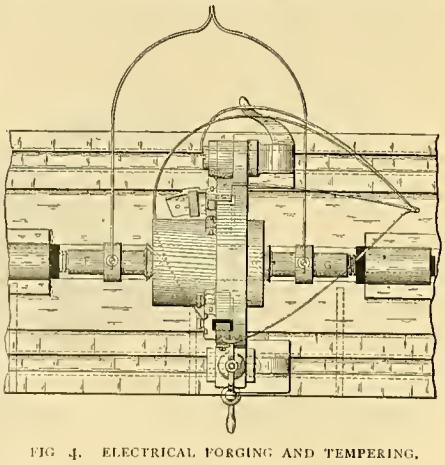


FIG 4. ELECTRICAL FORGING AND TEMPERING.

on the phonograph cylinder, which will be operated by electricity

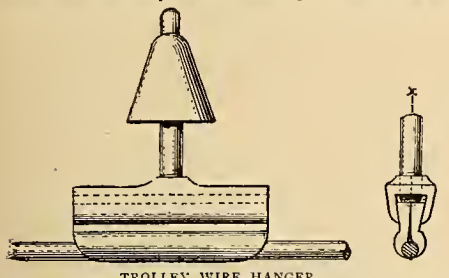
I shall be provided with some globes for incandescent light. They will be connected with the battery and placed in such positions that in case of alarm during the night the cause may be easily ascertained by simply switching on the light for a few seconds. If it is found that anything within the field of my kodak shall be worth photographing the flash light will be fired and the picture taken, including the cage and its surroundings.

The village council of Spring Valley, Ill., is seeking proposals for the installation of an electric light plant.

Trolley Wire Hanger.

A glance at the cut will reveal the features of this fixture. The body of the hanger has a longitudinal socket made with inwardly-inclined faces. Through the upper side of the body is a screw-threaded hole, which receives the screw end of the hanger bolt. Within this socket there are two wedge-shaped plates or blocks. Along the edges of these plates are formed grooves, which enable the plates to be clamped on to the trolley wire. In the upper edges of the plates there are small notches into which the end of the bolt enters when screwed into place.

The manner of using the device is clear. The bolt is screwed into the body, supports it and at the same time presses down on the plates. These, by reason of the inclined sides wedging together, tightly grasp the trolley wire. The weight of the wire itself tends to wedge the clamping plates together.



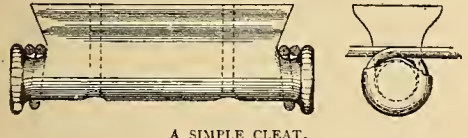
TROLLEY WIRE HANGER.

J. Sachs, New York, is the inventor of this hanger and C. S. Van Nuis, also of New York, is handling it.

A Simple Cleat.

Herbert C. Wirt of Boston devised the simple little insulator shown in the cut. It may be constructed of wood or porcelain. It is shaped, as shown like a block, having its longer side adapted to rest against the wall or ceiling. This cleat has at either end a knob projecting horizontally parallel with the side which rests against the wall. The knobs have each a contracted neck, so that the wire may be wound around them.

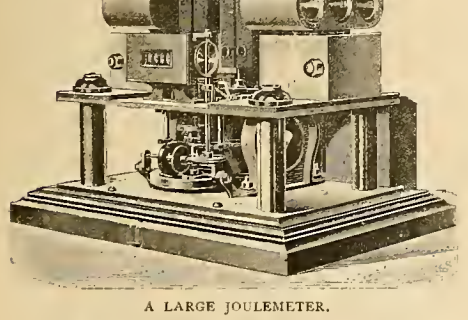
It is claimed that the use of this form of cleat greatly expedites the stringing of wires. The wires when in place are held at a slight distance from the wall, and their insulation will not be affected by any moisture on the wall, as is the case with the ordinary form of cleat where the wires are stretched in contact the wall.



A SIMPLE CLEAT.

A Large Joulemeter.

The Compagnie Anonyme Continentale of Paris has recently built a large joulemeter. This joulemeter is probably the largest ever made. By stating that the meter is large it is not meant that the instrument is of great dimensions, but that the power integrated is large. This meter, for 2,000 amperes and 100 volts, which is illustrated, is of the new Brillié type, and is used by the Société pour le Travail Electrique des Métaux, at St Ouen.



A LARGE JOULEMETER.

As the new form of Brillié meter is not very well known, it will not be out of place to explain the principle on which it works. The measuring part of the instrument is a wattmeter. The series coils are fixed, and the pressure coil is suspended as freely as possible. A copper disk is hung on the suspended coil, and a system of permanent magnets is arranged so that motion relatively to the disk produces Foucault currents. As soon as any power is used the moving coil deflects. This makes contact, and starts a small motor, which rotates the magnets in the direction tending to bring the suspended coil back to the zero position. As soon as this is achieved the contact is broken, and the motor slows down again. The wattmeter thus makes frequent contacts of short duration, which regulate the speed of the motor so as to keep the moving coil at zero position. The great advantage claimed for this arrangement is that there is little or no friction to interfere with the accuracy of the instrument. This meter is, it is stated, accurate, even at small loads, which cannot be the case with the ordinary motor meters, whose readings are always modified to some extent by the friction of the pivots or bearings. It is said to be accurate for alternating as well as direct currents, and has no frequency errors, and is also really an energy meter. The cut is taken from *Industries* of London.

A Dynamo Indicator, or Instantaneous Curve-Writing Voltmeter.[1]

By George S. Moler.

In connection with the work in dynamo and motor testing in the physical laboratory of Cornell University, it was found desirable that some method should be devised which would enable the student experimenting to very quickly explore the field of a machine, so that he could study some of the changes which might take place even in a few seconds. The double brush method of Dr. S. P. Thompson, and the single brush method of W. M. Mordey, are in use and give excellent results, but either of these methods requires a few minutes at the very shortest to obtain the data for a single curve.

To attempt to meet this want the writer devised the instrument which is the subject of this paper. It is intended to be used in tracing those curves which show the changes in potential of the two ends of a single coil of the armature, and also those showing the changes between one brush and one of the commutator bars, as the armature revolves. The instrument consists in the main of a very rapidly vibrating needle of a voltmeter, and a smoked cylinder against which the pointer is made to press at the required moment. The curve is traced during a single revolution of the armature and is then easily transferred to paper, and is thus placed in a permanent form to be studied at leisure. The voltmeter which is enclosed in the body of the instrument, is of the permanent magnet form. The needle is of soft iron, and is very short, and held at zero by being placed between the poles of a powerful steel magnet. The pointer is made of aluminium and is quite short. It is shaped so as to be as light as possible, and so that the air cannot offer much resistance to its motion. The cylinder is of metal very smoothly finished, so that it will offer very little resistance to the movement of the pointer. It is mounted upon a short shaft and is arranged so that it can be slid to several different positions; a spring dropping into notches holds it at each place. The stationary pivot at *A*, Fig. 1, is made with a springs so that the cylinder can be quickly removed for smoking or for transferring the curves. This short shaft is connected with the driving shaft of the instrument by projecting pins at *B*, so that it will always maintain the same relative position with the pin at *C*. The pin *C* is attached to a sliding sleeve which is pushed toward the point of the shaft by a spring. A hole or pin in the end of the armature shaft is to engage with the pin *C*, so that the cylinder will always have the same relative position with the armature. To operate the instrument two insulated wire hoops or bands are to be wound around some convenient part of the shaft or commutator, and one is to be connected to one commutator bar and the other to one of the adjacent ones. Small brushes are to be made to press upon these bands, and they are to be connected to the binding screws at *D*. The cylinder is then lightly smoked by removing it and revolving it over a candle or gas flame; then it is placed in position. The sleeve carrying the pin *C* is pulled back and latched in the notch *E*. Then the point is pressed into the center hole in the end of the armature shaft; this will put the drum in motion; then by letting the projecting knob strike the finger the sleeve will be unlatched, and will spring forward and engage with the pin in the end of the armature shaft. Then pressing the button *F* closes the circuit, and pressing *G* brings the pointer against the drum. *H* is a reversing switch. The base line of the curve is drawn by pressing *G* only. Another form of curve will be obtained if one of the terminals of the indicator is attached to one of the permanent brushes of the dynamo, and the other to one of the brushes pressing upon the band connecting with one of the commutator strips. Also a temporary exploring coil may be wound upon the armature, and its terminals may be connected to the indicator.

The voltmeter of the indicator is necessarily one of low potential, so that the changes in a single coil will produce a suitable deflection. For greater changes of potential a resistance must be be used in series with it. The curves are transferred from the smoked cylinder by dampening a sheet of paper and then rolling the cylinder over it. Three distinct copies have in this way been made from one set of curves. One of these instruments has been built and has been tested in various ways and is found to give very satisfactory results. The rate of vibration of the needle was determined while the pointer was in contact with the revolving drum and was obtained as follows: A current was applied so as to produce a deflection, then while the drum was revolving at over a thousand revolutions per minute the needle was brought into contact with it and the circuit was then broken, making a wavy line extending part way around the drum before it died out. The average rate of oscillation as determined from over 40 measurements was 103 per second, and the damping effect was so great that in .04 of a second the needle was brought to rest. It was also observed that the deflection was not changed by bringing the pointer in contact with the revolving drum.

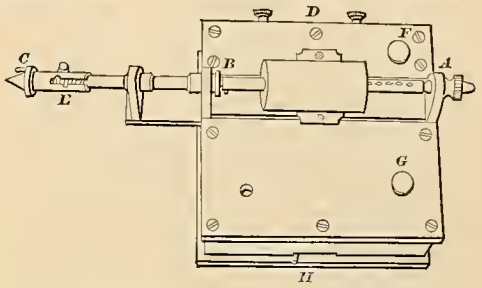


Fig. 1.

One of the desirable features of the indicator is the rapidity with which the curves can be made. The cylinder full of curves, eighteen in all, with their base lines, were made in 73 seconds, so it is seen that we can explore the field many times while a dynamo is charging up just after being started, or while any great change in load is being made.

In Fig. 2 are shown some of the curves produced by exploring the field of a 20 ampere shunt wound dynamo of the consequent pole type. The dynamo was driven at a speed of 1,075 revolutions per minute, and had an automatic regulator, which held it at 115 volts, with slight variations. The curves *a* and *b* were made while 20 amperes were flowing in the main line, and *c* and *d* while the outside circuit was broken. The curves *a* and *d* show the changes in potential of the two ends of a single coil. The line *g* shows the position of the center of the pole piece and the arrow the forward direction of the curves. The double curves upon each base line, were made by reversing the terminals by means of the switch *H*. The line *e* is the position of the neutral point when 20 amperes were flowing, and *f* its position when the line is open. The difference in shape of the curves shown at *a* and those at *d* is very marked. The curves *b* and *c* were made by connecting one terminal to one of the dynamo brushes and the other to one of the brushes connected to one end of a coil. These also show the change of the neutral point, and a change in shape for open and closed circuit.

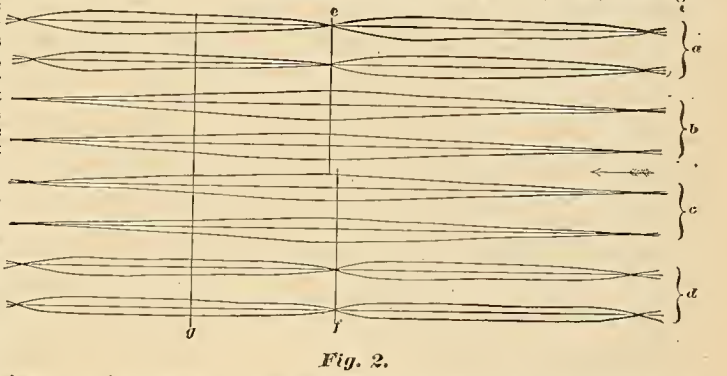


Fig. 2.

The instrument is calibrated by comparision with a standard voltmeter. For each reading on the voltmeter a line is drawn around a drum. When the pointer is not in contact with the drum some of the effects of inertia can be noticed, but when the contact is made they seem almost to disappear, and corrections may be applied to compensate for the lag on that account.

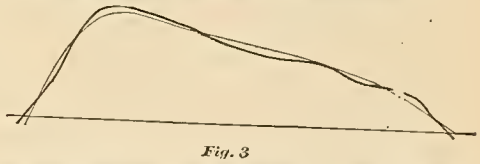


Fig. 3

To test the reliability of the instrument one of the 20-ampere curves for half a revolution and similar to *a* Fig. 2, was taken at random, and the data taken by two students, to obtain which they worked at least an hour, and had to contend with fluctuating speed and voltage. These two curves were drawn to the same scale and are shown in Fig. 3, the heavier and more fluctuating line being by the experiment. The agreement is about all that can be expected, so it seems that the instrument is capable of giving reliable results.

1. Read at the general meeting of the American Institute of Electrical Engineers, Chicago, Ill., June 6, 7 and 8, 1892.

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CONTENTS OF THIS NUMBER.

	PAGE
Blowing a Church Organ With Accumulators. Illustrated.	15, 16, 17
Electricity at the World's Fair	16
Telegraphing by Telephone	16
Electric Mill Indicator. Illustrated	17
Baker Submarine Boat and Sims-Edison Torpedo	17
Electric Forging and Tempering. Illustrated	18
Electricity in a Jungle	18
Trolley Wire Hanger. Illustrated	19
A Simple Cleat. Illustrated	19
A Large Joulemeter. Illustrated	19
A Dynamo Indicator or Instantaneous Curve Writing Voltmeter. By George S. Moler. Illustrated. (American Institute of Electrical Engineers)	19
Editorial	20
Magnifying Vibrations by the Aid of Electricity. Illustrated	21
Financial Aspect of Electric Lighting in Canada	21, 22
New Dynamo of the Detroit Electrical Works, Detroit, Mich. Illustrated	22
Power Transmitting Device. Illustrated	22
Bain's Special High Duty Generator. Illustrated	23
Electric Motors as Substituted for Steam Locomotives. By Arthur T. Woods	22, 24
New Electric Fan. Illustrated	24
Heavy Duty Engine for Electric Street Railway Service. Illustrated	24
The Bernstein Alternating Current Fan Motor. Illustrated	24
The Packard Lamp. Illustrated	24, 25
Steam and Electric Power. By J. J. Wright	25
The Arc Light Adapted for the Ophthalmoscope	25

DEPARTMENTS.

Correspondence	26, 27
New Incorporations	27
Electric Lighting	27
Electric Railways	27
Telephone	27
Miscellaneous	27
Trade News	27, 28
Business	28
Electrical Patents	28

AN interesting method of employing what might be described as "variations of magnetic friction" for the purpose of magnifying vibrations is described in another column. The apparatus is suggestive of the loud-speaking chemical telephone receiver invented by Mr. Edison. It will be remembered that in the chemical telephonic receiver a contact strip attached to the diaphragm bears on the surface of a chemically prepared revolving cylinder, and the friction at the point of contact is varied by the passage of current between the point and the roller. In the magnifier described magnetism is used in a most ingenious manner to control a simple device provided to set a diaphragm in powerful vibration.

EVER since the peculiar adaptability of electric power became generally known, organ builders and churchmen—to say nothing of the motor salesmen—have sought to avail themselves of the advantages of the convenient little electric motor. To every man that has exploited motors the enthusiastic clergyman or layman who wants to blow an organ by electricity, is a familiar figure. But in too many cases it has been necessary to turn away the willing buyer, for although the motor was easily obtainable, it was found well nigh impossible to secure the electric current at times when it was most desired. Had current from central stations been available it is fair to presume that nine-tenths of the church organs would now be operated by electric power. It is singular, though, in this connection that more use of the storage battery has not been made. That such an application of the accumulator is not only perfectly practicable but highly satisfactory in its operation, will be evident to the reader after a perusal of the leading article in this issue. The installation described is in a Philadelphia church. It has been in service over two years, the system is replete with features worth studying. The battery is charged from an arc light circuit, and for this reason the outfit may be taken as an excellent example of high tension transmission and its conversion for utilization at low pressure. The battery supplies one motor and this in turn drives a bellows that blows two organs. The Philadelphia plant is an interesting one and its projectors are entitled to credit for illustrating so forcibly that accumulators have a place that is as yet but poorly appreciated.

SOME interesting statistics have just been published by the census department regarding the operation of telephones in this country which, according to Superintendent Porter, "Show how necessary the telephone service has become in commercial and social affairs, and speak volumes for the enterprise that has attended the development of inventive genius in this branch of the electrical industries." From the tables presented it appears that in 1880 there were reported 148 companies, firms and persons operating telephone exchanges; in 1890, 53. The total investment in 1890, was $72,341,736, an increase of $57,735,949 in ten years. There was in the same time an increase of $13,306,502 in the gross earnings and for the corresponding time an increase of $8,770,168 in the gross expenses, making the increase in the net earning $4,536,334. During the same period the number of exchanges increased from 437 to 1241 and the number of miles of wire from 34 305 to 240,412. There was necessarily an increase in the number of employes In 1890, 8,645 persons were employed while in 1880 there were but 3,338. The increase in the number of subscribers was correspondingly large, the returns showing 227,357 as against 48,414, ten years ago. Very few people even in the electrical fraternity have any idea of the general use of the telephone and therefore it may occasion considerable surprise to announce that in 1890 according to the reports filed by the 53 companies engaged in the operation of exchanges 453,200,000 conversations were carried on by telephone. No better evidence of the dependence of the American people on the telephone can be required.

IN this connection attention may be called to the fact that the telephone interests are in a most advantageous position to meet competition from any rival companies that may seek to enter the field on the expiration of the "fundamental patents." If the Bell company should be deprived of every valuable patent it now controls its position is so well fortified that opposition on any large scale would be practically out of the question.

AN extraordinary advertisement appeared in an eastern financial journal a short time ago, and if the statements therein contained are true the makers and users of electric motors—and indeed of motors of all kinds—may well tremble, for we are told that a Minneapolis man has "invented a motive power that revolutionizes the work of the world." The name of this wonderful inventor, who, not content with devising a machine to utilize some one of the existing forces of nature, has boldly grappled with the root of the whole matter by producing a new "motive power," is S. H. Wood, and his object in taking the public into his confidence, to some slight extent, is to sell stock in a million dollar company at the rate of $2 per share, which is certainly not an exorbitant rate for a portion in the profits of "the most wonderful invention ever known."

Like another celebrated inventor, Mr. Keeley of Philadelphia, the Minneapolis scientist merely piques our curiosity by hinting at the nature of his invention without giving any definite information about it. We are told what it will presently accomplish; not what it is. The reader of the advertisement must content himself with this statement: "It is the simplest thing in the world; it is cheaper than steam, electricity, or any other kind of power in use at the present time. It is intended for running mills, elevators, cars, street cars, ships, buggies, wagons, and in fact every kind of machinery or vehicle that is known. A single motor of fifty horse power can be put in one of Mr. Lowry's street cars at a cost not exceeding $200, which will run the car at any rate of speed from two to thirty miles an hour, and at a cost not exceeding $50 per year. A single motor, with ballasted car combined, capable of drawing the heaviest train of cars ever taken out of Minneapolis, can be built for $3,000, and run at an expense not exceeding $5 per day; and a single motor can be put in a family carriage at a cost of $100, and run the carriage every day for a year at a cost not exceeding $25 a year." What more than this could be asked? Any man of average intelligence can see at once that Mr. Wood has what is frequently alluded to as "a good thing." We are confident that if he can demonstrate the truth of all his assertions and abate somewhat, perhaps, in the price of his shares, the Minneapolitan will receive substantial financial backing. But we can find little encouragement for the latter assumption, for the inventor announces that the price of shares is to be gradually raised. The advertisement was printed on June 20th, and it was then stated that the $2 rate would obtain until June 25th for shares "subscribed and paid for;" after that and until July 10th, $4 will be the price, and from that date until August 1st, $10 will be asked. One-half of this money is to go to the inventor, which is, of course, little enough; the remainder is to be applied to the manufacture of the motors, and Mr. Wood "promises to make a public exhibition of the motor on the streets of Minneapolis on August 1, 1892." What an item that trial will be for the Flour City papers! It will be nothing less than the dawn of a new era, and we are somewhat surprised that the inventor did not describe the event in those terms.

It is tantalizing to await for the slow whirligig of time to bring around the revolutionizer, but it must be proper, because Mr. Wood says so. "Until the patents are issued," he warns us, "it will be best for all concerned that the invention itself be kept under lock and key." And so we must possess our souls in patience—"until the patents are issued." Nor are we vouchsafed any information as to the existence of any company to handle the funds furnished by the subscribers. The inventor simply holds out his hands to a generous public and asks for money. It is difficult to see how any one could be dissatisfied with the arrangement proposed, but Mr. Wood seems even to have taken into account the possible existence of objectors, for he promises that on September 1st "any and every shareholder who is in any way dissatisfied can have his or her money back again." But why should any one want his money back, when for a beggarly $2, $4 or $10 he can get a share which the inventor estimates to be worth "not less than $100"? And, always assuming that Mr. Wood's assertions are true, that is certainly a very moderate estimate.

Enough has been said to keep the readers of the WESTERN ELECTRICIAN abreast with this remarkable and brilliant scheme and to forewarn the electrical fraternity of the Damoclean sword that is hanging over the builders, sellers and users of electric motors!

IT is estimated that a practical rapid transit system for the city of New York will require a carrying capacity of 150,000 passengers per hour in one direction. Louis Heilprin, a writer in the *Engineering Magazine*, says that the plans of the rapid transit commissioners are inadequate and he points out that to adopt any other system than one which would give rapid transit would be only preparing the way for new complications in the future. Mr. Heilprin says: "This idea of compressing the traffic into a four-track main artery under Broadway for a distance of two miles and a half is simply preposterous." Continuing, he says: "If eight underground tracks are needed above Fourteenth street it is absurd to imagine that four will suffice for the remainder of the distance. But the idea of having only four tracks for these two-and-a-half miles evidently has its root in the notion that the great underground thoroughfare ought to be, as far as possible, directly under Broadway. It is true that more than four parallel tracks cannot very well be located on the same level under Broadway without descending to a greater depth than the commission considers admissible. But is there any absolute necessity for locating the underground road precisely on the line of this thoroughfare? Better travel in comfort under the Bowery or South Fifth avenue than be packed like herrings under the aesthetic blocks of Broadway buildings. It might be well, indeed, for the east and west lines to converge somewhere in the vicinity of Union Square so as to meet in a capacious transfer station, which should permit passengers from the east side passing over to the west side and *vice versa;* but after thus meeting, the two roads ought to diverge again and pursue an independent course to the extremity of the island, from a quarter to an eighth of a mile on either side of Broadway."

Mr. Heilprin is not an enthusiastic advocate of the underground plan, but seems to be convinced that it is the plan most liable to be adopted. This only adds to his desire to have real rapid transit combining all the comforts of high speed transportation and eliminating as far as possible the discomforts of traveling through tunnels.

Magnifying Vibrations by the Aid of Electricity.

The accompanying cuts illustrate diagrammatically an ingenious yet simple method of magnifying minute vibrations or impulses, such as those emanating from, or set up in, a sound-producing or other vibratory body, or in an electro magnet, electric wire, or the like.

In carrying this invention into practical effect the vibrations to be magnified are transformed, when necessary, into a corresponding series of electrical vibrations by means of an electro-magnetic or variable contact device, such as a telephonic transmitter. These electrical impulses are then caused to circulate through the coils of one or more electro-magnets, which may be permanently magnetized or otherwise, whereby a magnetic field is created or varied in intensity. The strength of this magnetic field varies in accordance with the impulses passing through the coils. An electric conductor driven by extraneous force in a constant direction is so mounted with respect to the magnet that the whole or a portion of it passes through the magnet field. The magnetic field opposes to the movement of the conductor a certain amount of retarding force, varying with the variations in the field. Either the magnet or the conductor is mounted upon a secondary diaphragm or similar vibratory body and the various parts are preferably so arranged that the moving conductor normally exerts a constant, though generally very slight, push or pull upon the diaphragm in a direction more or less perpendicular to it. Momentary variations in the amount of the magnetic retardation cause corresponding momentary variations in the force of the push or pull, with the result that there is set up in the diaphragm a series of vibrations corresponding to the electrical vibrations or impulses passing round the coils of the magnet. By properly proportioning and arranging the apparatus there may be set up in the diaphragm vibrations exactly corresponding to but of a much greater amplitude than the original sound or other mechanical vibrations. Sounds may thus be produced having the same pitch and more or less of the same quality as the original sounds, but having a much greater intensity or magnitude.

FIG. 3 MAGNIFYING VIBRATIONS BY THE AID OF ELECTRICITY.

To magnify electrical impulses or vibrations the diaphragm or its equivalent is connected with a suitable electric transmitting device, which reproduces in a magnified degree the original impulses, or it may be, those passing round the magnet coils.

The illustrations show a form of apparatus embodying the invention.

Figs. 1 and 2 are a side elevation and a plan, respectively, of a type of apparatus in which the electric conductor is in the form of a revolving disk, the magnet not being shown in Fig. 2. Fig. 3 is a front elevation of the apparatus shown in Figs. 1 and 2, parts of the driving mechanism being removed.

Referring to the diagrams, Q is an electro-magnet around the coils of which the electric impulses from a telephonic transmitter are caused to circulate. The magnet is mounted upon a fixed base. This magnet may be polarized, if desirable, by a steel polarizer placed in its neighborhood or by causing a uniform current of electricity to circulate round the coils, or round independent coils wound on the same core. R is an electric conductor which may be in the form of a sphere or of a circular disk, as shown, and is preferably of copper. The disk R is mounted upon a shaft in such manner that the poles of the magnet embrace the disk, as seen in Fig. 3. The disk R is rotated in a constant direction and at a more or less uniform speed by light smooth bands and driving pulleys, operated by an extraneous force. A bracket supporting the conductor shaft is attached either rigidly, or by stout blocks of india-rubber, to the secondary diaphragm L at or about its center. Only a portion of the diaphragm is shown; but it is to be understood that its size relative to the other parts of the apparatus is much larger than is depicted in the drawings, and that it is supported in any manner which will permit of it vibrating freely—as, for example, at its edges, as shown in Fig. 1. Two sets of driving pulleys and bands are employed, as shown—one on each side of the disk R—in order that the latter may run smoothly and not impart undue vibrations to the diaphragm. The relative positions of the parts and the direction of rotation are preferably such that the pull on the diaphragm acts along lines more or less perpendicular to it.

The operation of the apparatus is as follows: The running tension of the bands is so adjusted that they exert normally a slight but uniform pull upon the diaphragm, sufficient to maintain the latter in a taut and sensitive condition. The electric impulses circulating round the coils make, by means of the magnet, a magnetic field whose strength varies as the force and duration of the impulses. The variations in the magnetic field offer correspondingly-varying amounts of retarding force to the rotation of the conductor disk R, and thus cause to be applied to the diaphragm similarly-varying amounts of the motive power of the disk. In other words, the force of the pull of the bands upon the diaphragm is varied in exact accordance with the impulses passing round the magnet coils, with the result that there is set up in the diaphragm a series of vibrations similar to the original vibrations or impulses. If the original vibrations are sound or other mechanical vibrations, the diaphragm L reproduces them, it is claimed, in a magnified degree.

This method was devised by R. Hope-Jones of Birkenhead, England.

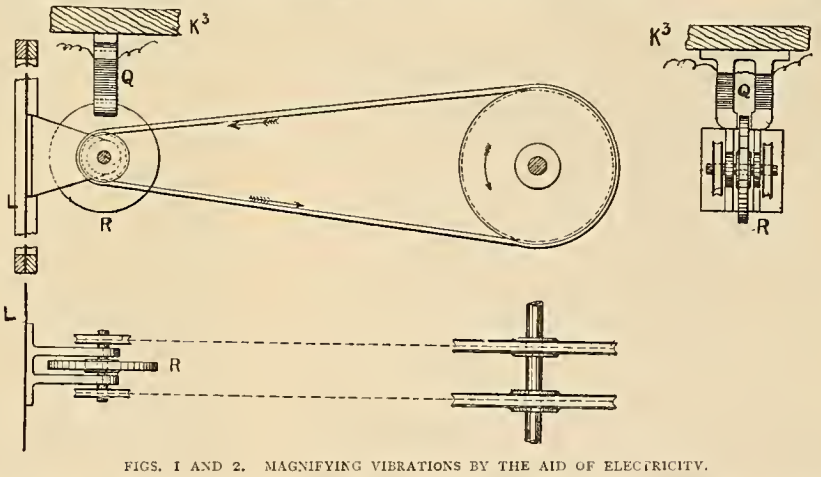
Financial Aspect of Electric Lighting in Canada.[1]

By S. J. Parker.

A dozen years ago I question if there was more than one installation in Canada and not many in the United States. To-day hundreds of plants costing millions of dollars have been installed in the great republic to the south of us, and our own Canada has employed this brilliant illuminant in all of its cities, most of its towns and many of its villages.

The New World may be said to have completely distanced the Old in its method of street lighting. Germany, France and Switzerland (which I had the pleasure of visiting last summer) have employed the system of arc lighting to some extent in their public places and on a few of their streets. Great Britain has been slow to move in the matter of arc lighting. London, while adhering to its murky gas for its streets, is rapidly introducing incandescent lighting for its shops and public buildings.

It is extremely gratifying to look back and realize in how short a time we have emerged from Egyptian darkness into a light equalling Luna's softest rays, and coping with the brilliant mid-day sun; at the same time the question will naturally present itself, does it pay as a commercial investment? Do the parties who have invested their millions in giving the public this brilliant illuminant receive an adequate return for such investments? I am afraid the results prove otherwise. Mistakes were undoubtedly made and money foolishly squandered in the initiation of many plants which, if the work had to be done over again to-day, would not be repeated; at the same time, even with the knowledge that experience has taught us, are we realizing or can we realize at present prices the golden harvest which the manufacturer, or rather his agent, pictured in such glowing colors? Such has not been my experience, and desiring to ascertain how my brethren in other parts of the country had fared, I, a few months ago, addressed to them certain questions from which I gathered that out of twenty-five stations with a capital of about $1,000,000, fourteen of them had paid dividends (in many instances not until the third year) of from 4 to 8 per cent., while the remaining eleven had not paid one cent of a dividend, and some of them had not met expenses. Of these twenty-five plants, thirteen, with a capital of over $700,000, were using steam as their motive power, of which only five paid any dividend. Three were run partly by water and partly by steam, of which two paid a dividend; nine were run by water, and eight of them paid dividends. From these returns I gathered that out of a capital of nearly $1,000,000 dividends had been declared on only about $400,000, while the investors of the remaining $600,000 had not received one cent of interest for their money, and this state of things had existed from one to three years. In analyzing these returns I found that the small plants run by steam, paying a dividend were getting for their arc lights (of from 1,200 to 2,000 candle power) 25 cents for midnight and about 40 cents per all night lights, while the plants run by water power could declare a profit on prices ranging from 10 to 12½ per cent. less.



FIGS. 1 AND 2. MAGNIFYING VIBRATIONS BY THE AID OF ELECTRICITY.

More recently my friend, Mr. Yule, of Guelph, made similar results. He found that out of fifty-two stations only thirty were paying any dividend, of which fifteen were associated with other businesses carried on during the day and the lamps shut off at midnight, the remaining twenty-two were not realizing any profit, and some were eating up their capital. Of the thirty dividend paying ones, seven were using a 9 to 10 ampere current; twenty-five, an 8 ampere current; one, a 6 ampere current; seven, a 4 ampere current. Of the twenty-two profitless plants, four were using a 9 to 10 ampere current; eleven, an 8 ampere current; four, a 6 ampere current; three, a 4 ampere current.

Appended to some of the inquiry sheets were replies not very complimentary to electric lighting as a profitable investment. One person who had been running a steam plant of twenty-nine lights (8 amperes) at 35 cents per night for 300 all nights in the year, says in answer to the question, was it a paying investment? "No; electric light apparatus cost too much, more than double what it is worth. There's no money for the central station man in it." Another with water power plant at twenty-two lights to 1:30 A. M. of 284 nights at $64 per year, says, "No; if we had our money out of the concern some one else could run it." Another rather laconically says, "No; never knew of any plant making money; expenses, depreciation in plant, etc., consume the whole returns. Sell gas at $1.50 and $2 per M. and short circuit your electric light plant." Similar remarks were made by many more of the fifty-two who answered the questions, so much so that I am led to the conclusion that to many, who have engaged in the electric light business, it has not proved the Eldorado which their imagination so fondly pictured. Such a state of affairs is unfortunate; surely a remedy can be found.

It is quite evident that the price received for the quality and quantity of light supplied is entirely inadequate to the outlay necessary for the production of such light, and the sooner this is understood by municipal corporations and others requiring the lights, the sooner will the business of electric lighting be placed on a sound commercial basis. While discountenancing any attempt at forming monopolies, still I think the time has arrived when there should be a closer union of the central station men, as well as the manufacturer, whereby the senseless and ruinous competition, so frequently engaged in, may be avoided and contracts obtained at a fair remuneration. In cities using large numbers of lights and employing the plants 365 nights in the year, the present prices may afford fair profits, but not enough, I am afraid, to provide a sinking fund to meet the necessary depreciation in plant. A field is, however, opening up for city plants which is not available to those situated in small towns and villages. The development of the transmission of electricity for power has within the last few years made considerable progress, and its use may fairly be counted upon in the near future in displacing horse power on street railways, and the motor run by electric light plants during the day may find employment in a thousand and one places where hitherto steam, horse or man power has been employed.

These advantages do not, however, and will not for years to come, extend to our town and village plants. Here we find installations of from fifteen to thirty arc lamps operated by steam power, running to midnight, and employed not probably more than an average of six hours out of twenty-four, and only getting from 15 to 20 cents per lamp per night for 300 nights in the year.

It does not require the wisdom of a Solomon to recog-

1. Abstract of paper read at the first annual convention of the Canadian Electrical association at Hamilton, Ont.

nize the fact that no dividends can be expected in such cases, and that it is only a matter of time, and a very short time at that, when either better prices must be obtained or the plants shut down.

Even in the neighboring republic, where much better prices are obtained, we find that, as a commercial investment, it has not met with that success which would warrant capitalists in again investing in like enterprises.

The following prices of Canadian plants are selected from the answers received to my inquiries:

Cities and Towns.	No. Lamps.	Price per night reduced to a basis of all night and 365 nights.
Brockville	29	35c.
Brantford	29	28¾c.
Belleville	41	28¾c.
Chatham	49	33c.
Hamilton	310	28c.
Kingston	—	28c.
London	275	28½c.
Ottawa	300	30c.
Owen Sound	30	24⅝c.
Quebec	308	22c.
Sherbrooke	52	34c.
St. Catharines	62	30c.
St. John, N. B.	220	25½c.
St. John, Nfd	43	42⅝c.
St. Thomas	29	28c.
Toronto	900 to 1,000	29¾c.
Winnipeg	100	75c.

While not desiring to be considered a pessimist in the matter of electric lighting, I think that the most sanguine will acknowledge that the present condition of affairs can not last for any length of time. A remedy must be found either in better prices or less cost. The sooner this remedy is found and applied the better for those whose capital is locked up in this business. We ask no bonanza, but we do contend that capital invested in electric lighting should be as profitable as that employed in other legitimate enterprises.

New Dynamo of the Detroit Electrical Works, Detroit, Mich.

The type of generator illustrated in the cuts is that which has been adopted by the Detroit Electrical Works for all sizes up to and including the 30 kilowatt machine. This dynamo is a two pole machine, in which the frame and bed plate consist of one solid casting. Above the 30 kilowatt size the type will be similar to that illustrated except that the machines will be multipolar. In designing this machine the advantages of slow speed have been kept in view also the matter of efficiency. As a result the machines of this type average, it is claimed, a slower speed than any other machines of equal capacity, while their efficiency compares favorably with any. The general design is such that the armature is protected on all sides by the frame of the machine, and the metal flanges of the field spools. On account of its compactness it requires small floor space.

All generators are compound wound to give any desired increase in voltage up to 15 per cent. at full load.

The armatures of the machines up to and including the 30 kilowatt size are of the drum type, but a special winding is used, which not only economizes space at the ends of the armature core and holds the wires at the ends firmly in position so they cannot chafe, but also has as its most important feature the advantage of having no two wires adjacent to each other that have between them any great difference of potential. This winding also gives the largest opportunity for ventilation, and makes the danger of crosses at the ends of the armature as small as possible. The commutators of these dynamos are of a new design, and mica is the only insulating material used in building them.

These dynamos are designed for a fixed point of commutation, which renders possible the reversing of the machine and changing from no load to full load without any sparking whatever being noticeable at the commutator.

The field coils are wound on metal spools and then slipped into place on the pole pieces, where they are almost entirely covered and protected by the iron frame of the machine. If, however, it is desired to replace any coil with a new one it is a matter of only a few minutes work to accomplish this. The insulation of the machine as a whole is carried to the highest possible degree.

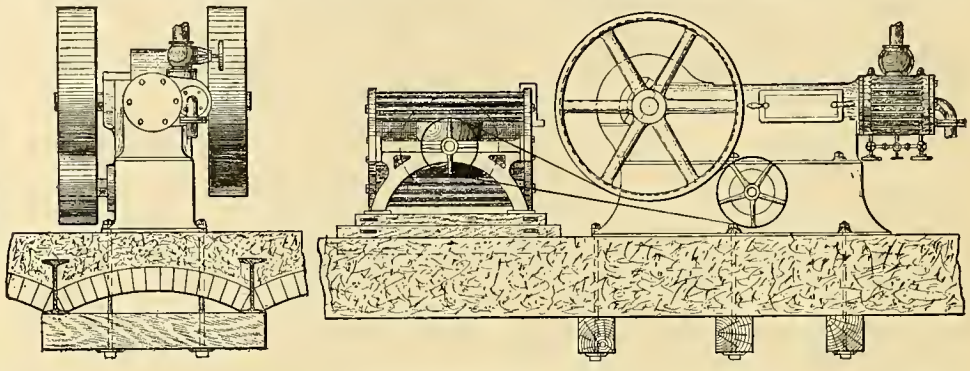
The journal boxes in the new type of machine are provided with self-centering and self-oiling sleeves, which insure perfect alignment and lubrication. Each bearing is provided with a gauge glass which shows the height of oil in the oil chamber, and with a cock by means of which the oil can be drawn off whenever desired. The lubrication of each of the bearings is accomplished by the use of two rings which revolve and carry oil to the top of the shaft, from which it is distributed by means of oil grooves in the self-centering sleeve. Directly over these rings, in the outer shell of the bearing, is a brass plug, which can be lifted out when it it desired to ascertain if the rings are working properly, or to put in new oil.

The rocker arm which supports the brush holders is mounted directly on the center of a self-aligning sleeve, thus insuring the brush holders being kept central with regard to the commutator.

Carbon brushes are used on all sizes of machines, both for motors and generators. The brush holders are of a new type. They provide just the tension requisite to make good contact of the brushes with the commutator without more tension than is required. This tension is obtained by the use of a spring coiled in the form of an involute, the outer end of which is continued straight over the side of the coil, which is below the brush holder, up to and a little above the outer ends of the carbon brushes. The idea of this arrangement is to have the tension due to the coil when its straight end is in a perpendicular position, just sufficient to insure the proper contact. Then, as the coil of the spring is mounted upon an adjustable axis which can be moved in or out, as the commutator brushes wear the spring can be moved inward, always with its straight end in a perpendicular position, thus insuring at all times the same tension of brush upon the commutator without changing the adjustment of the spring itself. This adjustment can be made by a single movement.

The under side of the bed of each machine has grooves planed in it so that the dynamo can be mounted on slides for taking up the slack of the belt. If it is desired to hold the dynamo in a fixed position, lugs cast on sides of the bed plate near the grooves, can be used for bolting the machine down to a foundation. The dynamo represented in the illustrations is provided with a motor headboard and the necessary terminals for connections. There is also provided in addition to these connections a double pole quick breaking headboard switch, so that when desired, and entirely independent of the switchboard appliances, the machine can be entirely disconnected from the mains.

The standard sizes of this new type of machine now being made are as follows, the ratings being in kilowatts: ⅛, ¼, ½, 1, 3, 5, 7½, 9, 15, 20, 30, 40, 60 and 100. Larger machines of the multipolar type will soon be brought out.

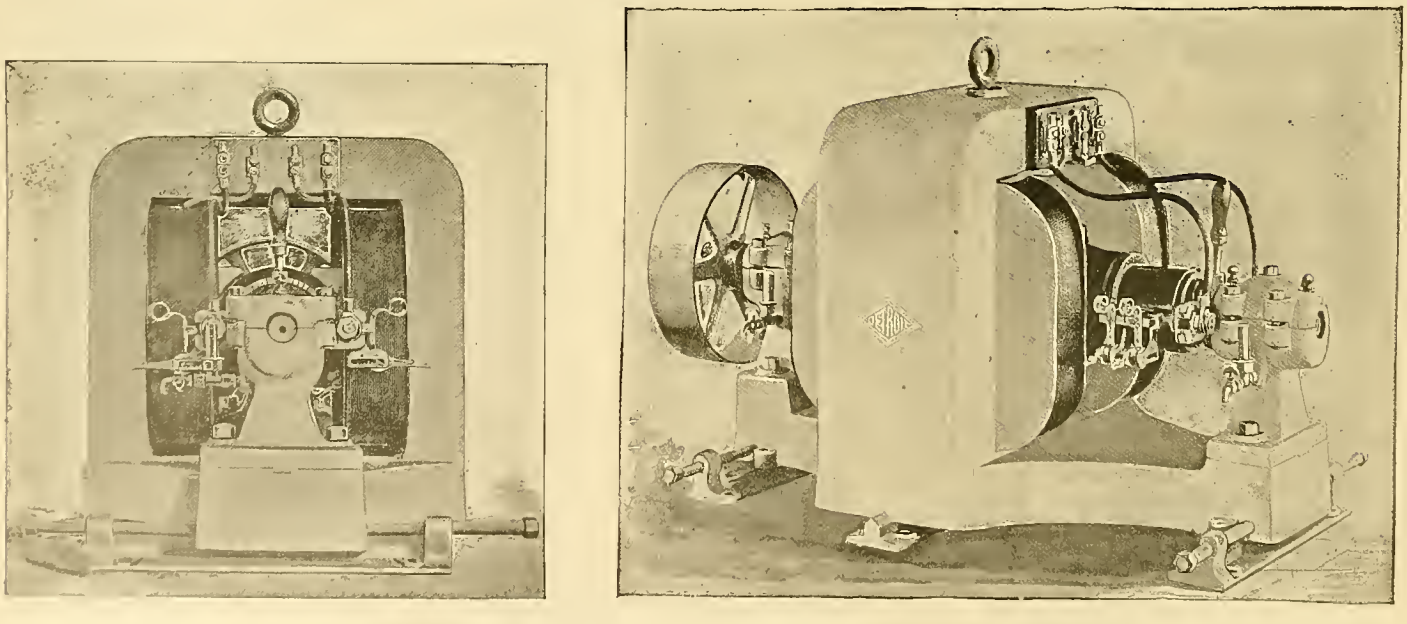


POWER TRANSMITTING DEVICE.

Power Transmitting Device.

In the accompanying cuts a device for transmitting power from engines to dynamos, is shown. The apparatus consists of a pulley supported by a stud which is secured to the base of the engine and requires no additional foundation or fixtures. Two dynamos may be driven from one engine by placing a pulley on each side of the base, and either dynamo may be stopped or started without interfering with the operation of the other machine, by sliding the dynamo on the base so as to bring the belt in contact with the lower surface of the engine pulley. A. L. Ide & Son recently installed a 35 horse power "Ideal" engine with this transmitting device driving a Thomson-Houston 250 light incandescent dynamo for lighting the Keeley Brewing company's plant, Chicago, Ill.

The engine and dynamo are placed on the floor, which is composed of "I" beams or brick arches as shown by the cut, having no foundation or support. The engine runs at 360 revolutions per minute and is so perfectly balanced that there is no perceptible vibration of the floor or building.



NEW DYNAMO OF THE DETROIT ELECTRICAL WORKS.

Kent, Wash., has voted in favor of electric lights.

Bain's Special High Duty Generator.

The object sought in designing this type of dynamo was to produce a machine that would be capable of high duty for a continuous run without excessive heating.

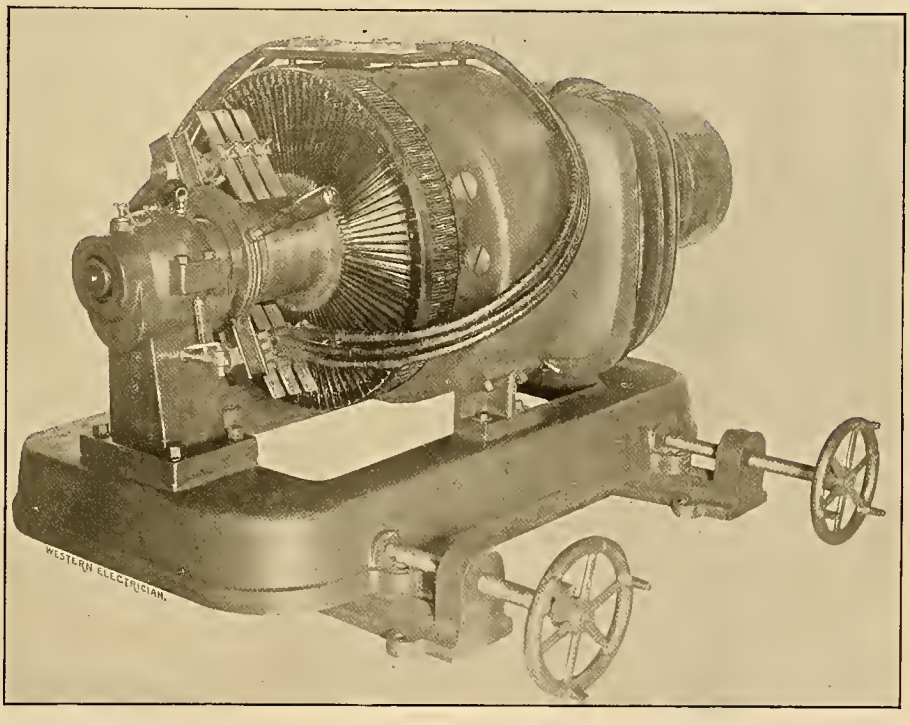
The armature of this machine is very large in diameter and by this means a 50 kilowatt generator has at least 6½ square feet of inductive surface presented to the field magnets. For this reason the wire on the armature is only one layer deep, which gives large cooling surfaces and low internal resistance. The peripheral speed is very great, and therefore the number of revolutions per minute is reduced to a minimum. There are a great number of sections in the armature, this construction producing a regular, smooth current, with very small difference of potential between sections. The sections of the armature are soldered to radial commutator segments, which have large surfaces exposed to the air to disperse the heat from the commutator and the armature. Any coil in the armature may be replaced without rewinding the entire part.

The commutator is made of pure tempered copper, insulated with the best mica; it is solidly put together, has a large wearing surface, and has no crevices in which dirt and metal cuttings might accumulate and short-circuit the sections.

The field, of the single horseshoe type, is, it is claimed, of the shortest possible magnetic circuit for a given strength. The field coils are wound in sections, and are slipped on so that damage to a coil will not render the entire field useless.

The bearings are of the ball and socket type, and are self adjusting and oiling. A large reservoir is provided for oil, into which dip rings that revolve on the shaft, for the purpose of supplying oil to the bearings. A glass tube shows the quantity and the condition of the oil in the reservoir. The armature shaft is short between bearings, and is very stiff and heavy.

The mechanical construction of this high duty machine has been given careful consideration. Its center of gravity is very low, and the supports for the bearings are rigid and substantial. The length of the bearings are three and one-half times the diameter of the shaft. The base casting is quite large. Machines of this type are now being built by the Bain Electric Manufacturing company, Chicago.



BAIN'S SPECIAL HIGH DUTY GENERATOR.

Electric Motors as Substitutes for Steam Locomotives.[1]

By Arthur T. Woods.

Judging from the editorial notes which appear frequently in certain "electrical" journals, the reader might naturally infer that "steam engineers" are a class of thick headed obstructionists who can see nothing good in electricity in any shape, while on the other hand certain "mechanical" journals would apparently have their readers believe that electrical engineers are ready to back any scheme, no matter how visionary, provided it involves the electrical distribution of power. Here is a recent sample from a prominent electrical journal which has until recently occupied a very conservative position in regard to electricity as applied to steam roads.

"Prompted probably by the near approach of a formidable rival in the form of electric locomotives, the builders of steam locomotives are continuing to make a little progress. Although the improvements are doubtless looked upon as important ones in the minds of steam engineers, nevertheless the actual increase of speed gained thereby, though not small, is by no means a great step in the solution of the problem of interurban rapid transit. Like the efficiency of the steam engine, the speed of a modern locomotive is already very near to a limit which it cannot exceed from the very nature of its construction. Just as the speed of a revolving wheel, and therefore that of an electric motor, is limited quite definitely by the bursting of the parts, so the speed of the present locomotive is limited by the hammer blow of the reciprocating parts. Besides this the danger of breakage increases very rapidly for higher speeds of steam locomotives. An increase of their size also requires heavier rails and stronger bridges."

Statements such as the above do not help the cause of electric traction, rather the contrary. Why not meet the question fairly and say that when it can be clearly demonstrated that it will pay to change the form of motive power on railroads it will be done and not before?

The possible advantages of electricity as a motive power over steam locomotives are greater cleanliness, higher speed and reduced cost of operation, including interest charges, depreciation and repairs in the latter. The greater cleanliness is evident and in some locations will doubtless prove to be a strong argument. Possible higher speed, as far as the structure of the locomotive is concerned, and as compared with the present types of steam locomotives may be also admitted to some extent, but the limiting speed for such locomotives has not yet been reached. The writer has carefully investigated the effects of the reciprocating parts of locomotives at high speed and is confident that there is no reason why steam locomotives cannot be built to run at a speed of 100 miles an hour and possibly considerably higher. That locomotives which were not intended for exceptionally high speeds have made runs at over 90 miles an hour simply speaks well for their construction it does not prove that the limit has been very nearly reached. The difficulty with such speeds is not a question of the locomotive, it is rather with signals, the distance necessary in which to stop, and the practical operation of a road for high and low speed trains at the same time. If the railroads throughout the country could be built with no grade crossings and for high speed service alone, the problem would be very different. Speeds could be attained with electric motors which are impracticable with the present forms of steam locomotives, and the problem would become simply one of there being enough high speed business to make the road a paying investment.

But the general railroad problem is not a question of great speed, but, rather, can existing railroads be operated electrically from power stations so as to show greater net earnings than they can by steam locomotives? If a perfectly general answer could be made to this question, it would have to be negative in the present state of development of electrical machinery. There are, however, a few railroads for which the conditions are such that an opinion as to the commercial feasibility of employing electricity as the motive power can be properly given only after a careful estimate.

The general problem, as well as it can be generalized, has been carefully worked out by Messrs. Crosby and Bell in their recent treatise on the electric railway and their discussion is well worth careful reading by all who are interested in the subject.

The first question which arises is whether individual cars are to carry motors, as in street railroad service, or whether there are to be electric locomotives in place of the the present steam locomotives. The motor car method would involve an entire reorganization of the train system on most steam railroads, that is, frequent light trains instead of heavy trains at longer intervals. There would seem to be no great difficulty in this in some cases, as, for example, for suburban service, where the traffic is not heavy; but when such traffic is heavy, amounting as it does at times to trains of from 10 to 15 cars at five minute intervals, and for freight service, electric locomotives at the head of the train seem to be preferable, if not the only practical, solution. When, in addition to this, the many advantages of separate locomotives are considered, such as avoiding the multiplicity of trains, the taking on and setting off cars at stations, the fact that little or no change in the number and size of train crews would be necessary, and that for a given amount of power electric locomotives could be built cheaper and of higher efficiency than small motors, it is safe to say that if electricity is to be applied at all to existing roads, it must generally be by means of electric locomotives.

Assuming for the present that such locomotives could be as readily obtained in the market as steam locomotives of equal tractive power, the problem is reduced to the question of whether or not power can be generated in central stations, transmitted to electric locomotives and used to haul trains more cheaply, all considered, than the same work can be done by steam locomotives. In the power stations we would have the most economical type of steam engines for the particular locality and these stations could be located at the most advantageous points in the district to be covered. The indicated horse power thus economically generated suffers losses during transmission to trains in engine friction, in transmission to the electrical generators or dynamos, in the dynamos, in the line, in the electric locomotive, and in the air and track resistance of the locomotive. When finally delivered at the locomotive draw-bar, the cost of this power, including interest and depreciation, must be enough less than the cost of the same power delivered at the same point by a steam locomotive to warrant the additional expenditure necessary for the electrical equipment. It is at once apparent that the problem is one requiring careful calculation at best, and when the uncertainty as to the probable losses in some of the links of the chain is considered, the difficulty of making an estimate which can successfully stand criticism will be appreciated.

At first glance, when it is stated that a horse power can be developed in a triple expansion condensing engine with about one-half the consumption of steam that is required in a good single expansion locomotive, the proposition of making the substitution sounds not only feasible but attractive. But when it is learned, as stated by Messrs. Crosby and Bell, that a 40 per cent. loss "is about the best we do with our present systems of electric street car propulsion," and the difference has to cover the increased first cost, the evidence of increased net earnings is not so clear. And when we remember that this low water consumption of the triple expansion engine is obtained only when working under the most favorable conditions, and when developing the power for which it is designed, and that when underloaded or overloaded its efficiency falls off rapidly, the electric side of the question does not look so financially attractive.

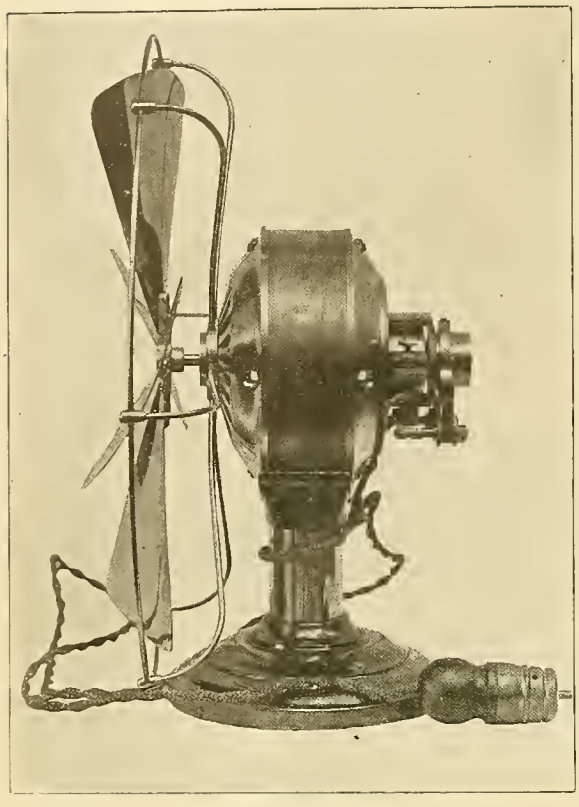
It is shown by a table which gives a summary of the results of the estimates made by Messrs. Crosby and Bell that with 60 per cent. efficiency for the electric engine, electricity becomes more economical than steam only at about 140 miles per hour, and that for 80 per cent. efficiency the two are about equal at 60 miles per hour. The 80 per cent. efficiency, has not, I believe, yet been obtained in practice. At lower speeds, according to this table, steam locomotives are the more economical. Assuming these figures to be substantially correct, it follows that there is no immediate prospect of electricity becoming a competitor of steam for freight traffic. In this comparison a very economical type of stationary steam engine has been compared with a locomotive in which there is considerable room for improvement. It is therefore safe to say that until much more efficient means of generating and utilizing electric power are discovered, and as long as a steam engine in some form is the prime mover, no system of electric traction can compete commercially with compound steam locomotives for freight service. For passenger traffic it may be a competitor under certain conditions, as already stated, but there are several electrical problems yet to be solved before electricity will be commercially possible, except in rare instances. Judging from the high efficiency which has recently been developed in transmission of power by multiphase currents in Europe, the successful use of very high potentials, and the improvements which may reasonably be expected soon in alternating and multiphase current motors, it is not improbable that electricity may be applicable in localities where its use is now commercially impossible. The more uniform the volume of traffic, the higher the price of coal, and hence the greater the proportion which the cost of the fuel bears to the total operating expenses, the higher the speed which is practicable and which will pay, and the greater the value of the absence of smoke and cinders, the greater are the probabilities of electricity being the best form in which to use power for railroads.

In the above it has been assumed that electric locomotives can be readily obtained. Until recently there was no evidence that builders of electrical machinery were prepared to undertake the construction of electric locomotives of sufficient capacity to replace steam locomotives of ordinary size, but it is now reported that three 80-ton electric locomotives have been ordered for use on the Baltimore Belt railroad. This is the best to date, but as these locomotives are to work in tunnels, where freedom from smoke is an important factor, and as, according to the report, the locomotives are not to be delivered until "early next year'

1. From the *Railroad Gazette*.

it is not very encouraging for the cause of electric traction.

Steam has been replaced by electricity upon at least one road, however, viz., the St. Louis & Suburban. It will be remembered that this road operated about three miles of cable road in the city, which connected with a narrow gauge steam division about sixteen miles long. During the past fall and winter the cable road has been converted into a trolley line, the gauge of the steam division has been widened, and the whole has been equipped electrically, with the power station located about seven miles from the city end of the line. For about eight miles from this end the road is double track, and a street car service with from two to four minute intervals is maintained. The remaining



NEW ELECTRIC FAN.

11 miles is single track, and cars are run at intervals of about 15 minutes to Ramona Park, which is about 12 miles from the city end of the line. While six trips per day are made over the remaining seven miles in Florissant. This is an exceptional case. The cable road was in bad shape, and if the form of power had not been changed, expensive repairs or reconstruction would have been necessary. As it is now, there is an electric street car line which gradually changes into a light traffic suburban line. The suburban part beyond the power station, which is conveniently located for coal supply, takes but a small part of the total power, and under these circumstances can probably be operated more cheaply than by steam locomotives. The average running time on this road is about 11.6 miles per hour, including stops, varying from about 6 miles per hour near the city end of the line to possibly 20 miles per hour for short distances in the suburbs.

The present status of the question of electric versus steam locomotives may be summarized as follows:

1. There is no prospect of electricity replacing steam for long distance freight traffic.

2. There is a possibility of electricity becoming an economical substitute for steam locomotives for high speed service wherever the traffic is sufficiently heavy and constant to warrant the construction of lines of track independent of those used for moderate speeds.

3 There are very few localities in the United States in which the conditions are such as to make such a substitution commercially possible, with the efficiencies at present obtained with electrical machinery.

4. If the electrical equipment could be purchased at reasonable prices, there are a few short lines of steam railroads on which the passenger traffic is such as to make electricity a possible form of motive power at present speeds.

5. It is probable that electric locomotives will be used in tunnels and for switching in cities where freedom from smoke is important.

6. No electric locomotive capable of doing the work of a medium weight steam locomotive has as yet been constructed.

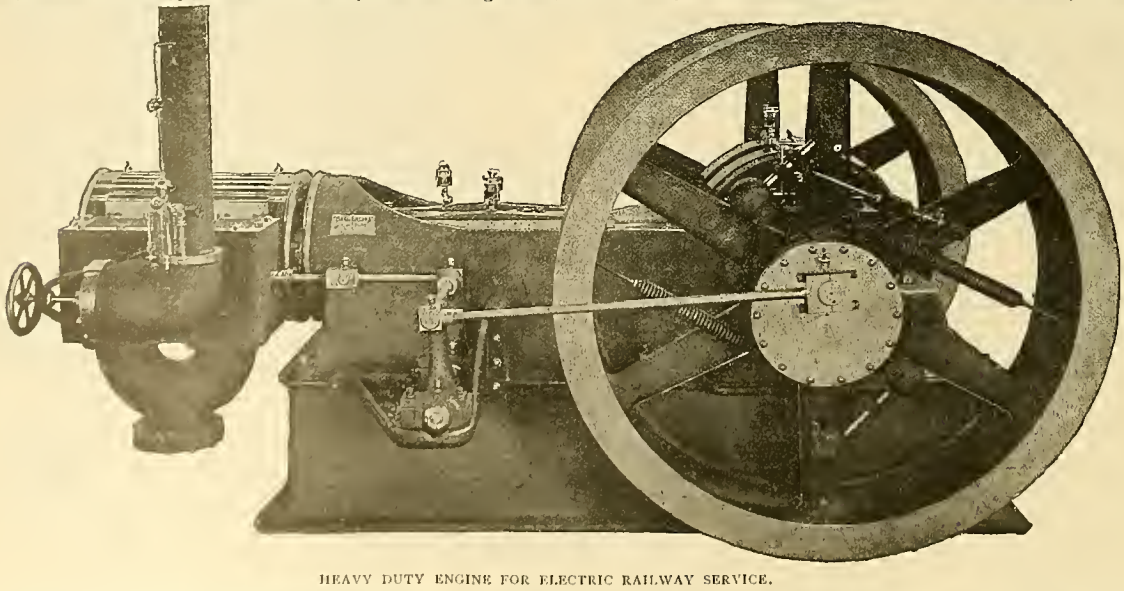
New Electric Fan.

Starting out as one of the luxuries of electrical devices, the electric fan has passed through something of a transformation, so that now it is regarded as one of the necessities in many places. Probably no other small device has shown such a series of improvements, following close upon each other, as the motor fan. From a noisy claptrappery affair of a few months ago, to the handsome mechanism of to-day, has been a short cut. An example of this reformation is the fan represented in the illustration. In workmanship and neatness it is all that can be desired, and its efficiency is manifested by the flattering orders which its exploiters have already received. The device is placed on the market by the Electrical Supply company, Chicago. It is claimed that it requires no more current than is needed to operate the ordinary sixteen candle power lamp.

Heavy Duty Engine for Electric Railway Service.

The extremely varying load which a steam engine in an electric railway power station is so often called upon to carry calls for the fulfillment of special conditions, prominent among which are great strength and prompt action of the governing mechanism. It was through lack of one or both of these essential points that some of the engines in the early installed stations showed themselves unfit for the task assigned them.

In the accompanying illustration is shown an engine recently brought out by the Ball Engine company, of Erie, Pa., especially for electric railway service. It will be seen that this engine is, for its cylinder capacity, of great strength and weight—in fact, the company claims that its engines are, for the horse power, the heaviest made. The connecting rod and crank shaft are of forged steel. The crank shaft in the connecting pin and in the journals is 8 inches in diameter. The crank pin boxes are lined with strictly genuine babbitt; the cross-head boxes are of pure copper and tin. The cross-head pin is of tool steel. The system of oiling the running parts is very simple. The style of valve which has been used by this company with such great success in the past in its electric engines, is also employed in the heavy duty engine. This engine, it is stated, has shown in practice perfect regulation under conditions where the variation of load on the generator from zero to full capacity has occurred during less than five seconds of time.

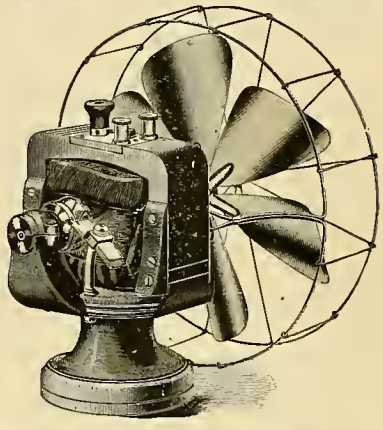


HEAVY DUTY ENGINE FOR ELECTRIC RAILWAY SERVICE.

The Bernstein Alternating Current Fan Motor.

The Bernstein Electric company of Boston is introducing a new electric fan for service on alternating current circuits.

The special features of this motor which, its maker claims, render it at the same time unique and desirable, are as follows: The motor has no electrical connection between its field and armature and withstands a heavy excess of potential without undue heating or danger of burning out. It has only one brush and runs without sparking. It is



THE BERNSTEIN ALTERNATING CURRENT FAN MOTOR

noiseless in running, and it consumes only 65 watts. It has self-oiling bearings.

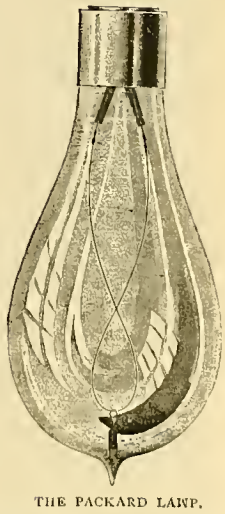
This motor is wound for either 50 or 100 volt alternating circuits or for other voltages on special orders.

These motors of the type "T," are of ⅛ horse power and run at a speed of 1,600 revolutions. Their height without the fan is 9 inches; the fan ordinarly supplied is 12 inches from tip to tip of blades.

The Packard Lamp.

The cut shows the Packard high grade railroad lamp with a supported or tied filament. The support in this particular type of lamp consists of a platinum wire connected to the bulb, as indicated, and bent around the filament in the form of a ring. Sufficient space is given so that the carbon does not rest on the platinum except in case of violent vibration, when each support is necessary. Great care is taken in the manufacture of this lamp, and the reports of practical tests are most favorable.

The ordinary Packard lamps are made in sizes of 8, 10, 16, 25, 32 and 50 candle power. It is claimed that at a test in one of the largest central stations in the country, out of a dozen different makes of lamps the Packard was one of the three that survived to the end and kept up its candle power to a remarkable degree. This lamp is manufactured by the New York & Ohio company, Warren, O., and is handled in New York by Chas. E. Chapin, as eastern agent.



THE PACKARD LAMP.

Steam and Electric Power.[1]

By J. J. Wright.

I will venture to offer a few suggestions on the distribution of electricity for power purposes, which I hope may prove of benefit to those of our members who may contemplate the introduction of such a system. Firstly, then, your power has to be produced; and if you wish to do an extensive business by supplying power at a reasonable rate, or if you have to meet competition you must figure to produce it at the the lowest possible cost. To allow for the various losses in converting your power into electricity and re-converting in the shape of power again, you will always have to produce a certain percentage more than you recover. Economy in the prime mover is therefore more than ever a necessity. You are a happy man if you possess a water power within reasonable distance of a fairly good market, but it seems to me that water powers, as a rule, for some inscrutable reason, are usually located in very inaccessable places. Power you must have. Wind is out of question, and water having failed, we must fall back on our old friend.the steam engine. I am not going to thrash out the obselete controversy of high speed engine versus slow speed. The question has been settled long since. Be moderate in all things. While you are avoiding the high pressure steam eating flyer on the one hand, do not go to the other extreme and build an unwieldly engine that makes one revolution to-day and another to-morrow. Five hundred horse power is about all you should employ in a single unit, but of course the size of engine will be governed very largely by the extent of the power plant you propose to install. But here let me give you a special piece of advice. If you honestly think one hundred horse power will be enough for the demand upon you, make it two hundred. If you think two hundred will suffice, make it four, and you will come out about right in the end. If you have no water for condensation, be very cautious about meddling with a compound engine. Unless the load is accurately proportioned to the size of the engine, the low pressure cylinder will be a positive detriment and it is well known that in this respect a power circuit fluctates very widely. If water for condensation can be obtained, by all means use a compound condensing engine, but if you do so and have a good boiler and carry at least one hundred and twenty five pounds of steam pressure make the diameter of the low pressure cylinder larger than the common practice, in fact nearly as large as the third cylinder would be in a triple expansion combination. I have very strong doubts whether the middle cylioder in a triple expansion engine is any good at all. It is an open question whether the slight saving of steam by the more uniform temperature of the cylinder is not more than overbalanced by the increased complication, weight and friction of the extra moving parts. The reason for the existence of a triple expansion engine is that it is the outcome of a gradual evolution, first the high pressure, then the compound, then the farther use of the steam to ensure the benefit of the vacuum in a very large area of piston in the final cylinder. Now drop the middle cylinder and use a large low pressure in proportion as a compound, you will get the benefit of a vacuum over the increased area, and you will find equal results will be attained with less proportionate wear and tear and risk of accident.

Now another point. If your engines are of considerable size, and a compound of the proportion spoken of would have a comparatively heavy low pressure piston, place them upright. They will take up less room, and instead of having a heavy piston of a ton or a ton and a half weight dragging along the bottom of the cylinder you have it floating in the centre. Wear and tear is reduced to a minimum and large economy in fuel and oil is the result. Let your engines move lively, but at a reasonable speed, say from 85 to 90 revolutions for a 250 or 350 horse power engine, or to express it in a better form, say at about six hundred feet of piston speed per minute. If circumstances compel the use of high pressure engines, see that they are large enough to have plenty of room to take the utmost benefit from the proper expansion of the steam. An engine to be economical should not carry more steam than from one-eighth to one-quarter of a stroke at the outside.

Having a steam plant that we can depend on producing power at the lowest possible figure, we must turn our attention to the question of its distribution in an economical manner. This is not at all an easy problem to solve and much will here again depend on location. The higher the pressure at which power can be distributed, the greater the economy in first cost of construction and in subsequent operation; but there are two serious drawbacks to high potential—first, increased liability to derangement in the electrical apparatus, and second the difficulty of building and successfully operating motors of small power. Given a certain distance to your center of distribution, you have to strike a balance between interest on cost of large size copper conductors to reduce the resistance, and the extra consumption of fuel required to drive your current over small wires. I am speaking now of a system of constant potential suitable for distribution to consumers in large or small quanties and not of the new fangled long distance alternating current exploits that require a death's head and cross bones painted on every pole as a gentle hint to the unwary to keep their own side of the highway. For distribution from a central station within a reasonable area, say half to three quarters of a mile in any direction, a pressure of 250 volts appears to be most suitable Motors can be wound for current as small as a quarter of a horse power. For greater distances, a second system of 500 volts could be utilized with advantage and at not too heavy an expenditure for copper. There are many experiments being made with a view of bringing out a power distributing system by means of alternating currents, but at present there does not seem to be anything positive in sight that would be better than a constant potential direct current system at a pressure as low as could be consistently used taking into account distance from source of power, cost of fuel and interest on cost of copper mains for its supply.

It might be possible in very large installations or where the ground to be covered is considerable in extent, to establish a system of high tension mains to distribute an alternating current to central points and there transform it to a lower potential and utilize it to drive a motor dynamo. This would again produce a direct current at the pressure desired. Except for small powers it would seem as if the complication introduced in a method of this kind would make the power realized about as expensive as steam on the spot. The position of a pessimist in electrical matters is a somewhat risky one to take at the present day, but it does appear to me that some of the schemes proposed for long distance power transmission are a trifle outside of the limit of commercial success. The line must be drawn somewhere at a spot where the expense of maintaining costly electric apparatus and the interest on the original expenditure will about counterbalance the cost of fuel and maintenance of a steam engine. It will also be found very much cheaper to locate a factory requiring a large amount of power at the source of power itself, than incur a continual expenditure to transmit that power to a distance. As an instance, the elaborate scheme of water power which is now in course of evolution at Niagara Falls may be cited. The American scheme, however, has crystallized into action, and large works are already undertaken. The primary object is to locate consumers at the power, but incidentally it is proposed to transmit a large quantity to the city of Buffalo. Time will show to what extent this may be commercially feasible, but when the complicated nature of the operation and its cost is considered, there is room for a pretty large size note of interrogation.

First, we have the proportion of the cost of the water power to begin with, royalties, cost of rock excavation, cost and maintenance of turbine wheels and a tendance. The electrical outfit must be first, low tension dynamos producing alternating current, then transformers to raise the pressure sufficiently high to overcome the twenty miles and more of conductors to the city; the cost of maintenance, and above all, the protection of this twenty miles of line; then again transformers to reduce the pressure to a manageable point; low tension, alternating current motors to convert the current again into power; and finally the cost of its distribution. This expenditure will have to compete with coal at a cost for steam purposes of from a dollar to a dollar and a half per ton. Wonderful things have been done by means of electricity and this enterprise may be successfully accomplished, financially I mean. Its practicability from a scientific standpoint has been already demonstrated.

There are locations, however, in our own country, (a country where a paternal government is doing its best according to its light to further the interests of its people by imposing a duty on fuel), and these places are at such a distance from the source of supply that freight is very costly. Here, if anywhere will the cost of long distance power plants and their existence be justified. But the distance must not be too great or the maintenance of the insulation of the conductors and transformers will become a difficult task as an everyday business operation. Sufficient has been accomplished experimentally; it only remains for it to attain permanent success. I remember the time, and not so very many years ago, when we considered it a big thing to operate a dynamo in one room and arc lights from it in the next. In those crude and early days it was often necessary for the operator to have his eyes on both of the at the same time. Now arc lights circuits of twenty miles in length are not uncommon. It may be feasible in the near future to carry high tension secondary currents for long distances in grounded tubes containing oil, and connected to transformers in metal vesse's also containing oil, and so protected as to preclude the possibility of accident from contact with them. Probably after a system of this kind is perfected and installed, it will be a fine thing, but it will be more or less risky to the experimenters before the perfect system is reached. I have often thought that a cheap and effective motive power might be devised from the repeated detonation of small quanties of high class explosives in situations where the power generated would do the most good, say behind a piston as gas is exploded in the cylinder of a gas engine. The difficulty would appear to be in separating at each stroke a minute quantity of explosive without making injurious connection with the whole stock in hand. It might be made successful, but at the expense of several relays of inventors.

Elaborating these high tension systems may have a similar effect on the available stock of electricians at the outset, but I have no doubt before very loog we shall become accustomed to much higher potentials in electrical matters than we now have any idea of. Now I remember when 8 lights was the average size of an arc light dynamo and a 12 lighter a monster, and shall not readily forget when, after much consultation, it was decided to build a 16 lighter, with what amount of respect for its power we approached the task. When it was completed, it was a creation to stand off from and admire at a distance It was merely a repetition of history. At one time a speed at ten miles an hour on the railway was considered simply as flying in the face of Divine Providence. It is unnecessary to state what the limit of prudence in this respect is considered to be now. This brings us to another devolepmeotof electricity as a power agent and that is the proposed electric railroad projected between Chicago and St. Louis. We have very little information as to the methods to be adopted or the voltages to be employed. We are told, however, that the speed is to be 100 miles an hour, and that the line is to be perfectly straight. It will be necessary. If the projectors had said further that it is to be fenced in with boiler plate it might, to some extent, relieve the feelings of the farmers along the right of way. We are to have some information on the possibilities of electric railroading a little later, so I must not anticipate. The possibilities and probabilities are rather wide apart at present.. The electric tramway fills the bill to perfection for city and suburban passenger traffic, but you must admit when you see a steam locomotive handle a freight train a quarter of mile long or so, that the electric motor has a fairly hard row to hoe before it will take possession of a trunk line of railroad.

1. Abstract of a paper read before the Canadian Electrical association at Hamilton, Ontario.

The Arc-Light Adapted for the Ophthalmoscope.[1]

It is remarkable how little stress is laid by authors on the kind of light that is to be used for purposes of ophthalmoscopic examination. "The flame of a well-burning lamp," is all that is ordinarily specified. And I presume that the most of the profession regard the Argand burner as offering the best form of flame, and gas, under ordinary circumstances, as the best source of illumination. Sunlight is spoken of as having been occasionally employed, but its use is often impossible and generally impracticable. He who has once been able to command a room darkened by shutters, with a round aperture in one of them, and who, waiting for a suitable day, has reflected from his mirror into the eye of the patient the light furnished by the surface of a white cloud, has seen the fundus illuminated with a clearness and purity of color he had never before witnessed, and has ever after longed to be able to dispense with the yellow glare of the ordinary gas flame, even though passing through a chimney of blue glass.

During the past winter I have been experimenting with the electric light. The incandescent lamp, to which I first directed my attention, was soon found to be impracticable. The outlines of the glowing loop of carbon were reflected on the interior of the eye, giving only linear illumination and leaving the territory between and around their borders in comparative darkness. Increasing the amount of candle power and shielding the flame by means of a frosted globe lessened, but by no means obviated the evil. I then secured a small arc light, which has proven most satisfactory. As private houses with us are rarely furnished with other than incandescent circuits, it became necessary to utilize them. The lamp constructed uses five amperes of current and produces 500 candle power, when burning at a pressure of 45 volts. A special carbon is used to give the proper quality and color of light. A resistance coil, placed in circuit with the lamp and connected with it by a flexible cord, takes up the balance of the voltage. The lamp is held on a metal base which carries an upright on which is mounted the apparatus for adjusting the carbons and feeding them toward each other. This upright is provided with a shield, at one end of which is a slide in which ground glass may be inserted for the purpose of toning the light.

The lamp may be connected with any incandescent circuit, it and its resistance being placed in the branch with a five ampere switch. The branch on which it is placed should have a carrying power of six amperes. The lamp I am at present using occupies a space of about six by nine inches. Its conductor being flexible it can be readily moved about the table. The aperture in the shield is an inch and a half in diameter. Through this shines a brilliant and steady light that readily adapts itself to the needs of the observer. He can employ it for oblique illumination, use it with the mirror alone for testing the transparency of the media or for retinoscopy, or apply it to the examination of the fundus in either the direct or inverted image.

Despite the character of this light, I find no unpleasant effect complained of by the patient. No complaint of dazzling has been made, and no greater inconvenience caused than would have been the case with the Argand gas burner. I have no hesitation in stating that I find the light the best I have ever used. The color of the fundus approaches more nearly to that obtained under exceptionably favorable circumstances by day. The definition is greatly improved, being clearer than that obtained with any other form of artificial illumination. Repeated comparisons instituted between the Goddard gas burner I have had in use for more than twenty years and the arc light show the superiority of the latter. This has proved particularly the case in certain forms of slight macular disorganization I have lately had the opportunity of examining. The careful and repeated scrunity required when gas was used yielded to the certainty afforded by a single glance aided by the electric lamp. Slight haziness of the vitreous, as well as floating bodies and membranes in this portion of the eye, assume unusual distinctness.

I cannot but think that when the arc light has been perfected for this purpose it will supersede all lamps now in use. The reason for giving no drawings or additional details of the lamp I am at present using is that we are now endeavoring to effect improvements in its construction. It is a distinct advance on its predecessor, and specifications for a third are now being worked out. I trust to have a good working lamp to exhibit at the meeting of the American Ophthalmological Society next July, and to be then able to refer those who may desire to obtain it to the manufacturer.

1. From a paper on "Recent Added Facilities for the Examination of the Eye," by Hasket Derby, M. D., in the *Boston Medical and Surgical Journal.*

Somewhat Forgetful.

In Dexter the other evening the electric lights did not commence business at the usual hour, says the *Commercial* of Bangor, Me., and the people could not understand it. It became dark and darker and traders were fretting. At last the manager of the company harnessed up and drove down to the power station, two miles below the village. The station was brilliantly illuminated, and the assistant sat comfortably therein reading a book. At the somewhat heated inquiry of the manager, the other's face dropped. He jumped to the switch and ejaculated: "Thunder! I forgot to turn the lights on." He had been running the dynamo two hours for his own personal illumination.

CORRESPONDENCE.

New York Notes.

New York, July 2.—The people in the vicinity of the the great metropolis apparently require quite an extended period of time in which to accustom themselves to look out for electric cars that move faster than a snail's pace. Every day or two one hears of an accident on a motor line. It will probably be sometime before people learn that if rapid surface transit is desired, it is the car and not the man that should be entitled to the right of way.

On Friday, a new system of communicating fire alarms by telegraph to the quarters of the engine and hook and ladder companies in New York city went into effect. It is designed to reduce as much as possible the annoyance and trouble caused the firemen by the transmission of all alarms of fire simultaneously to all the engine and hook and ladder companies throughout the city, which has been the rule since the establishment of the present fire alarm system.

It has been pointed out that there did not appear to be any good reason why, if an alarm was sent in from the box at Battery Place and Broadway, the firemen in Harlem and in the annexed district above the Harlem should be roused from their slumbers, if the alarm happened to come in at night, come down the sliding poles, and hitch up the horses; nor that the firemen situated down town should be disturbed for an alarm of fire in Harlem. Yet this system has survived for years to the great annoyance of the firemen and the detriment to their health by being routed out of their beds a number of times during the night.

For sometime, therefore, the fire department has had in view a change of system. The new arrangement was devised by J. Elliott Smith, the superintendent of Fire Alarm Telegraph, and as planned under his supervision and that of Chief Operator Farrell, it went into effect.

In the new system, the territory covered by the different engine, hook and ladder companies has been divided into telegraphic circuits, and beginning at 8 o'clock Friday morning, all alarms sent in from the street boxes were sent out from Fire Headquarters on that circuit only with which the fire companies due on the first alarm at the station sent are connected. The companies on the other circuits were not to be disturbed.

It was found inadvisable to divide the city into districts by arbitrary lines, but for the present the sending out of alarms from Fire Headquarters will be governed by the circuit system. Second, third, and fourth alarms will be sent out as heretofore, simultaneously over all the circuits, and, necessarily, to the quarters of all the companies in the department, so that the entire fire fighting force will be made aware when a large or dangerous fire is raging.

There has been a great deal of time and money expended in perfecting this system and it is hoped that it will prove satisfactory. The inauguration of the system, which will be hailed as a great boon by the firemen, has been delayed by the difficulty in arranging the new circuits and changing the wires from aerial lines and placing them in the subways, and also by the illness of Superintendent Smith. If this system proves a success, and there does not appear to be any reason why it should not, it will be further extended so that fewer companies will receive first alarms, and perhaps it may result in the transmission of a first alarm turned from a street box only to those companies who are assigned to answer such a call.

Western readers will be interested to know of the incorporation, at Albany on June 29th, of the United States Wire & Cable company, with a capital of $1,000,000. The business of the organization is to manufacture and sell wire rope cables, conductors of every kind for the transmission of electricity, and all wires used in connection with and for the use of electrical machinery, apparatus and the building, installation and use of electric plants to make and sell machinery, and insulation and covering of wires, cables, and conductors for electricity. The locality of the company's business is Schenectady, and the directors are B. F. Sunny, Chicago; Silas A. Barton, Boston; Samuel Insull and Dana Greene, New York; John Kreuss, Schenectady.

Word has been received from Secretary and Treasury L. B. Somerby that at the regular meeting of the Franklin Experimental club, of Newark N. J., Tuesday, June 21st, it was decided to discontinue the meetings until the second Tuesday in September. The laboratory and reading room will however be kept open for the benefit of members.

The Rogers Typograph company of New Jersey and the Electric Typograph company of West Virginia have been combined. The new company will be known as the Rogers Typograph company, and its headquarters and shops will be at Detroit.

W. F. O.

St. Louis, Mo.

St. Louis, July 2. — Temporary repairs to the Twelfth street bridge have been made, and through traffic has been resumed on the Union Depot electric railway lines.

The Delmar avenue & Clayton Railway company has been incorporated with a capital stock of $5 000. The incorporators are B S. Barnes, M. B. Greensfelder, E. L. Dorsenbach, Chas. K. Ramsey and C. C. Nichols.

Jes F. Porter of J. G. White & Co., New York, spent several days in St. Louis last week looking after prospective business.

Frank H. Pond, president of the Pond Engineering company, reports the sale of four Armington & Sims engines for the Salt Lake Temple, for use in connection with the electrical plant; also two 500 horse power engines for the Adams street station of the Chicago Edison company.

The Merchants. Electric Light & Power company has been incorporated at Joplin, Mo. The incorporators are J. W. Freeman, J. V. Pierce and O. F. Freeman.

William Windack, president of the Interstate Complete Electrical Construction company, has just returned from a trip to the Northwest, taking in Kansas City, Omaha and several Iowa points.

The Midland Electric Railway company, operating a two-mile line in St. Louis county in connection with the St. Louis and Suburban railway, met with considerable trouble with its water supply last week, and was obliged to shut down its plant. Current was supplied in the interval from the Suburban company's station.

The Lebanon Light & Water company, Lebanon, Mo., has increased its capital stock from $100,000 to $250,000.

The Municipal Electric Light & Power company is increasing its incandescent plant by the addition of three 3 000 light alternators. One of these is already in position, another is on the way from the works, and the third will be ready for shipment soon.

The St. Louis office of the Thomson-Houston Electric company has been removed from the Chamber of Commerce to 723 Locust street, the former location of the Edison General Electric company. This consolidated office of the General Electric company is under the associate management of H. H. Humphrey and W. L. Arnold.

The Missouri Electric Light & Power company has issued a map of St Louis showing the location of its circuits. This is claimed to be one of the largest and altogether one of the most remarkable incandescent stations in the country. The system used is the Westingbouse alternating. The circuits are extended to West Cabanne Place, a distance of more than five miles from the station. There are now about 63,000 lights connected, divided as follows: Commercial, 40,000; domestic, 18,000; city, 5,000.

The Hope Electric Light company of Carterville, Ill., expects to start up its new central station on July 4th. The system used is the Heisler series incandescent, installed by the Interstate Complete Electrical Construction company of this city.

D. E. Garrison & Co., contractors for track equipment for railways, report excellent business in electric railway work. They are furnishing the entire track material, including rails, fastenings, switches, etc., for the six miles of the Fort Scott Rapid Transit company, Fort Scott, Kan , which is changing from horse to electricity; also four miles of track material for an extension of the Topeka, Kan , Rapid Transit company, and two miles each for extensions of the Lincoln, Ill.. electric railway and the Gate City electric railway of Keokuk.

A number of changes have been made in the Pond Engineering company. William S. Love, secretary, has removed to Chicago to assume the management of the Pond Machinery company, filling the vacancy occasioned by the resignation of Albert Blanchard. A. W. Remnitz, late manager of the Dallas office, has been transferred to St. Louis, assuming a responsible position in the conduct of this office.

The Edward Thomas Electric Railway company of Belleville, Ill., is meeting with considerable difficulty in its efforts to supply the citizens' of that city with rapid transit. The Old Citizens' street railway is still in possession of the tracks on the principal streets, and refuses to remove them, although repeatedly notified by the city officials to do so. The fight has got into the courts, and the outcome will be awaited with interest. The Thomas company can do nothing until an adjustment is reached, although it stands ready to begin work at once. It is proposed to extend the new line to East St. Louis.

Dr. Wellington Adams of the Adams Electric Railway company, has been invited to repeat his lecture on the Chicago–St. Louis road before the Franklin Institute. Dr. Adams announces that grading on the line will be begun before August 1st. Preliminary work is now in progress along the right of way, and the office force here is busily engaged on diagrams and plats.

Capt. Robert McCulloch, general manager, and Winthrop Bartlett, engineer, of the consolidated Cass avenue lines, have returned from their eastern trip of inspection of large electrical railway plants. They visited the works of all the leading manufacturers of electric railway apparatus, and noted the recent advancements in this line. Their present plans contemplate the use of two 100 horse power and one 500 horse power units, each engine and generator being built together. The generators will be built up directly on the engine shaft, attached to it by means of face couplings. Contracts have been placed for ties, rails and wire, and a force of engineers is now locating poles. It is expected that material will begin to arrive within ten days, when the active work of reconstruction will begin.

The equipping of the Cass avenue, Union and Northern Central street railway lines with electricity will remove the last horse lines from the central and residence districts of St. Louis. In the remote suburbs there remain a few extensions still operated by horses, but electricity will soon be substituted on these.

So much has been said of the inability of small lighting stations to earn proper returns on the capital invested, that it is refreshing to learn of well authenticated cases to the contrary. The Waterloo, Ill , Electric Light company has just paid a dividend of six per cent. out of the net earnings of its first half year. W. H. B.

Milwaukee, Wis.

Milwaukee, July 2.— Francis E. Hinckley of Chicago has at last won a point in the litigation over the Milwaukee electric railway. In their case against that company Charles F. Pfister and August Vogel made a motion for judgment on the answer. The plaintiffs claimed that they had an equitable lien on the company's property in the $250,000 worth of bonds to secure the payment of a loan of $125,000. The hypothecation of the bonds, the court held, was void under the statute which provides that bonds cannot be issued for less than 75 cents on the dollar. Under this law, the court held, the plaintiff cannot rightfully hold the bonds, and the complaint was dismissed. Another motion, one to allow John H Manschot to interplead as a defendant, fell with the first one. The judgment as to the bonds will not prevent Mr. Pfister from recovering the amount of his loan. He still has a majority of the stock which, with the bonds, was given to him as collateral. Beside, other remedies are open to him. The decision on the bonds, which was rendered by Judge Johnson of the circuit Court, is the first in Wisconsin that covers the point in issue. Judge Jenkins of the United States Court here has a similar question to decide, and his ruling is being awaited with interest, inasmuch as the Milwaukee electric railway case will be appealed to the Supreme Court.

Henry Villard, president of the North American company and of the Milwaukee Street Railway company, was in the city last week. With him were Secretary Spofford and Mr. Cromwell of the North American company. Under the guidance of Henry C. Payne they rode over the new electric lines in Manager Lynn's palace car. Mr. Villard found thirty-five miles of electric railway in operation and expressed himself as satisfied that the work of construction had been carried forward as rapidly as possible considering the long spell of rainy weather. He stated that work on the new lines and extensions would be commenced as soon as the old lines were rebuilt. He said that it would be impossible to extend the Soldiers' Home line to the fair grounds this season. The necessary material could not be secured in time, he said, and if material already ordered was diverted to that use it would interfere with the rebuilding of some of the city lines, which was out of the question. "Wait," he said, "until our work here is completed, and you will see a system that you will be proud of." He stated that he had no idea of seeing street railways equipped with storage batteries. He added that for some time he had been looking for a practicable storage battery system, but had found none.

The common council has passed the ordinance giving the Western Union Telegraph company the right to string aerial cables in the business district. By the terms of the new ordinance the cables in the down-town section must be strung by August 1st.

The Milwaukee Street Railway company has secured permission from the common council to lay tracks on Harman street from Island avenue to Walton street.

The trustees of the Exposition have decided to sell the arc lighting plant at that institution and to light the building with incandescent lamps exclusively in the future.

An electric motor will be provided for a new organ which is to be erected in the Baptist Tabernacle. In three or four Milwaukee churches the organs have been supplied with electric motors.

It is proposed to have the Hinsey electric cars, which now run on Oneida street to Milwaukee street and thence to Michigan street, leave Oneida street at Broadway, run south to Michigan street and thence to the North Western depot. An attempt to perfect the arrangement is being made.

Business men and a number of city officials are in favor of exhibiting a perfect model in miniature of Milwaukee at the World's Fair and of paying the expense, which would be about $10,000, out of the city treasury. C.

PERSONAL.

Mr. Hilles, of Bognall & Hilles, Yokohama, Japan, was in Chicago last week.

C. O. Baker, Jr. of Newark, N. J., returned last week from a visit to Buffa'o.

J. E. Beggs, of the J. E. Beggs Machine & Supply company of New York, has just returned home from Boston.

P. J. McFadden, who is in charge of the meter department at the Chicago office of the General Electric company, was in Boston last week.

J. K. Metzger of the Northwest Thomson-Houston company was married in Washington on June 16th to Miss Edith Mullan of that city. Mr. and Mrs. Metzger will reside in St. Anthony Park, Minn.

J. F. Connor has resigned as Chicago representative of *Electricity* and accepted a more remunerative position in the Chicago office of the *Manufacturer's Record*. His friends are congratulating him.

F. H. Prentiss, New York, consulting engineer to the New York Steam Heating company, New York city, and president of the Buckeye Electric Manufacturing company, Cleveland, O., was in Chicago on Saturday last.

R. Sumner Parmly, son of S. P. Parmly, president of the Standard Electric company, Chicago, was drowned while bathing at Ann Arbor, on June 24th. The deceased was 22 years of age. His grief-stricken father has the sympathy of the entire electrical community.

C. A. Daigh and Morgan Brooks of the Electrical Engineering & Supply company, St. Paul, Minn., and the National Electric Manufacturing company, Eau Claire, Wis., spent several days last week at the companies' office in the Rookery, Chicago. Mr. Brooks returned to St. Paul Saturday night, while Mr. Daigh left the city for a short vacation.

Prof. J. P. Barrett, city electrician of Chicago, has issued a circular making the following announcement: "The management of the business of the city electrical inspection department will hereafter be under the direction of J. J. S. Wilson, secretary. He will receive all applications for inspection, payments of fees, reports of insulation, measurements, removal, etc., and will assign inspectors their work."

NEW INCORPORATIONS.

Point Sewell Hotel company, Norfolk, Va.; capital stock, $300,000; gas and electric works.

Columbus Mining company, Richmond, Va.; capital stock, $50,000; mining and manufacture, gas, water and electric works, etc.

Newport Electric Light company, Newport, N. H.; capital stock, $15,000; electric lighting; Col. Seth M. Richards, Newport, N. H.

Hartford Electric Light & Power company, Hartford, Vt.; capital stock, $12,000; manufacturing light and power; Alfred E. Watson, Hartford, Vt.

Pontiac Water, Light & Power company, Chicago, Ill.; capital stock, $60 000; build, operate and lease water, gas and electric light works; W. G. Reeve, Princeton, Ill.

Immisch Electric Navigation & Power company, Hoboken, N. J.; capital stock, $250,000; to manufacture machines for the production of electricity, etc.; T. Aub, 54 Wall street, New York, N. Y.

Bristol Electric company, Rutland, Vt.; capital stock, $15,000, furnishing heat, light and power and carrying on such other business as is connected therewith at Bristol, Vt., Rockwood Barrett, Rutland, Vt.

Morningside & Highland Park Street Railway company, Pittsburg, Pa.; capital stock, $35,000; constructing and operating an electric railway in Pittsburg; Arthur E. Linhart, 138 Fifth avenue, Pittsburg, Pa.

Northern Electrical Supply company, Concord N. H.; capital stock, $5,000; buying, selling railway, telegraph, telephone, lighting and heating apparatus and supplies and all electrical apparatus; Geo. P. Warde, Concord, N. H.

Gray International Telautograph company, Chicago, Ill; capital stock, $1,000,000; to buy, sell, own and operate electrical appliances, and patents and privileges in foreign countries; F. W. Cushing, 225 Dearborn street, Chicago, Ill.

San Francisco Electrical Storage company, San Francisco, Cal.; capital stock, $1,000,000; to deal in and manufacture electrical machinery and generate and deal in electric light and power; Wilson & McCutchen, San Francisco, Cal.

Valley Light & Water company, Sumner, Wash; capital stock, $50 000; to erect, construct, maintain and operate water works, electric light plants, gas works, etc., and supply towns of Puyallup and Sumner with products thereof; Mason Mortgage Loan company, Tacoma, Wash.

The Queen City Electric Railway company, Marion, Ind.; capital stock, $180 000; construct, own, maintain and operate by means of electricity or other motive power, lines of street railway through the streets of Marion, and extensions of such lines beyond the limits of said city, and it is proposed to construct such lines in said city of Marion and extensions thereof to and into the town of Jonesboro in said Grant county, and also to dispose of surplus electricity for power and other purposes.

ELECTRIC LIGHTING.

There is talk of the organization of a new electric light company in Rochester, N. Y.

The Albany, N. Y., Electric Illuminating company has been absorbed by the Municipal Gas company of that city.

An incandescent electric light plant of 2,500 lights, capacity is to be erected in the Cook county, Ill., hospital.

Reports of electric light plants forced to suspend operations on account of the floods have lately been received from many of the towns on western rivers.

Manager C. R. Huntley of the Brush Electric Light company of Buffalo denies that the company's prices will be raised on account of the new underground work.

The stockholders of the Hartford, Conn., Electric Light company have voted to increase the capital stock from $200 000 to $250,000 by the issue of 500 new shares of $100 each.

Proposals for the electric lighting of Cairo, Ill., will be received by the city clerk until July 12th. The tenders must be for not less than 70 or more than 100 arc lights of 2,000 candle power each.

The incandescent electric light plant of Wilson & Van Ness at Valparaiso, Ind., was destroyed by fire early in the morning of June 29th. The fire is said to have been caused by an explosion in the dynamo room. The loss to the firm will aggregate $15,000. The plant will be rebuilt.

Max M. Rothschild, owner of a lease of premises at No. 19 Third avenue, Chicago, has filed a bill in the Circuit Court to restrain the Central Electric Light company, which has its plant on the lot adjacent, from connecting a large tubular smoke stack six feet in diameter and 100 feet high with large boilers on the premises.

ELECTRIC RAILWAYS.

An electric railway is to connect Minneapolis with the suburb of Bryn Mawr.

It is stated that the cable and electric railway companies, at Los Angeles Cal, are to be merged into one corporation.

The Mobile Electric Railway company has purchased Westinghouse and Thomson-Houston apparatus for its station.

The electric railway company and the electric light company of Aurora, Ill., now occupy the power house of the former jointly.

William Kingman, known throughout Boston as "the big motor man" of the West End company, died recently. He weighed 325 pounds.

The Pittsburg & West End Railway company will substitute electrical power for horses, increasing its indebtedness from $75,000 to $500,000.

It is said that since the change to electricity the earnings of the Colerain avenue line in Cincinnati have increased from $127,000 to $250,000 per annum.

Two electric cars in Boston recently caught fire by some means, the flames in each instance bursting through the floor, and a large number of passengers were injured in the wild scramble to get out.

The new power house of the Denver Tramway company has ground dimensions of 165 by 110 feet. The dynamo and engine room is 110 by 92 feet. Water is supplied from an artesian well.

A reporter of the *News* of Denver, Colo., interviewed Ralph W. Pope, T. R. Taltavall, Thomas D. Lockwood and M. B. Leonard of Richmond, Va., on the subject of the application of electricity to existing steam railroads during the recent convention of railway telegraph superintendents at Denver. The prevailing opinion was the conservative one that it would be some time before steam locomotives were abandoned by the trunk line companies.

The projectors of the Chicago and North Shore electric railway desire to secure the right of extension south from Graceland avenue to Dewey court. The intention of the ordinance granting the permission already obtained is to provide a continuous line of rapid transit from the down-town district to Evanston. By an ordinance already in existence the company has the right of way from Graceland avenue north. It now desires to go a mile and a half south to Dewey court to a connection with the cable, avoiding a transfer to the Evanston avenue horse car line.

TELEPHONE.

The Sunset Telephone company is planning to put the telephone wires in Oakland, Cal., underground. The work of putting the wires underground will cost between $30,000 and $40,000. The area within which the wires will be buried will include the fire limits

The aldermen of Racine are considering the question of bringing action to revoke the franchise of the Wisconsin Telephone company in that city. The city wanted to rent instruments from the telephone company for use in connection with the police alarm system, but the company charged what the aldermen consider an exorbitant rate.

It is proposed to greatly increase the capital stock of the Chicago Telephone company on account of the expense of the installation at the World's Fair and of burying the wires and extending the system. The present capital is $2 260,000. The details of the plant for Jackson Park were described in the WESTERN ELECTRICIAN of April 30th.

MISCELLANEOUS.

The New York *World* asserts that Park Benjamin of New York has the largest library of electrical literature in the country. The collection comprises about 1,000 titles, in 1,200 or 1,500 volumes.

The aldermen of Omaha have created the office of city electrician, but the mayor refuses to make the appointment until the duties of the new official shall have been defined by ordinance, to the end that the wiring of the may be under supervision.

The jury in the case of Thomas and Anna Beard against the Argentine, Kas., Electric Light Company, for $5,000 damages for the death of their son, returned a verdict in favor of the company. It was alleged that young Beard had placed his hand on a live wire and met instant death.

One of the Missouri river boats recently ran into the telephone, telegraph and electric light wires that stretch across the river from Prospect hill to Covington at Sioux City, Ia., and tore them down. All telephone communication between Sioux City and Covington and South Sioux City was cut off for a time.

A press dispatch from Parkersburg, W. Va., of June 25th, says: Capt. S. S. Stowe, who owns a large farm above Marietta, had a peculiar experience a day or two ago during the heavy thunderstorm which prevailed along the valley. A very large potato field, in which the rows of hills were very long, was struck by lightning. The electricity ran from hill to hill, completely withering and destroying over 400 hills, killing vines and tubers. The ground all about the hills looked, as the captain expressed it, as "if it had been all splattered out."

Sealed proposals will be received at the office of D. J. Swenie, fire marshal of Chicago, until 12 m. Tuesday, July 12th, for furnishing the city of Chicago with 2,300 feet of 60 conductor and 10,300 feet of 30 conductor lead covered telephone and telegraph cables, in accordance with specifications on file at the office of J. P. Barrett, superintendent of city telegraphs. Proposals must be made out upon blanks furnished by the superintendent of city telegraphs and be addressed to the fire marshal, and indorsed "Proposals for Lead-covered Telephone and Telegraph Cables," and be accompanied by $200 in money or a certified check for the same amount on some responsible bank doing business in the city of Chicago and made payable to the fire marshal.

TRADE NOTES.

The International Okonite company has just favored its patrons with souvenirs in the way of unique match boxes, bearing the company's trade mark.

For the most complete catalogue of electrical books ever published address the Electrician Publishing company, 6 Lakeside Building, Chicago.

The office of the Brush Electric company, formerly located in the Gate City Bank Building, Atlanta, Ga., has been removed to room 78 Old Capitol Building.

George Cutter, Chicago, has just left the city for a ten days' business trip through the East. The Cutter factory is running full blast to fill the orders for the Cutter magnetic cut-out.

The Port Huron, Mich., Electric Railway company has awarded the order for an improved engine to the Ball Engine company, Erie, Pa. The engine is a 400 horse power cross compound of the latest type.

The arc lamp for oculists' use referred to by Dr. Hasket Derby in the paper on "The Arc Light Adapted for the Opthalmoscope," presented in this issue, is manufactured by the Electric Construction & Supply Company of New York.

A neat advertising medium was found by the Electrical Supply company, Chicago, which sent out numerous "fire crackers" to its patrons. These bogus "crackers" contained a slip on which was set forth the qualities of the fuse wire sold by this company.

Diehl & Co of New York are obliged to run their factory overtime to keep pace with the orders on hand for their well known Diehl fan. Diehl & Co. also report large sales of 1 6 horse power motors for government use. These small motors are run in connection with the electrical cancelling machine now used for stamping letters in a number of United States postoffices.

E. E. Johnston, western manager for the Gould's Manufacturing company, Seneca Falls, N. Y., has a very attractive window display at his office, No. 2 South Canal street,

Chicago. A triplex pump built for tank service and boiler feeding is kept in constant operation by a one horse power Keystone electric motor, throwing a large stream of water into a glass tank. The window is a prominent one, and the display is attracting much attention.

The Atlantic steamships, City of New York, City of Paris, City of Rome, the Alaska, and the Arizona, will hereafter use the Buckeye coiled filament incandescent lamp to the exclusion of all other makes. These great floating palaces have each a very large isolated electric light plant, and during the year must use a large number of lamps. The officers of the Buckeye company are somewhat proud of the preference shown their lamp.

The North Hudson County Railroad company, Hoboken, N. J., last March purchased a 300 horse power latest improved Ball engine from the Ball Engine company, Erie, Pa. It was so well satisfied with the performance of the engine that an additional engine of the same power from the same company has been ordered. The Englewood Electric Light company, Chicago, Ill., has also ordered a 500 horse power improved Ball cross compound engine through the Chicago office of the company.

Among the sales made by the McGuire Manufacturing company, Chicago, of the No. 19 F steel truck for June delivery are the following: The Central Traction company, Pittsburgh, Pa., four; The Marrinette Electric Street railway, Marrinette, Wis., six; The Fort Clark Electric Street railway, Peoria, Ill., eight; Pittsburg & West End railway eleven. The officers of the last mentioned company were favorably disposed towards a different type of truck, but four of the McGuire make were sold them under protest November last, and now, after this impartial trial an order has been given for the entire equipment of the road.

A. R. Hussey who has been doing business under his own name at 211 Randolph street, Chicago, for some time, has associated himself with W. P. Allen in the organization of a company, to be known as the Allen-Hussey company. The new concern will occupy an office at 225 Dearborn street and do a general electrical business. The company will manufacture a line of specialties of which Mr. Hussey is the designer, and in addition will have a large force of men engaged on a number of good wiring contracts just secured. Mr. Hussey and Mr. Allen have both a wide acquaintance in the city, and with experience and energy the new undertaking should meet with success.

The recent electrical storms have severly tested all kinds of electrical apparatus, and some queer freaks of the slippery fluid have been reported. One that seems peculiar was the destruction of several transformers on the circuit. This in itself is not so strange, but that the current should select every alternate device on a circuit carrying over a dozen transformers and leave the others uninjured seems most singular. Some transformers, though, are so built and provided with reliable fuses that they are never harmed, and in this connection the Electrical Supply company, Chicago, reports the performance of the Stanley transformer as being remarkable, as it has reeeived but one complaint relating to the hundreds of machines it has sold. And this single instance seems to have been the result of a mechanical defect which escaped the inspectors at the factory. The Electrical Supply company is gratified with this clean record of the Stanley transformer.

BUSINESS.

The Boston Braid Manufacturing company, Boston, has just moved into much larger quarters to accommodate its growing trade. In future the company's address will be 27 Beach street, Boston, Mass.

Perry & Demeritt, of Montpelier, Vt., are sending out to the trade a very neat little pamphlet giving illustrations and descriptions of their "L. P. and D." system of power transmission. They also give a list of the regular styles and sizes besides a number of very valuable testimonials from various companies who now have their system in operation.

The rapid sales of the Ries regulating socket, manufactured by the Ries Electric Specialty company, of Baltimore, Md., has necessitated an eastern representative. Accordingly the company have secured the services of N. L. Schloss, who until recently was New York agent for Thomas H. Dallett company of Philadelphia. Mr. Schloss will handle this specialty in all the New England states and also in New York state.

The New York & Ohio company of Warren, O., manufacturers of the well-known Packard incandescent lamp, is energetically pushing its eastern business through Manager Chas. E. Chapin of its New York office. The distance between New York and Ohio seems annihilated when goods ordered to-day reach the metropolis by express the next morning. This time has been made in several instances when there has been an urgent demand for lamps. Mr. Chapin's offices are at 136 Liberty street, New York.

The Ashton Valve company, 271 Franklin street, Boston, announces that it has bought the entire plant, material and business of the Boston Steam Gauge company, together with a series of valuable patents, and has consolidated the business of both houses. The new concern has secured the services of the former manager, H. L. Willard. The company will continue to manufacture all classes of steam pressure and vacuum gauges, water pressure and ammonia gauges and all similar instruments used in connection with steam plants.

The Detroit Electrical Works, Detroit, Mich., have already received orders for the new type machines as follows: Times building, Chattanooga, Tenn., two 30 kilowatt generators, one 9 and one 15 kilowatt motor; Bagley estate, Detroit, one 40 kilowatt generator and five 9 kilowatt motors. This contract also includes five freight elevators and controlling devices for motors, so that each elevator is operated by one 9 kilowatt motor. This motor is controlled by means of the starting rope of the elevator, the motor only running when the elevator is in use.

A neat and very tasteful reminder of the American Electrical Works of Providence, R. I., has just been received. A miniature of the stars and stripes in red, white and blue, silk and satin, on the cover of a little folder, brings kindly Fourth of July greetings from this well-known house. "There is but one American flag and but one American Electrical Works," tells its own story of patriotism, and all who have had dealings with this progressive firm know where American characteristics may be found. The American Electrical Works will have their annual clam bake on Saturday, July 23d, at Silver Spring, a suburb of Providence, and a large number of friends are expected from New York and Boston.

Less than a year ago, owing to the great expansion of business, the Ball Engine company, Erie, Pa., was forced to erect a large and complete machine shop which was filled with the latest and most improved tools. No idea was entertained at the time that any further increase would be necessary for several years to come; but the demand for the latest types of Ball engines has been so great, especially for electric railway work, that already the Ball company has been again compelled to make a farther extension of the same building. This improvement will be built on the gallery plan the same as the other portion of the building. It will contain, among other valuable features, complete testing blocks and apparatus, and will be capable of testing engines of very large capacity. Every engine that leaves the works of the Ball Engine company is thoroughly tested and guaranteed to give satisfaction under the most unfavorable circumstances.

The Westinghouse Electric & Manufacturing company, of Pittsburg, in accepting the contract for the entire incandescent lighting of the grounds and buildings of the World's Columbian Exposition, promised the directory the finest and most complete electrical installation the world had ever seen. Users of wire, then, will be interested to know that the Westinghouse company has decided to use exclusively Grimshaw white core wire, cables, tapes, and compounds. Doubtless many of the buildings will also be tubed with Vulca ducts. It is unnecessary, perhaps, to say in this connection that although the World's Fair is to be supplied with over fifteen million feet of wire, a sufficient stock of Grimshaw wire will always be kept in the company's warehouse to fill all orders with the usual promptness. From the fact that Grimshaw wire has been selected exclusively to supply what will probably be equivalant to 150,000 16-candle power incandescent lamps, Manager Geo. H. Meeker may be pardoned for his natural feeling of elation.

The Oshkosh Electric Light & Power company, has just placed an order with the Rice Machinery company, 65 Canal street, Chicago, for the entire outfit of shafting, floor stands, friction clutch pulleys, etc., to be used in its new plant now in process of construction at Oshkosh, Wis. The plant, when completed will be one of the largest generating stations in the country. The Rice Machinery company is general western agent for the Dodge Manufacturing company, of Mishawaka, Ind., and the appliances are to be of the lattter company's manufacture. The Dodge patent split disk clutches and wooden split pulleys will be used throughout. The main shafting is 6 inches in diameter and will be supported on the Dodge improved adjustable floor stands. The bearings will be of the late improved chain oiling pattern. The main receiving pulleys from the engines are the Dodge Manufacturing company's celebrated wood split pulleys, and will be of sufficient capacity to transmit 500 horse power each. The Rice Manufacturing company is making special efforts in the electrical fields, and it has installed some important plants, among which is the Bessemer Electric company, at Bessemer, Ala., 400 horse power.

ELECTRICAL PATENTS.

Issued June 28, 1892.

477,635. Electrical Keyboard. William E. Blodgett, Faribault, Minn.

477,637. Electric Regulating Apparatus. Julien M. Bradford, Portland, Me.

477,645. Battery. William A. Childs, Englewood, N. J.

477,656. Lightning Arrester. Frederic Haselwander, Frankfort, Germany.

An atmospheric current is led to a space containing an explosive charge, the energy developed by the consequent explosion of which breaks the circuit.

477,652. Writing Telegraph System. Harry Etheridge, Pittsburgh, Pa.

A number of autographic telegraph instruments are arranged in series on two circuits, both normally open, and automatically and consecutively acting; circuit closing means are arranged, one in each circuit, for closing the circuits.

477,665. Individualizing Cutout for Printing Telegraphs. Samuel R. Linville, Philadelphia, Pa.

477,695. Thrust Collar for Axles of Electrically Propelled Vehicles. Richard P. Osgood, Methuen, Mass.

477,708. Electric Current Regulator. Charles D. Sigsbee, U. S. Navy, and Thomas S. Hayward and Frank S. Anderson, Easton, Md.

Finely divided conducting material is placed between perforated plates of low conductivity, arranged so that the current flowing through the perforations has a devious route through the conducting material. Change of resistance of the conducting material is obtained by change of pressure.

477,712. Automatic Test for Burglar Alarm Systems. Alfred Stromberg, Chicago, Ill.

A clock mechanism is adapted periodically to short circuit a coil normally in series with the protective screen, and to actuate recording mechanism at the central station.

477,729. Dynamo Electric Machine. James J. Wood, Fort Wayne, Ind.

477,732. Method of Insulating Electric Conductors. Arthur V. Abbott, Closter, N. J.

The method consists in applying coats of vitrous enamel, holding the same in place by a wrapper of organic substance, and vitrifying the enamel and destroying the organic matter of firing.

477,734. Electric Railway. Joseph W. Bates, Minneapolis, Minn.

477,735. Process of Making White Pigments. John Blair, Spokane, Wash.

477,753. Insulator. Frederick D'A. Goold, New York, N. Y.

477,781. Device for Suspending Trolley Wires. Joseph Sachs, New York, N. Y.

477,786. Socket for Incandescent Lamps. Evelyn L. Smith and George C. H. Foster, Bridgeport, Conn.

477,787. Electric Conductor. Charles T. Snedekor, Worcester, Mass.

In combination with a rubber coating, fireproof coatings are used, which are composed of magnesia China clay and silicate of soda.

477,810. Receptacle for Portable Electric Lamps. Herrman Molendo, New York, N. Y.

477,835. Phonoporic Telegraphy. Charles Langdon-Davies, London, Eng. Patented in France, June 22, 1891, No. 214,350.

477,853. Electric Telemeter. Cornelius T. Barrett, Brooklyn, N. Y.

477,866. Telephony. Robert Hope-Jones, Birkenhead, Eng.

An apparatus for magnifying minute vibrations comprising an electromagnet responsive to such vibrations, a conductor passing through the field of the magnet, and subjected to a pull by said field, and a vibratory diaphragm responsive to variations in the force of said pull.

477,869. Electric Switch. Herbert M. Pilkington and Roger S. White, Brooklyn, N. Y.

477,870. Anti-Inductive Device for Telephones. Simon Pollak, Prague, Austria-Hungary.

Two induction coils are placed at the subscriber's station, one coil being in circuit with the line, the other in circuit with the telephone, the latter being pivoted, whereby its axis may be adjusted at any angle with the axis of the other coil to prevent induction noises due to the action of the microphones.

477,879. Electric Current Transformer. Norman T. Wilcox, Meriden, Conn.

A direct current electric motor is provided with collecting rings in circuit with segments of the commutator of opposite polarity, from which rings the alternating currents thus formed pass to a transformer. The secondary of the transformer is connected in a similar manner with a commutator and collecting rings for straightening the secondary current.

477,890. Mast Arm Electric Switch. Thomas Dillon, Indianapolis, Ind.

477,897. Electric Lock. William H. Hollar, Elizabeth, N. J., and Frederick S. Holmes, Malden, Mass.

477,898. Electric Lock. William H Hollar, Elizabeth, N. J., and Frederick S. Holmes, Malden, Mass.

477,913. Voltaic Body Battery. Wilson F. Potter, Albany, N. Y.

477,914. Secondary Battery. William L. Silvey, Lima, O.

477,931. Telephone Tablet. Joseph S. Gould, Columbus, O.

477,940. Pickpocket and Coat Thief Detector. John F. Hurd, Chicago, Ill.

477,950. Electric Alarm. Stephen M. Mathews, Rat Portage, Ontario, Can.

477,951. Composite Electric Conductor. Charles A. Mezger, Brooklyn, N. Y.

477,975. Electric Bath Apparatus. Henry E. Waite, New York, N. Y.

477,980. Insulator. Herbert C. Wirt, Boston, Mass.

An insulator corresponding to a cleat has end projections around which the wires are wound.

477,984. Electric Lamp or Conductor Support. Charles Bell, Stroudsburg, Pa.

477,986. Electrical Stop Motion for Knitting Machines. Albin Beyer, Brooklyn, N. Y.

478,011. Automatic Electric Change Maker and Check Receiver. Thomas Mangan, New Orleans, La.

478,018. Electrode for Secondary Batteries. Harry G. Osburn, Chicago, Ill.

An electrode plate is formed of a single piece of material, and comprises longitudinal slotted receptacles, and thin connecting webs to render the plate yielding.

478,026. Conduit for Electric Railways. Carl T. H. Schwieger, Berlin, Germany.

478,032. Electrical Organ. Richard P. Strand, St. John, Can.

11,250. Electrical Measuring Instrument. Edward Weston, Newark, N. J.

The invention embodies a stationary coil and a movable coil in the field of the stationary coil, a spring opposing the action of the movable coil and a circuit including both coils.

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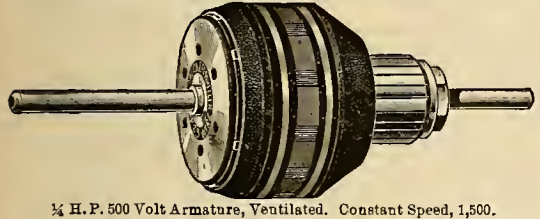

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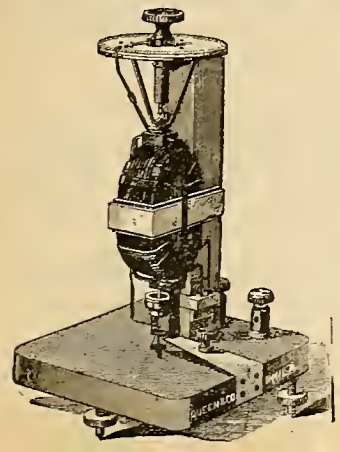

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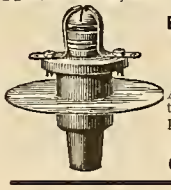

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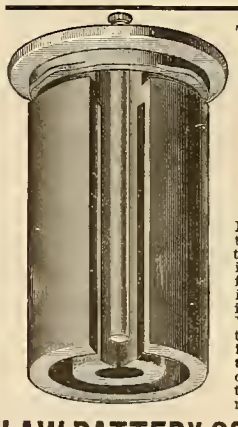

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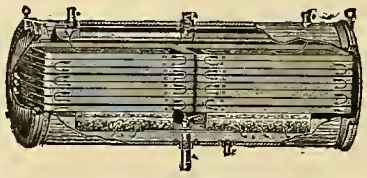

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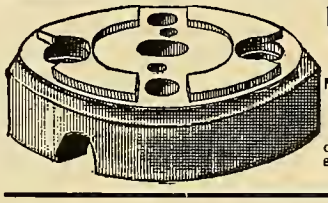

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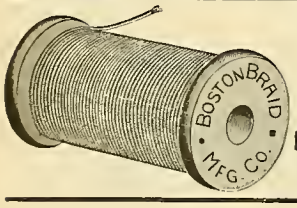

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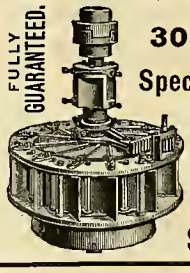

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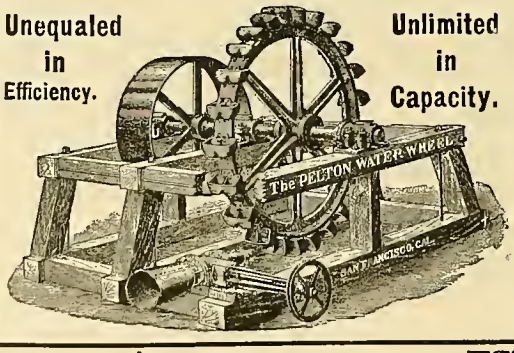

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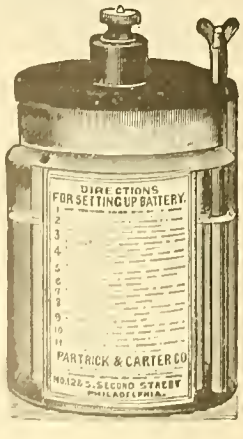

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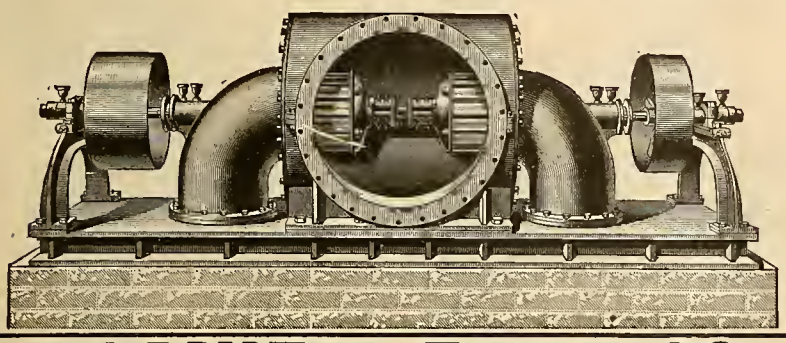

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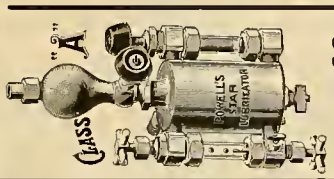

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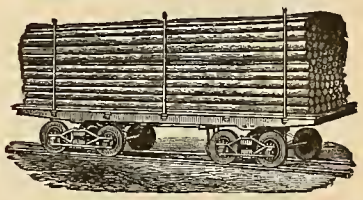

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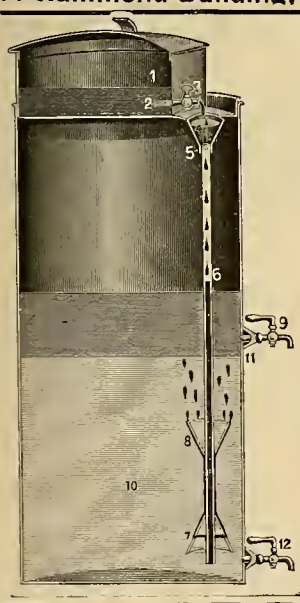

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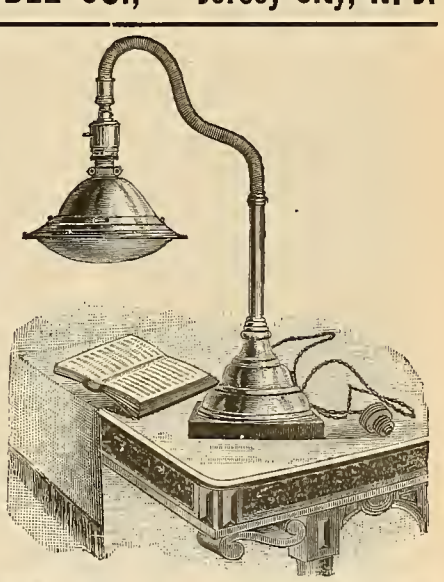

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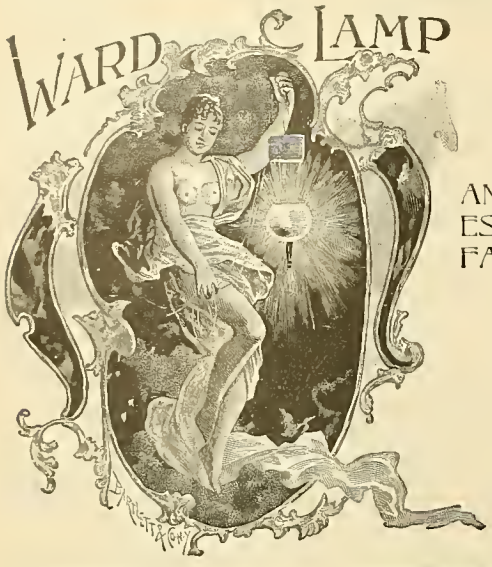

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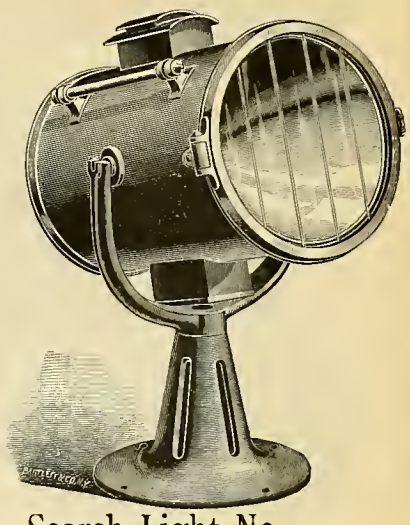

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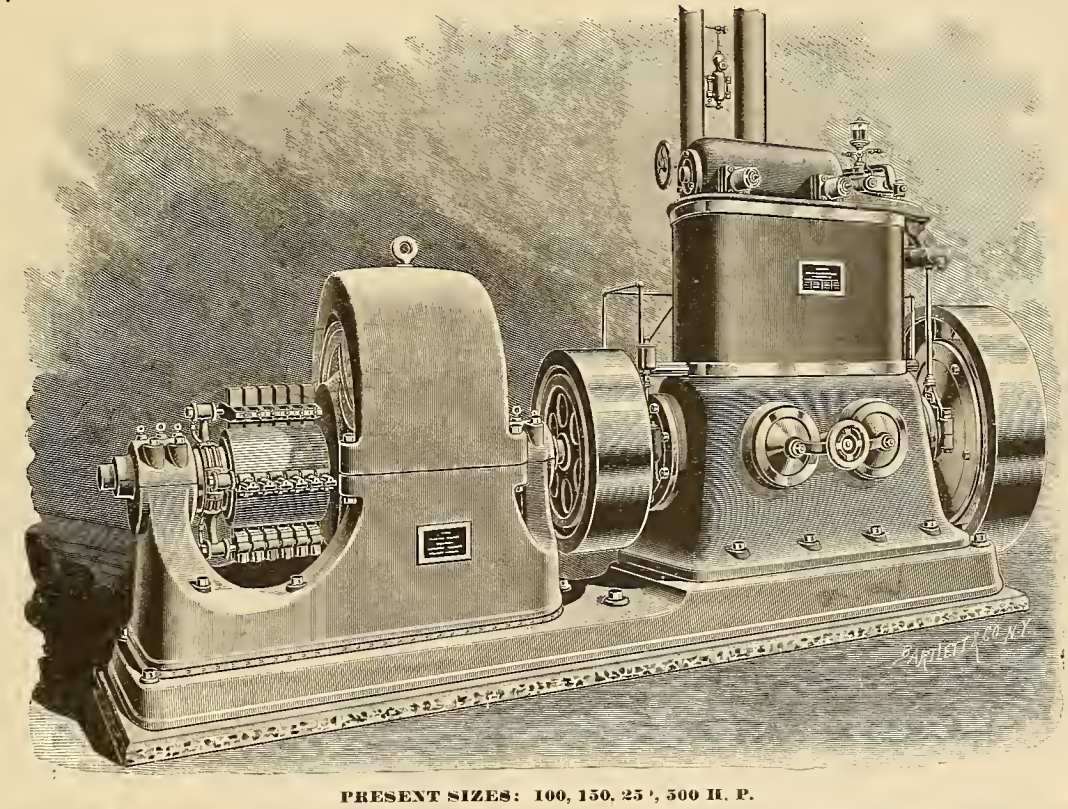

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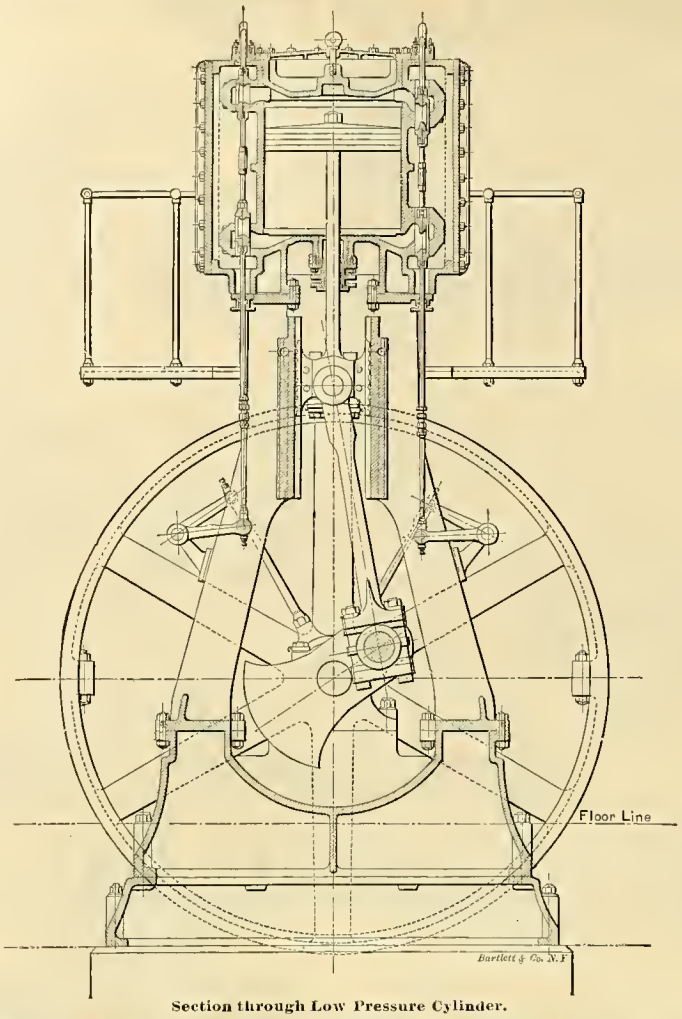

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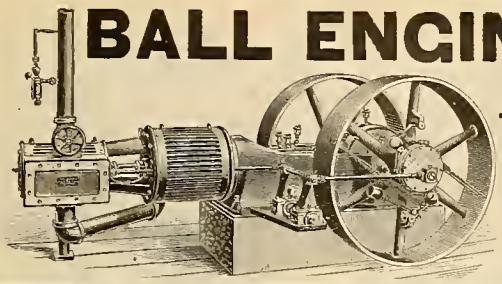

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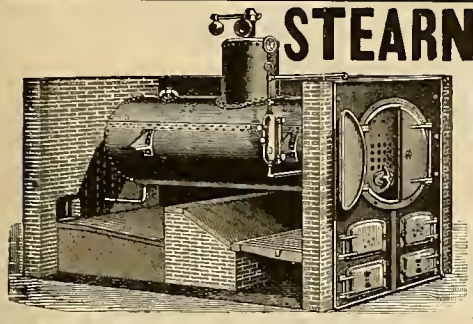

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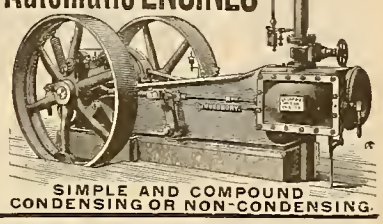

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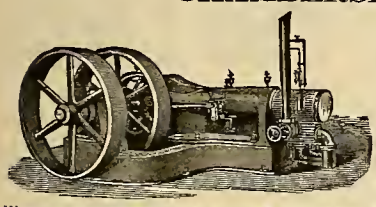

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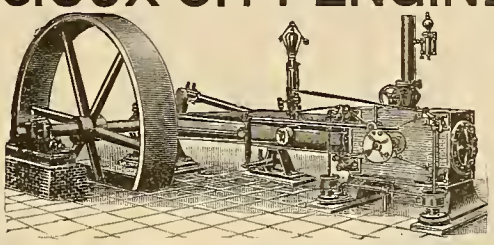

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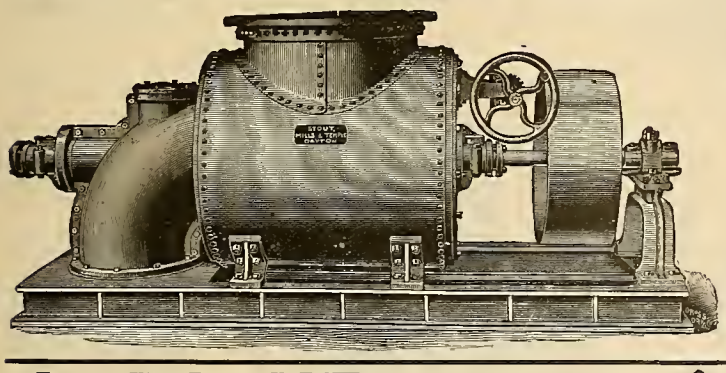

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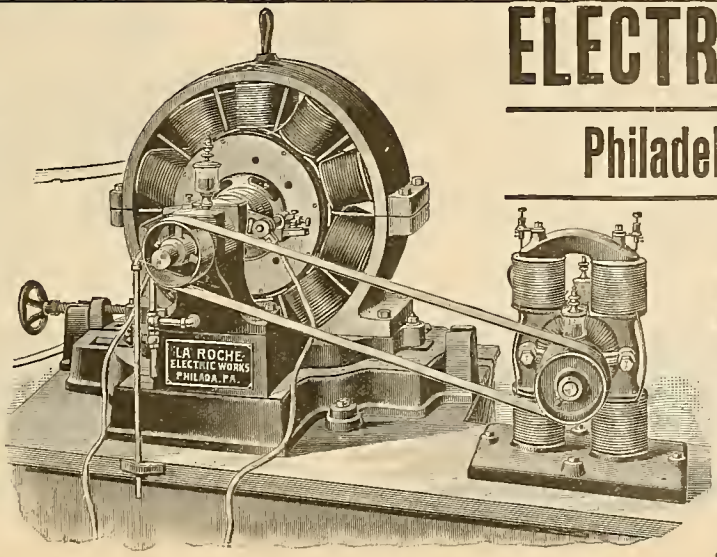

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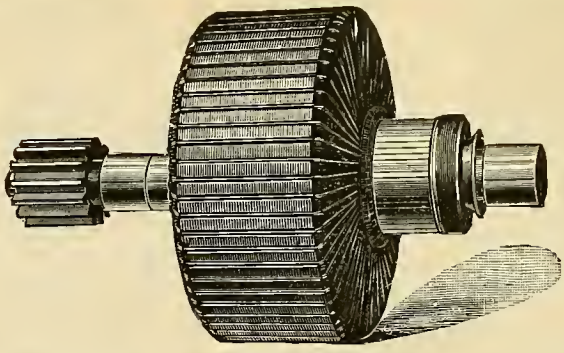

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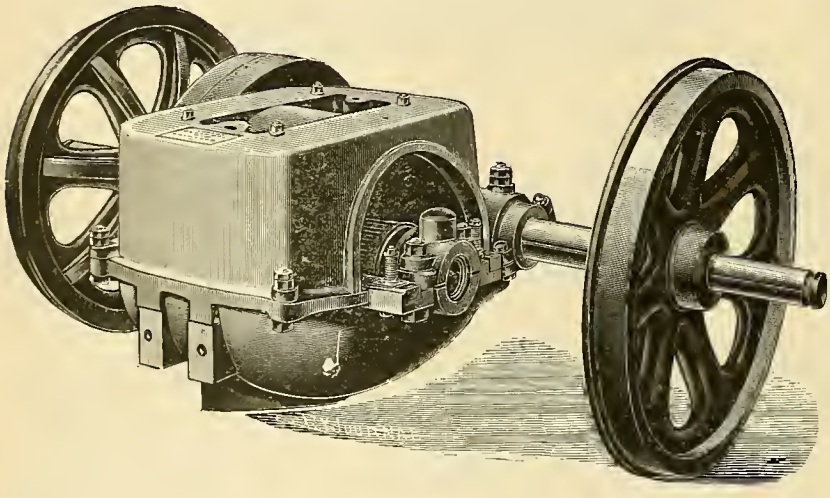


It Excels all Preceding Motors.

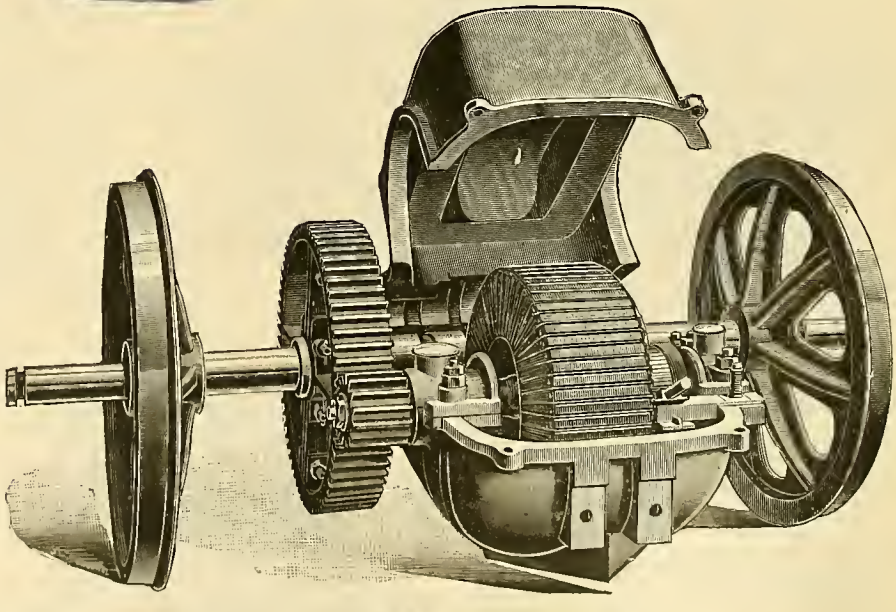
Cost of Maintenance Reduced to a Minimum.

$10 per Year for Renewal of Pinion and Gear.

3382 Already Sold to Railway Companies.

Strong Indorsements from those using it.

Send to us for Prices and Information.



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BARE AND INSULATED.

We carry an immense stock of

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UNDERWRITERS,
MAGNET and
ANNUNCIATOR WIRES,

Manufactured by the Chicago Insulated Wire Co.

We are General Western Agents for

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Can furnish from Chicago stock,

Any Candle Power, any Voltage, and to fit any Socket.

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And can furnish from Chicago stock any size

RUBBER COVERED WIRES or LEAD INCASED CABLES.

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Annunciators, Burglar Alarms, Bells, Batteries, Etc., Etc. Write for prices.

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54 and 56 Franklin Street, Chicago, Ill.

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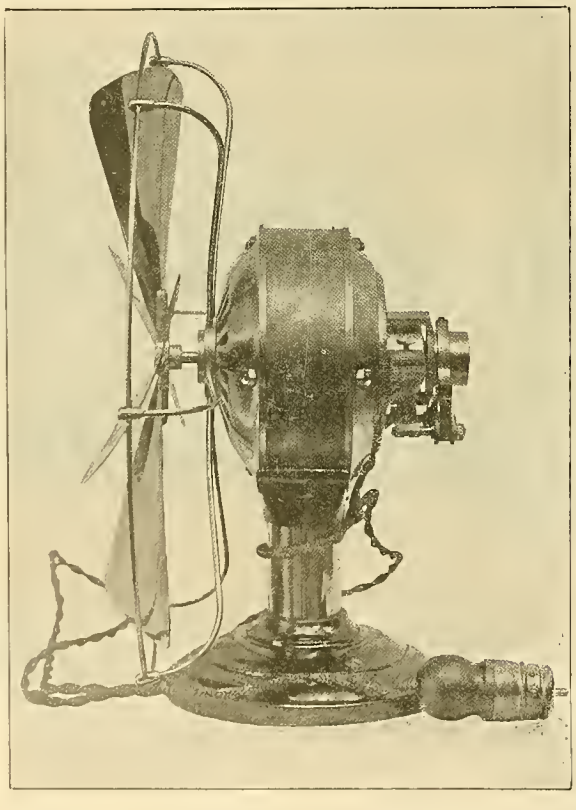
FAN MOTORS.

ALL KINDS,

FOR DIRECT OR

ALTERNATING CURRENTS.



The above photographic reproduction illustrates one of our best designs in Fan Motors. We have them in all sizes, to suit the purpose of customers. They are all well made and designed for the highest economy in current consumption. The motor illustrated is designed to be operated on 50 Volt Alternating Current circuits, and is superior in construction to any Fan Motor on the market. It is provided with *self-oiling bearings*, which contain sufficient lubricant to run it for several months. The *brushes are of carbon.*

We are prepared to furnish these motors at very reasonable prices and ship on receipt of order.

Where the Weather Comes From.

The man on the top of the Auditorium Tower, who makes all the weather around here, was puttering over his instruments the other day, jabbing his fingers first into one mysterious thingumbob and then into the other, screwing the weather up a little here and letting it down a peg or so there, according to his own sweet will. Suddenly he stopped in front of his big pet thermometer and a puzzled look stole over his face—one of the boys near by heard him crooning to himself:

"Strange what a drop of alcohol no bigger than a shot,
Within a tiny tube of glass can do;
It makes the weather freezing cold or awfully sizzling hot,
By going up or down an inch or two."

But something was wrong—the song died on his lips, and with a cry of consternation he turned to an assistant—

"Holy snakes! Jabez, what's struck us?"

"Why?"

"Why! plenty of "Why"—run up the black flag! Here's a cold wave comin' thicker'n a fog, or a ——".

"Hold up Professor, hold up—I know what's the matter—it's that Supply Company over on Michigan Avenue—they've opened a fresh barrel—"

"Barrel? le'mme go"—

"Barrel of fan motors—got the whole front of a store full and every blamed one pointed this way—going like blazes."

"Run over and stop 'em quick! the bottom of this gauge 'll be dropping out next—ugh!"

"All right Professor, all right." And he went out and whistled to the elevator man to come up and get him, while the Professor turned to his hot-wave machine and tightening up the thumb screw, with a fiendish glitter in his eye, muttered:

"'Fan motor' is it?—'Fan'—I'll fan 'em."

SHIELD BRAND

AND THE SUN.

Some folks "stand in" with the powers that be. We notice a recent announcement that says "the sun don't set on our wire." We always wondered how they did that—where they got their "pull." Of course it's a nice amicable arrangement with the sun. But the makers of Shield Brand Moisture Proof are out in the cold, so to speak—they're not one of the 400, and Shield Brand has to be built to bear all the mutations of wind and weather. We havn't any injunction "agin" the sun—he's liable to "set" on the wire any minute—but it won't hurt it, and the insulation won't stick to his pants, but it *will* stick strictly to business all the time. That's Shield Brand.

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—MANUFACTURERS OF—

VULCANIZED INDIA RUBBER Cables, to any Specification up to 8,000 Megohms per mile.

ABSOLUTELY PURE RUBBER CABLES.

CONCENTRIC CABLES, any milage, FLEXIBLE CORDS, SILK, HEMP, COTTON DYNAMO WIRES and CABLES, very pliable. Every variety of INCANDESCENT CORES.

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CABLES AND CORES.

THREE and TWO - WIRE CABLES, to any specification up to 8,000 Megohms per knot.

CABLES of High Insulation and Long Life, all milage.

If you are not acquainted with the merits of Habirshaw Insulation we shall be pleased to send you samples upon application.

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GENERATORS
for Railway and other Motor Circuits.

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INCANDESCENT LIGHTING,
Alternating and Direct.

METERS. **MOTORS.** **CUT-OUT**
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$3 per Annum. EVERY SATURDAY. 10 cents per Copy.

Vol. XI. CHICAGO, JULY 16, 1892. No. 3

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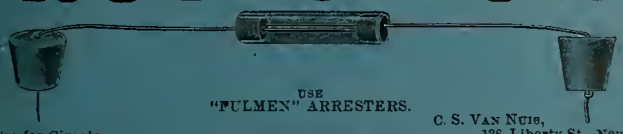

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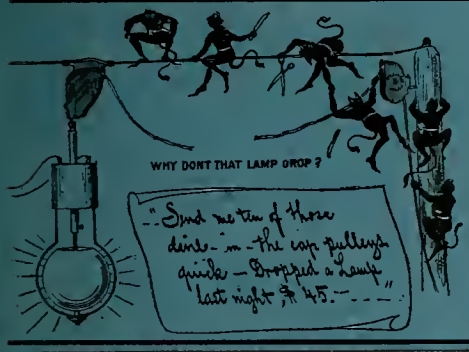

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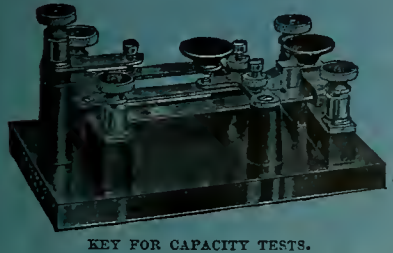

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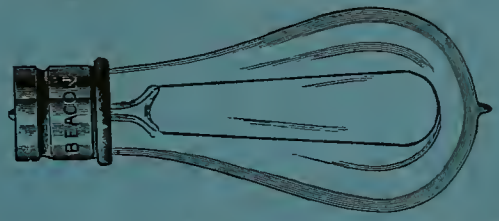

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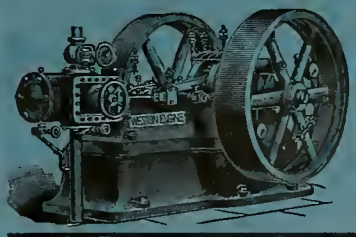

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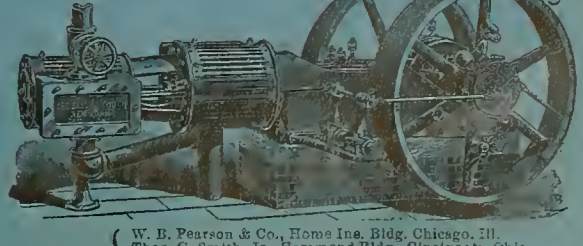

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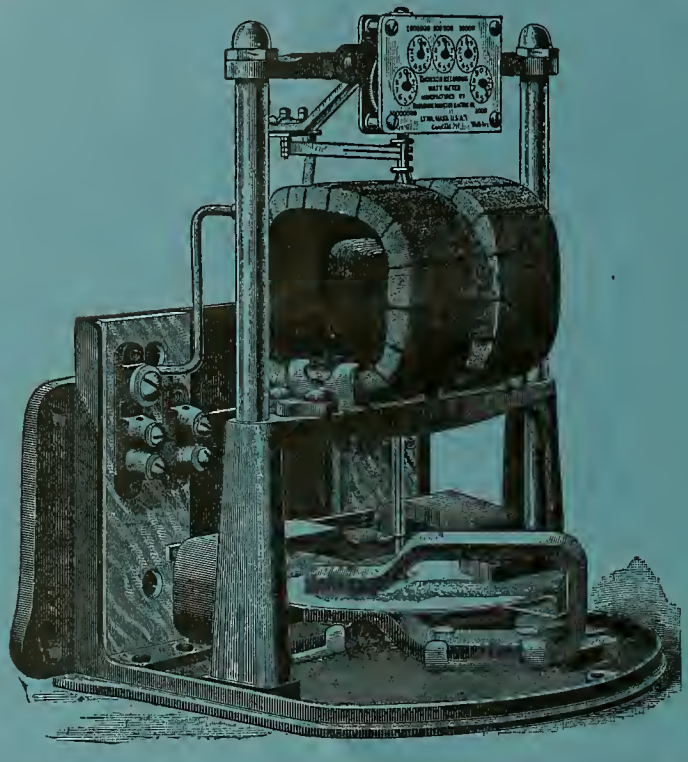
For Lighting and Power Circuits.



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Absolutely Reliable when correctly adjusted and properly installed.
Send for Descriptive Catalogue No. 7,007.

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Thomson-Houston Electric Co.

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GERMANTOWN ELECTRIC LIGHT CO.,
(Signed) Chas. M. Allen, Supt.

LANSING, MICH., April 6, 1892.

Thomson-Houston Electric Co.,
BOSTON, MASS.

GENTLEMEN:—Answering yours of the 31st regarding the THOMSON-HOUSTON RECORDING WATT METERS, would say that we are well pleased with them so far, and consider them better than anything else we have tried.

Yours truly,
LANSING ELECTRIC LIGHT & POWER CO.,
(Signed) E. F. Cooley, Supt.

Thomson-Houston Electric Co.,

PRINCIPAL OFFICE,
620 Atlantic Ave., Boston, Mass.

WESTERN OFFICE,
148 Michigan Ave., Chicago, Ill.

INDEX AND CLASSIFICATION OF ADVERTISEMENTS.

ALPHABETICAL LIST.

American Battery Co..... ix
American Desk & Seating Co.. xvi
American Engine Co..... xii
Andrae, Julius.....—
Andrews & Co., A. H..... ...—
Babcock & Wilcox Co., The.... i
Ball Electric Light Co..... xvi
Baggot, E xiv
Ball Engine Co.....xix
Ball & Wood Co., The i
Beacon Vacuum Pump & Elec. Co.i
Becker Mfg. Co., John..... xiii
Beggs, J. E., Mch. & Supply Co. x
Bernstein Electric Co..... .....—
Boston Braid Mfg. Co..... xiv
Bowers Bros..... xvi
Bristols' Mfg. Co..... ..—
Brookfield, Wm..... xii
Brush Electric Co viii
Bryan, W. H.. xiii
Bryant Electric Co..... xii
Buckeye Electric Co., The..... ix
Butler Hard Rubber Co..... —
Central Electric Co..... v
Chicago Electric Motor Co..... xiii
Chicago Rawhide Mfg. Co..... —
Consol. Elec. Mfg. Co., The..—
Crescent Ins. Wire & Cable Co. xiii
Crocker-Wheeler Electric Co.. xiii
Cushing, F. W..... vii
Cutter, Geo..... i
Cutter Electrical & Mfg. Co...—
Dayton Globe Iron Works Co.. xix
Densmore Typewriter Co..... xii
Detroit Electrical Works..... xxiv
Diamond Electric Mfg. Co.... xii
Dixon Crucible Co., Jos..... xiii
Dudley & Co., W. W..... xii
Duplex Electric Co., Ltd.....—
Eastern Electric Cable Co..... xiii
Easton Electric Co..... xv
Edison General Electric Co.....viii
Electric Cons. & Supply Co... xvi
Electric Engr'g & Supply Co.. ix
Electric Secret Service Co.....xvii
Electrician Pub. Co. .....—
Electrical Construction Co.,The. xii
Elec. Eng.& Sup. Co., The....—
"Electrical Progress".....—
Electrical Supply Co., The... xxii
Elektron Mfg. Co..... xix
Emerson Electric Mfg. Co..... ix
Empire China Works..... xvi
Enterprise Electric Co..... xv
Falls Rivet & Machine Co..... ix
Ferracute Machine Co..... xiv
For Sale..... x, xii, xiii
Fort Wayne Electric Co..... xxiv
Gravity Purifier Co.....—
Great Western Elec. Supply Co. vi
Greeley & Co., The E. S.....i
Gregory, Chas. E..... xii
Hart & Hegeman Mfg. Co..... x
Heisler Electric Co..... —
Hill Clutch Works..... xvii
Hine Eliminator Co.....—
Holmes, Booth & Haydens.... xiv
Illinois Electric Lamp Co..... xv
India Rubber & G. P. Ins. Co. xxiii
Institute of Technology..... xiii
Interior Conduit & Insulation Co. x
International Okonite Co..... i
Jewell Belting Co..... i
Johns Mfg. Co., H. W..... xvii
Kartavert Mfg. Co..... xvi
Keller & Degenhardt..... i
Kelly Brothers .....—
Knapp Electrical Works xxi
Lake, J. H. & D., Co.....—
Lake Erie Engineering Works.xviii
Lane & Bodley Co.....—
La Roche Electric Works.....—
Law Telephone Co..... xiii
Leclanche Battery Co., The. ..xiv
Lefmann, Julius..... xv
Leffel & Co., Jas..... xv
Leonard & Co., H. W..... .. xvi
Link Belt Machinery Co..... xv
Loud, H.M. & Sons Lumber Co. xiv
Lovell Mfg. Co., Ltd..... xiii
Mather Electric Co..... x
Morse & Co., A. M..... xii
Munsell & Co., Eugene.....xiii
National Carbon Co..... xiv
National Electric Mfg. Co.... —
New York Insulated Wire Co. x
New York & Ohio Co..... i
Ostrander & Co., W. R..... xix
Page Belting Co..... —
Partrick & Carter Co..... —
Pearson & Co., W. B.....xviii
Pelton Water Wheel Co..... xiv
Perkins Elec. Switch Mfg. Co. ix
Phoenix Glass Co..... xix
Pierce, Jr., Josiah. xv
Pioneer Armature Co.....xiii
Porter-Leavitt Elec. Motor Co. xiii
Powell Co., The Wm.....—
Premier Electric Co., The..... xvi
Queen & Co..... xiii
Racine Hardware Mfg. Co.....—
Rae, Frank B..... xiii
Railway Equipment Co..... x
Ries Electric Specialty Co..... x
Rockford Electric Mfg. Co.... xi
Roebling's Sons Co., J. A xvi
Rose Elec. Light Supply Co.. xiii
Rose Polytechnic Institute.... xiii
Royal Electric Co.....—
Samson Cordage Works. xii
Sawyer-Man Electric Co..... v
Schindel & Schindel.....—
Schuyler Electric Co..... xvii
Sechrist, Albert..... xii
Short Electric Railway Co iv
Shultz Belting Co.....xvii
Siebert, G..... xiii
Sioux City Engine Works.... xix
Smith, A. T..... .....—
Smith, Thos. G. Jr..... —
Somoff, J. L..... —
Sperry Elec. Mining Mach. Co. xvi
Standard Electric Co..... iv
Standard Paint Co x
Stanley Electric Mfg. Co..... vi
Star Electrix Co... xv
Stearns Mfg. Co..... xix
Sterling, W. C..... xv
Stilwell & Bierce Mfg. Co. xiv, xv
Sunbeam Incand. Lamp Co...xxiii
Taylor Engine Co.....—
Thomson-Houston Elec. Co.. ii, xx
Union Hardwares Co..... xii
U. S. Electric Lighting Co..—
Utica Elec. Mfg. & Supply Co. x
Van Nuis C. S..... i
Vulcanized Fibre Co..... xv
Waddell-Entz Company..... xii
Wannopee Pottery Co..... xvii
Wanted..... xiii
Western Electric Co.....xiv
Westinghouse, Church, Kerr & Co.....xviii
Westinghouse Elec. and Mfg Co. xi
Weston Engine Co..... i
Williams Engine Works..... . xii
Woodhouse & Rawson, Ltd....—
Worthington, Henry R..... xii

CLASSIFIED LIST.

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Heisler Electric Co.
La Roche Electric Works.
Lovell Mfg. Co., Ltd.
Mather Electric Co.
National Electric Manufacturing Co.
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Royal Electric Co.
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Standard Electric Co.
Waddell-Entz Company.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

Electric Lava Gas Tips.
Smith, A. T.

Electric Railways.
Detroit Electrical Works.
Edison General Electric Co.
Rae, Frank B.
Short Electric Railway Co.
Thomson-Houston Electric Co.
Westinghouse Electric & Mfg. Co.

Electrical and Mechanical Engineers.
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Leonard & Co., H. W.
Pierce, Josiah Jr.
Rae, Frank B.

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Electrical Supply Co., The.
Greeley & Co., The E. S.
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Keller & Degenhardt.
Leonard & Co., H. W.
Rae, Frank B.

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Cutter, Geo.
Cutter Electrical & Mfg. Co.
Electric Engineering & Supply Co.
Ries Electric Specialty Co., The.
Utica Elec. Mfg. & Supply Co.

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Thomson-Houston Electric Co.

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Lake Erie Engineering Works.
Lane & Bodley Co., The.
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Pearson & Co., W. B.
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Electric Engineering & Supply Co.
Electrical Eng. & Supply Co.
Electrical Supply Co., The.
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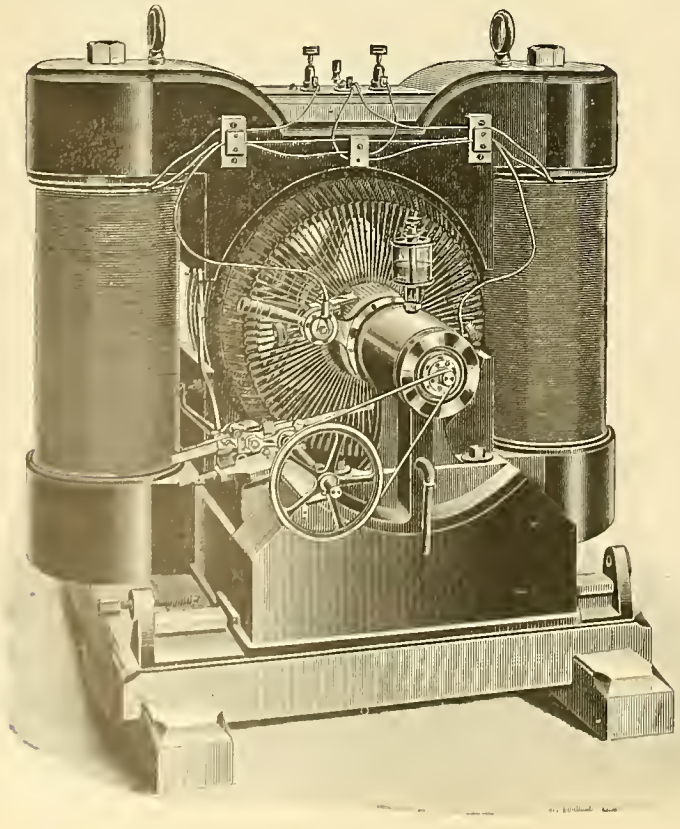

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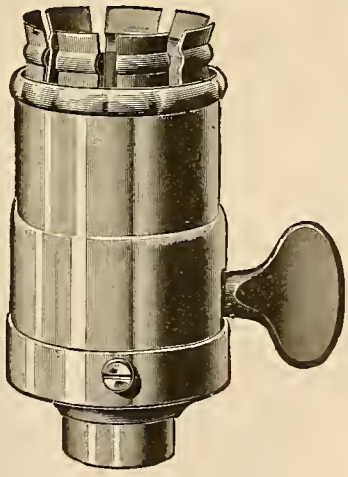

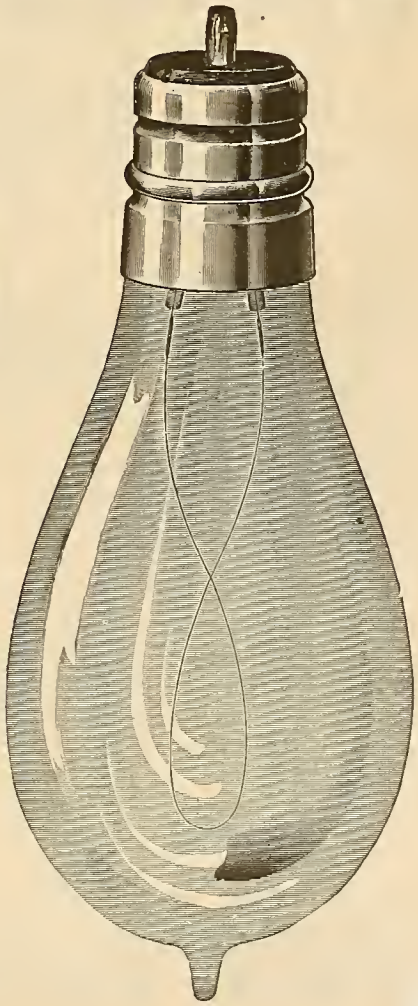

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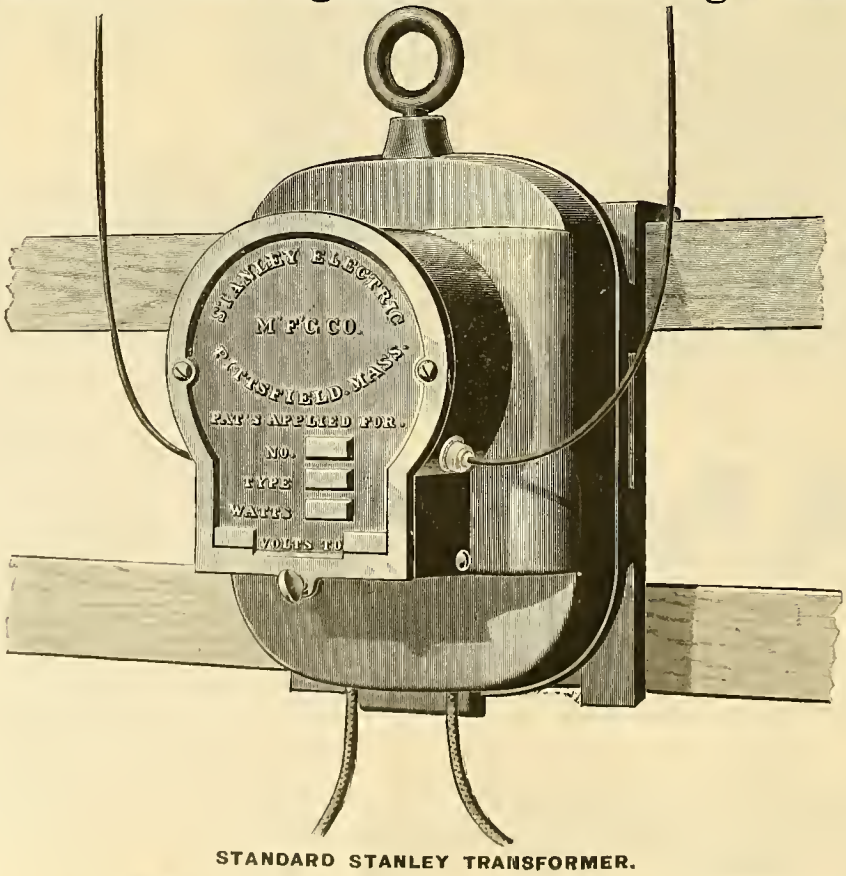

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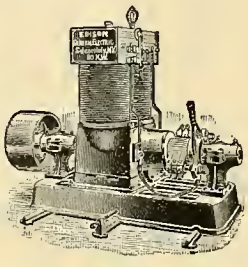

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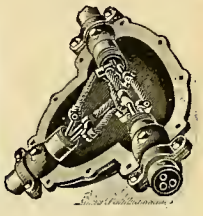

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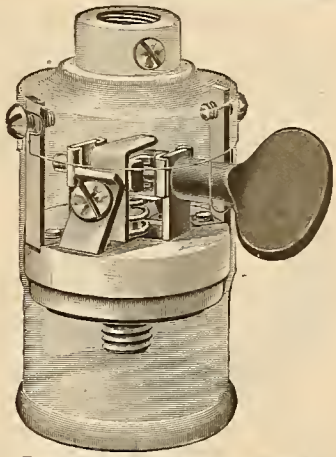
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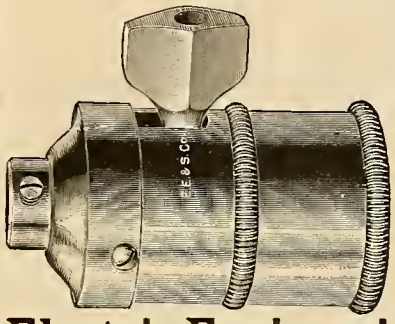

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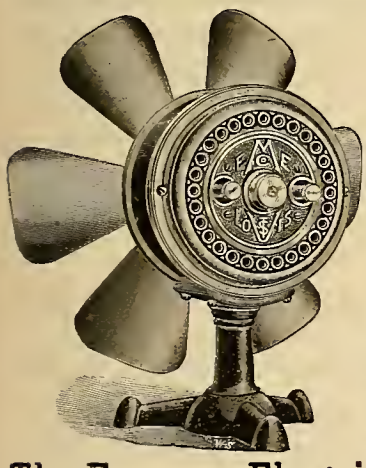

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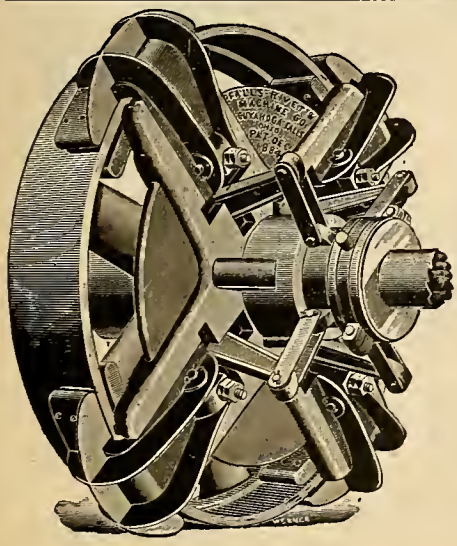

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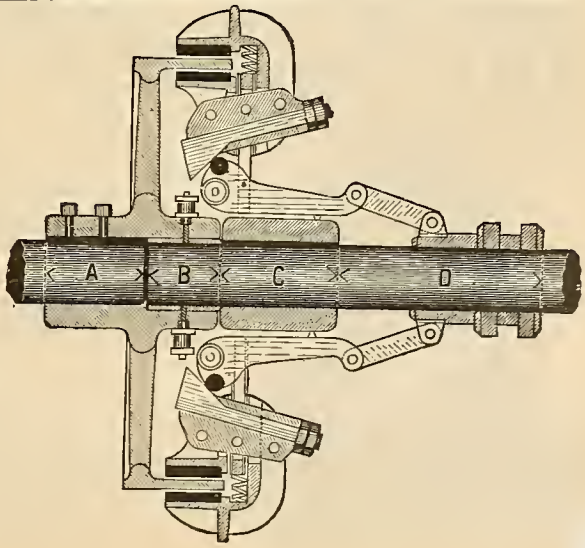

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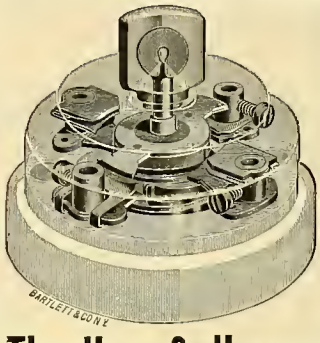

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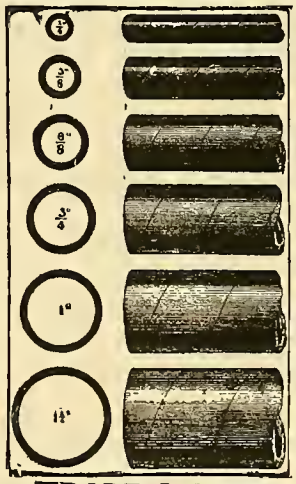

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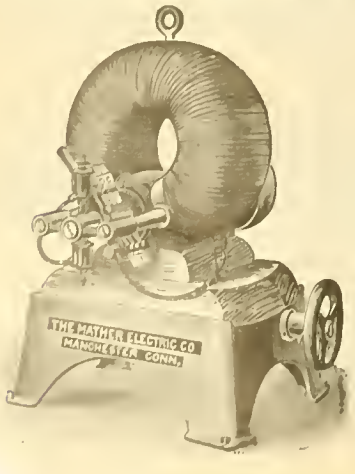

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NOTICE!!!

The Westinghouse Electric & Manufacturing Company will, at its own cost and expense, defend any and all suit or suits that may be instituted by any party against purchasers for the alleged infringement of patents, when such alleged infringement shall consist in the use of apparatus manufactured and sold by it.

We call the attention of users of electric railway and lighting apparatus to the attempts being made by the Edison-Thomson-Houston electric combination, or Trust, to secure, by threat and otherwise, a monopoly of the electric lighting and power business, which they are not entitled to, and cannot secure by means of their patents. If they could succeed in frightening users into entering into contracts binding them to take only the apparatus supplied by the Trust, then such users would be subject to a contract which they might have some difficulty in setting aside.

A proposed contract submitted by the Trust to one of our customers indicates that they intended to bind such customer to use exclusively apparatus manufactured by the Trust, and on such terms and for such prices as the Trust might name from time to time; and it is a fair presumption that the Trust would exact a margin of profit greatly above what is generally considered a fair manufacturing profit, in order to pay dividends on their immense capitalization (fifty million dollars capital stock, ten millions of which is preferred) and the interest on the proposed issue of ten millions of bonds.

The users of electric lighting and power apparatus, however, by refusing to purchase, except upon the terms and conditions on which they ordinarily purchase machinery, i. e., with the right to go into the open market unhampered to purchase their future supplies, or repairs, or alterations (as they should do), will always be free to select the best apparatus and details.

The Westinghouse Electric & Manufacturing Company sells all of its apparatus and makes all of its contracts on the above basis, and has never done otherwise, relying for future sales upon the merit of its apparatus.

We suggest the following as worthy of your careful consideration:

1. Enter into no contract with any electric light or power company except with respect to each purchase, and see that there are no hidden limitations or unreasonable provisions.

2. See that every contract contains a clause substantially as follows, for your protection as to patent matters, which clause is inserted in all of our contracts:

"The company shall at its own cost and expense defend any and all suit or suits that may be instituted by any party against the purchaser for the alleged infringement of a patent or patents, when such alleged infringement shall consist in the use of any apparatus, machinery or device, or parts thereof, manufactured or sold by the company, for which the purchaser shall have made all payments then due, provided that immediate notice of the institution of such suit or suits be given in writing by the purchaser to the company, and that the purchaser shall permit the company, through its counsel, to defend the same, and shall give all needed information, assistance and authority to enable the company to do so, and thereupon, in case of an award of damages in such suit or suits, the company shall pay such award, but the company shall not be bound to defend any such suit or suits, nor to pay any damages therein when the same shall arise by reason of the use of parts not furnished by the company."

3. Bear in mind that the agents of the Trust and its stockholders are numerous, and that specious arguments may be advanced, and threats used, to induce you to bind yourself to purchase apparatus only of the Trust.

4. If users of electric apparatus will act judiciously, then no Trust or Combination can expect to receive a higher price for apparatus than is warranted by fair competition.

When the Westinghouse Electric and Manufacturing Company entered upon the manufacture of railway apparatus, the price charged by the present members of the Trust was about $3,500.00 per car equipment. One-half of the above figure is the asking price to-day, and this reduction has been brought about by competition.

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The members of the Electric Trust (Thomson-Houston, Edison General, Fort Wayne and Brush Companies) made bids for the incandescent lighting of the World's Fair, in each instance amounting to about $1,800,000.00, and they have since offered to do the same work for $550,000.00, the result of our competition.

We invite the co-operation and support of all users of electrical apparatus, who desire to have the benefits of competition.

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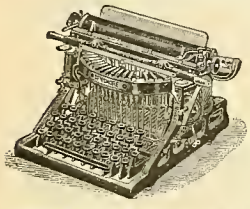

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A board of experts appointed by the government to examine and receive bids on the best machine, unanimously reported that the **Densmore** contained more points of excellence than any other, and that it was the best machine of all.

We will appoint a reliable dealer in unoccupied territory as soon as possible, and in the meantime will ship machines on approval to parties having a good commercial rating.

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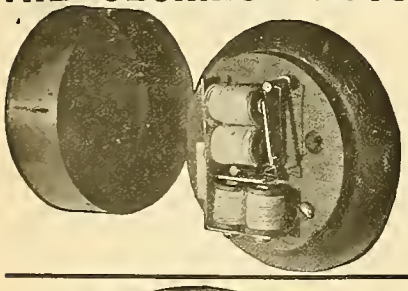

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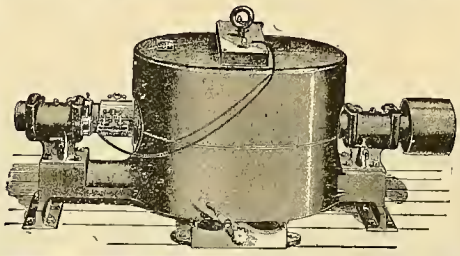

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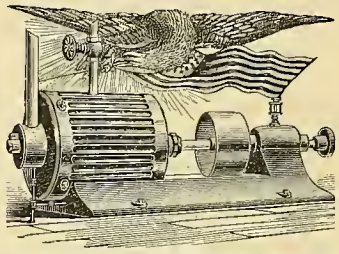

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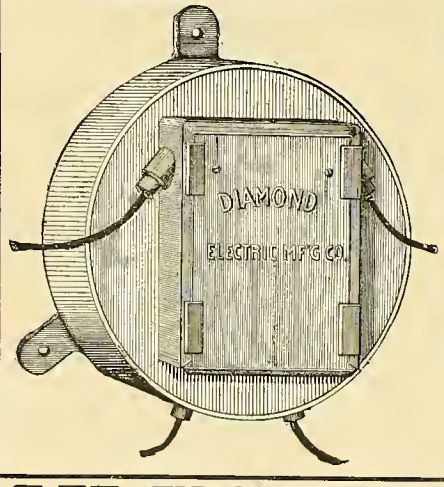

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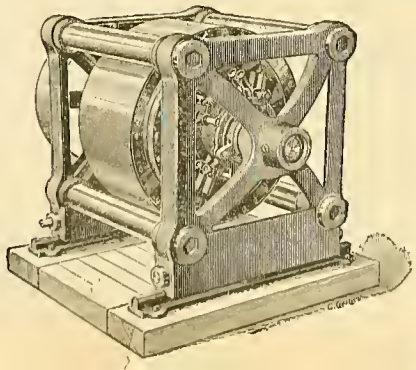

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EVERY SATURDAY.

Vol. XI. CHICAGO, JULY 16, 1892. No. 3

Cyrus W. Field.

During the last few months the attention of the public has been directed to Cyrus W. Field, whose death occured July 12, at his country home at Ardsley Park near New York City. When it became known that his condition was critical expressions of genuine sorrow were heard on all sides, and it was generally agreed that one of the greatest characters of American history was about to pass away. Cyrus W. Field's life had been passed almost entirely in promoting great public enterprises, and his name and fame as the father of the ocean telegraph are known the world over.

Cyrus West Field was born on November 30, 1819, at Stockbridge, Mass., and belonged to a remarkable family, which boasted of revolutionary heroes. His father, David Dudley Field, Sr., was a Congregational minister in Somers, Conn., where he married Submit Dickinson, whose father had fought side by side with her husband's father through the revolutionary war Cyrus was the seventh child, his brother, Henry Martyn, a preacher of considerable ability, and his sister, Mary, being younger. David Dudley Field, who, aside from Cyrus, is the most celebrated member of this remarkable family, was the first child. Stephen J., associate justice of the United States Supreme Court, and the late Jonathan, who was president of the Massachusetts Senate, were older than Cyrus. There were two other brothers, long since dead—Matthew, a noted engineer, and Timothy, who was an officer in the United States Navy. None of these, however, it may be safely said, attained the world wide reputation of the subject of this sketch. His early training admirably fitted him for the great work which he afterward undertook and the successful completion of which entitled him to a prominent position among the leading men, not only of his own age, but of the world.

At Stockbridge he secured a common school training and at the age of fifteen years started out for himself. Like most boys of his time he turned toward New York. He entered the establishment of A T. Stewart at a salary of $2 per week. This was not very encouraging but the training he received at this time proved of great value to him in after life. When he first engaged in business for himself he was not successful, in fact several of his early ventures failed, but he was persistent, and his ability, earnestness and perseverance were rewarded at last.

Mr. Field had acquired considerable wealth in 1853, when he determined to retire from mercantile pursuits. After traveling for several months through South America he returned to New York, where an effort was made to enlist his influence in support of a telegraph line to Newfoundland. It was the intention of the promoters of this project to carry the line to St. Johns, where connection could be made with a fast line of steamers that, it was believed, could reach Ireland in five days. This enterprise was not accorded much encouragement as it was looked upon as a wild-cat venture. It was broached to Mr. Field and he in turn conceived the idea of the Atlantic cable. This last proposition was so much in advance of anything yet presented that it was regarded as conclusive evidence of insanity and Mr. Field was ridiculed by the so-called "conservative" element. Even after the subject had received the careful attention of scientists and engineers of this country and Europe there was division of opinion as to the practicability of the scheme, but many famous scientists and not a few capitalists encouraged the idea and assured its promoter of their support. While the project for an Atlantic cable was making but little progress there was a strong movement on foot to establish an overland telegraph by way of Alaska and Northern Russia, and this, strange though it may seem to-day, was considered far the more practicable route. No doubt this had much to do with the lack of interest in the submarine project. At any rate Mr. Field found it a herculean task to secure support of capitalists, but when once he enlisted their sympathy they never wavered in their support.

It was decided to form a stock company for the purpose of laying a cable. Peter Cooper was the first subscriber. Moses Taylor, Marshall O. Roberts and Chandler White, were also co-laborers in this undertaking. Concessions were obtained from the Newfoundland Legislature, and on May 6, 1854, the New York, Newfoundland & London Telegraph company was formed. Messrs. Cooper, Taylor, Field, Roberts, and White were named directors. Mr. Cooper was chosen president, Mr. White vice president, and Mr. Taylor secretary. A capital of one million five hundred thousand dollars was subscribed on the spot, of which Mr. Field contributed two hundred thousand dollars in cash. At this time the work was taken up and pushed with vigor. The line from New York to St. Johns was completed in a year, but this work

Cyrus W. Field.

cost more than a million dollars and the projectors of the enterprise were obliged to seek assistance. The United States and Great Britain aided materially. Both governments were induced to organize expeditions, and the surveys established the validity of the theory beyond question. The directors persuaded Mr. Field to go to Europe and ask financial aid. In the summer of 1856 Mr. Field induced the English government to furnish ships for soundings and for laying a cable, and to pay the company an annual subsidy of at least fourteen thousand pounds for government messages. Mr. Field next organized a company with a capital of £350,000, of which he subscribed one-fourth. It was known as the Atlantic Telegraph company. Mr. Field met much more opposition at Washington than at London, and it was only after a determined contest that he received government aid. The first attempt to lay the cable, which was made in 1857, proved a failure and greatly discouraged many who had been interested in the project. This could not be said of the man most interested. He never despaired, in fact, each failure or disappointment served to spur him on to even greater efforts. He was apparently a man of wonderful resources and great energy, and it was well that he possessed these qualities, for one with less courage or with a less hopeful disposition, must necessarily have abandoned the enterprise. While these unsuccessful attempts were being made to lay the cable Mr. Field's faith in the ultimate success of the project never faltered; he was confident while all around him were disappointed and disgusted.

When his persistence had begun to tire his friends, success came, and Mr. Field's scheme, which had been termed the freak of a disordered brain, became a reality. The successful expedition started from Valentia, Ireland, July 13, 1866. The Great Eastern, which carried the cable, arrived at the harbor of Heart's Content on July 27th, but as the Newfoundland cable was not completed there was a delay of two days. On the morning of Sunday, July 29th, the people of New York city received through the *New York Herald* the announcement that "the cable is laid and in perfect working order," which had been telegraphed by Mr. Field on his arrival at Heart's Content. The news was received with rejoicing, but even at that time the people did not fully realize the importance of this great work.

With success came honors and acknowledgments from the government and scientific bodies. Congress bestowed a gold medal upon Mr. Field and voted him the thanks of the nation. The grand medal of the Paris Exposition was also awarded him in 1867.

In reviewing Mr. Field's work, James D. Reid, in his admirable history of "The Telegraph in America," says that the credit is universally ascribed to Mr. Field. "It is one of the honors alike unquestionable and unquestioned," according to this authority. "Neither is it overstating the importance of the successful laying of the Atlantic cable if it be claimed that no gift of science or manly courage has to such a degree dignified and unified the civilization of the world, or given like life, scope and value to its commerce."

Mr. Field's public work did not end with the laying of the great cable. In 1877 he became interested in the old New York Elevated Railway company controlling valuable franchises but up to that time accomplishing absolutely nothing in the way of furnishing rapid transit. For ten years he controlled this great enterprise and in that time the value of the stock advanced from $14 per share to $172. When in 1887 Mr. Field retired from this enterprise he withdrew to private life and did not figure again in public affairs. He was beloved and respected by all, and in his declining years had many devoted friends.

Trouble with Electric Letter Stampers.

Now that electrical stamping machines have been set at work in the Chicago postoffice as well as in other postoffices throughout the country, the letter writers in the World's Fair city would do well to remember that trinkets, keys and similar matter if inclosed in the envelopes are liable to harm not only the canceling machines but the letter as well. The new stampers, which have just been introduced in the Chicago postoffice, and which were illustrated in a recent issue of the WESTERN ELECTRICIAN, have demonstrated that the letter writing public sends some curious things through the mails. Several days ago one of the letters which went through one of the machines disabled it, throwing the stamping apparatus completely out of gear. When the letter came out it was found to contain a door key. Another machine has since been disabled by another key. The chances are that any light breakable trinket, after going through a stamping machine, will not be

in as good condition as before. It will either break the machine or the machine will demolish it. Hence the post-office officials urge that such merchandise be inclosed in boxes, which are not put through the machine.

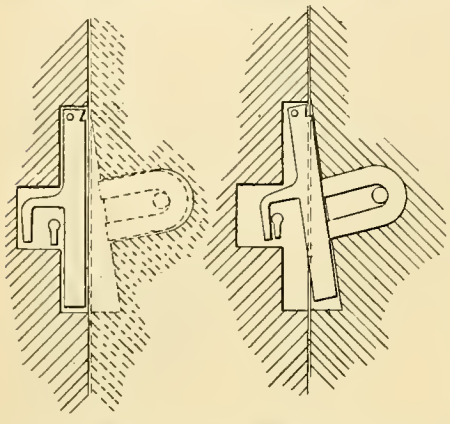
Magnetic Lock.

The accompanying cuts illustrate a magnetic lock which will automatically lock itself when a door or lid upon which it may have been placed, is closed.

The essential working parts of the lock are a permanent horseshoe magnet and an armature, the armature constituting the bolt of the lock.

In Figs. 1 and 2 the lock is shown unlatched and latched, while Fig. 3 represents the lock on a door with the bolt in that position it would assume just before the door was closed.

The manner in which the lock operates is as follows: When the door is closed the catch will be drawn by the



FIGS. 1 AND 2. MAGNETIC LOCK.

magnet into the recess, as shown in Fig. 2, the result being, of course, to lock the door. The catch is formed with a projecting arm or finger which is bent at right angles near its end and so constructed and arranged that it can be pushed back with the aid of a key, so as to withdraw the catch from engagement with the recess overcoming the resistance of the magnet, and thus releasing the door.

In order to prevent a knife from being slid down between the catch and the magnet so as to push back the catch without using the key, the bolt is formed as indicated with a notch on its forward edge, so that when it is in its locked position the notch will extend across the space between the door and its jamb, as illustrated in Fig 2, thus forming an effectual stop to the downward passage of a knife.

This lock was devised by H. V. Smith, of South Yarra, near Melbourne, Victoria.

Telegraph Service at the National Conventions.

Every four years the resources of the telegraph companies are taxed to the utmost to supply the newspaper and commercial demand for telegraph service at the Republican and Democratic national conventions. The whole nation wants to get the earliest possible news from these important gatherings, and extraordinary demands are made on the telegraph companies in consequence. Especially was this the case at the recent Republican convention at Minneapolis, on account of the comparatively remote position of the city and the inferiority of its telegraph facilities to those of the larger cities in which the conventions are usually held. The amount of special matter sent out from Minneapolis was also larger than that from the Chicago convention, owing to the fact that the papers in the latter city figured very largely in the totals from the Minneapolis convention, while of course they had no need for the telegraph in the case of the convention held in their own city. But in spite of the unfavorable conditions, the companies, by making extensive preparations and anticipating all emergencies, were able to meet handsomely all demands made upon them, and the newspaper men had only words of praise for the service, although, prior to the Minneapolis convention, there were many misgivings on the part of the six or seven hundred correspondents who attended.

The Western Union company reports that it handled 3,500,000 words of special dispatches to newspapers alone during the Minneapolis convention, while the Postal Telegraph company puts the corresponding volume of its business at 1,478,000 words. This makes a total of nearly 5,000,000 words in specials, which is equivalent to about 3,300 columns of type matter, such as is employed in the average daily newspaper. If this multiple report were published in an eight page newspaper that appeared every day in the year and contained nothing else, it would take considerably over thirteen months to print it. The largest day's business recorded by the Western Union was on June 9th, when 470,750 words were sent. The Chicago convention is responsible for 2,655,793 words of specials sent over the Western Union, and 1,636,448 over the Postal lines. The largest single day's business with the Western Union was on June 22d, when 368,721 words were sent. The Postal, however, exceeded this record, having 391,236 words to its credit on June 21st.

The figures given above are exclusive of commercial business and the regular report of the United and Associated Press associations. Nearly all of the convention dispatches sent out from Minneapolis over the Western Union wires were relayed at Chicago. From June 4th to 11th, the period of the Minneapolis convention, the Chicago office of this company handled 24,115,140 words—a statement that will give an idea of the total volume of business. During the Republican convention of 1888 at Chicago the local Western Union office sent out 14,525,239 words, and by comparison the great increase of this year is seen. The telegraphic business of the Minneapolis convention was the largest ever known. The Western Union company sent out about 9,000,000 words all told. During the Chicago convention of this year the Western Union business from the office in this city amounted to 21,537,120 words. At the Minneapolis convention the Western Union company handled 400 bulletins from the hall, averaging twenty words each. These were distributed from the Minneapolis main office on twenty circuits and on twenty additional circuits from the St. Paul office, making a total bulletin service of 336,000 words. The Postal people also made a feature of their bulletins, both from Minneapolis and Chicago. The promptness and efficiency of the latter company's service was largely due to the efforts of J. H. Dickinson of the New York *World*, who is at once an experienced newspaper man and an expert telegrapher. Mr. Dickinson telegraphed the bulletins directly, watching the course of events keenly, and sending out the brief dispatches without the interposition of writing. At Chicago he had a seat on the platform, near the chairman, and from this point he manipulated his sending key. The sounder of the instrument, however, was located in the operators' room below, on account of the noise, and Mr. Dickinson was connected

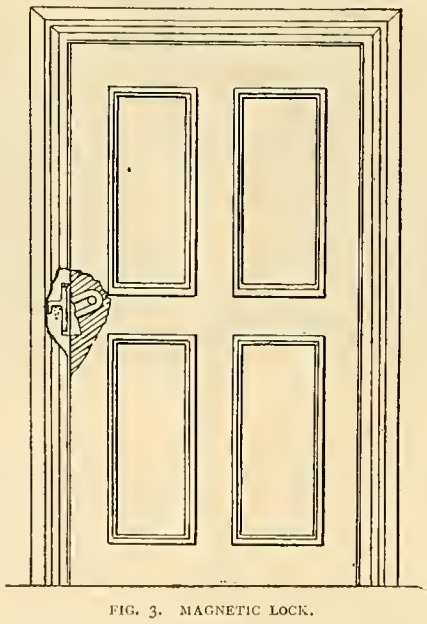
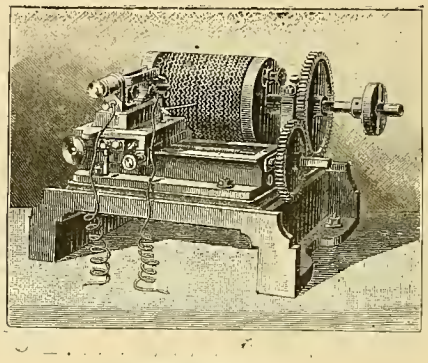


FIG. 3. MAGNETIC LOCK.

with it by a speaking tube, in order that he might be assured from the sound that it was working properly.

Elaborate preparations for the Minneapolis convention were made by both companies. The Western Union put in two new copper wires between Minneapolis and Chicago in addition to an iron wire that had been strung but a short time before. The use of several railroad wires was also secured for night service. The lines were constantly patroled by men selected for the purpose, and arrangements were made with the railroads for special engines in case of storm or emergency. The result exceeded the anticipation of the most sanguine of the company's officers, despite the rainy weather, and all the business that was presented was easily handled. One night a storm on the Milwaukee & St. Paul route brought twelve or fifteen wires down at 8 P. M. about one hundred miles south of Minneapolis, but, thanks to the excellent precautionary system, they were all working at 10 o'clock. The trouble was promptly located, and linemen were quickly dispatched from La Crosse, Wis., on locomotives. On another occasion the wires went down on the Wisconsin Central route at a point 180 miles south of Minneapolis and thirteen miles from Abbotsford, Wis. The trouble arose at 4:30 P. M., and the wires were working in a little over two hours. It was by such exact supervision and prompt work as this that the service was kept up to the mark attained.

All the Western Union wires at Minneapolis were worked on the quadruplex system, and about sixty operators were employed in addition to the regular Minneapolis force. Forty-seven of these men came from Chicago. The operators worked like Trojans, and averaged eighteen hours a day. In consequence of their fear that the facilities would prove insufficient, the newspaper men filed their copy early, and there was a constant stream of



SPEED INDICATOR.

manuscript at the receiving offices. The afternoon paper men began to get their matter in as early as seven o'clock in the morning, and about four in the afternoon the correspondents of the morning papers began to make themselves felt. The telegraph officials did everything in their power to reassure and accommodate the newspaper men. The New York Life Insurance company's building was given over to the correspondents, and here a temporary telegraph office was installed. Conspicuously posted in it was this encouraging sign: "Dump it in by the car-load; we can handle it." And the company made good its promise. Col. R. C. Clowry of Chicago, general superintendent for the Western Union, was personally in charge at Minneapolis, and the details of the plan were laid out by C. H. Summers, the electrician of the Chicago office. The local arrangements were in charge of Isaac McMichael, the manager at Minneapolis.

The Postal company ascribes the excellence of its service to the employment of through copper circuits and the use of the Phillips code of abbreviations, expert operators taking the report down in long-hand on typewriters.

Speed Indicator.

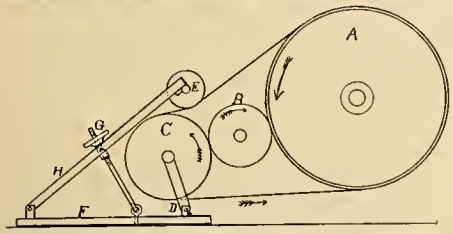
The device shown in the illustration was designed to give a more complete record of the speed of a shaft than can be gained by the use of an ordinary form of speed indicator. It is used to indicate not only the speed within a given time, but the variations of speed during that time.

Generally, the apparatus consists of a cylinder which is attached to the shaft whose speed it is proposed to measure. In front of it is a tuning fork mounted on a carriage, which is moved by a pinion engaging a gear on the cylinder shaft. Attached to the end of one tine of the tuning fork is a stylus designed to trace a record on the paper covering of the cylinder. When caused to vibrate the tuning fork beats intervals of time, which do not vary except within the narrowest limits. In the present case the tuning fork makes 512 vibrations per second, and the movement is maintained by the employment of an electro-magnet.

The stylus having been adjusted so that it bears properly on the cylinder, the latter is connected to the shaft and the revolution begins. The stylus begins to register its vibrations by a wavy line, as shown in the illustration. It will then be easy to compute the time of a revolution. It is possible to notice a variation even to the extent of a five-thousandth of a second, for it is practicable to distinguish as minute a part of the record as a tenth of a vibration. A number of experiments have been made to determine the limit of possible variation in several machines. In the case of a steam engine the variation was found to be 5 per cent., and 6.25 per cent. in the case of a gas motor. The cut is reproduced from *La Nature*.

Another Close Connected Power Transmitter.

There is a rapidly increasing demand for reliable close connected power transmitters for driving dynamos. This is the case especially in Chicago, where in the down-town building space for an electric lighting plant is so valuable. The accompanying cut represents diagrammatically an arrangement devised by Foree Bain through which, it is



ANOTHER CLOSE CONNECTED POWER TRANSMITTER.

claimed, a dynamo may be driven satisfactorily, and yet be placed very close to the engine.

Referring to the cut, *A* represents the driving pulley of a steam engine; *B* is a paper friction pulley keyed to the dynamo shaft, the dynamo being mounted on the usual sliding base; *C* is a pulley hung from a hinged frame *D*. The belt passes as indicated around pulleys *C* and *A*. *E* is an idle tightener pulley mounted on another hinged frame *H* which may be tightened into position by the hand-wheel *G*; *F* is the base of the device which is held to the floor or foundation by lag screws or bolts.

When it is desired to start the dynamo, all that is necessary is to slightly move the dynamo forward on the slide until the paper pulley is firmly in contact with the engine pulley, then the screw wheel *G*, which takes the slack out of the belt, is tightened and by means of the pulley *C* applies power to the dynamo pulley. By this means the dynamo is driven by friction from opposite sides and the shaft is relieved of the side strain which is present when a machine is driven by the ordinary methods. It will be noticed that there is no side pull on any of the shafts employed except the tightener, and the amount of strain on that is a very slight proportion of the driving power of the apparatus.

This power transmitting device is being introduced by the Bain Electric Manufacturing company, Chicago.

Recent Thunder Storms in France.

Thunder storms of marked severity were by no means confined to this country during the month of June. *La Nature* mentions the recent fatality at Lincoln Park in Chicago, in which three persons were killed by lightning, and publishes a formidable list of casualties due to the same cause which occurred in France about the middle of the month. Several persons were killed, a number seriously shocked, and considerable property was destroyed. It also refers at some length to the storm at Bourges on May 4th, during which one soldier was killed. The account states that a squad of eighteen soldiers was overtaken by the rain, and while running toward shelter all, with one exception, thrown to the ground by the lightning. All but four were able to arise, and of this number three were

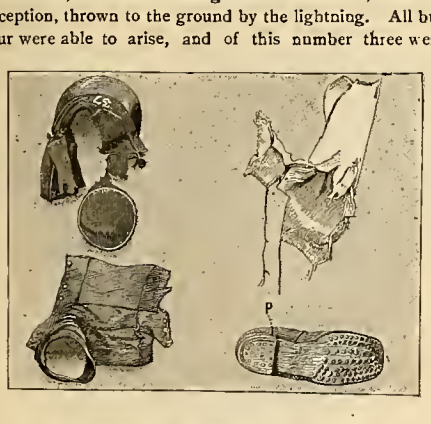


FIG 3. RECENT THUNDER STORMS IN FRANCE.

finally restored to consciousness at the hospital; the fourth man died.

Fig. 1 is supposed to represent the scene when the lightning struck the men to the ground. The illustration was made from a photograph taken at the place where the catastrophe occurred. The artist gives his conception of the accident in Fig. 2. He built up his picture by endeavoring to embody the descriptions of those present. Only one of the company saw the lightning, which seemed, he asserted, to be a triple flash.

According to the statements of the physicians who examined the body of Bouveau, who was killed, the current first entered his head and badly burned his hair and beard. His clothing was torn, as appears from Fig. 2, which shows the condition in which the cap, gaiter, shoe and underwear was found. It was assumed that the current passed to ground through the shoe, which was punctured at the point *P*.

Electricity at the World's Fair.

While the official report of the tests of the launches at Jackson Park has not yet been presented to the committee of directors on grounds and buildings, the trials have all been concluded. The electrical tests of the cells employed on the electric boats were made the latter part of last week by Messrs. Pierce and Field, and the current strength, capacity and voltage of the batteries when charged were carefully measured. The final report is expected soon.

Eight electric elevators will carry passengers to all parts of the lofty administration building. They will be put in by the Crane Elevator company of Chicago, and will be equipped with Eickemeyer motors.

The ducts for the incandescent wires for the woman's, children's, *Puck*, White Star, horticultural and service buildings and the greenhouses are now being laid. The conductors for these buildings will be taken from feeders on the elevated railway structure, and will be laid in iron or vitreous pipe wherever they are contiguous to any inflammable substance. The interior wiring of the administration building has already been begun. Superintendent Keller has established a temporary office in the southern end of the horticultural building, on the second floor. As soon as machinery hall is completed he will open an office in that building.

The Western Union Telegraph company expects to have five or six offices open for business at the World's Fair. The principal office will be in the administration building. Copper circuits will be used, and the Exposition company's conduits will be utilized.

On June 11th the WESTERN ELECTRICIAN contained an editorial allusion to the scheme of Willis N. Stewart of Milwaukee, who is endeavoring to get the Milwaukee Industrial Exposition association to set on foot preparations for a "grand electrical exhibition" to be held at Milwaukee next year and intended to rival the electrical display at the World's Fair. At that time the futility of the plan was pointed out in this journal, and it was shown that the Milwaukee people could not hope to arrange an electrical exhibition that could in any way compare with the corresponding department of the World's Fair. It seems however, that the plan has not been entirely abandoned, although its projectors now appear to entertain a well-defined doubt as to its practicability. On June 30th A. Trumpff, secretary and manager of the Milwaukee association wrote to the Edison General Electric company, at Chicago, asking the support of that company. Manager Sunny promptly placed a copy of the letter in the hands of the World's Fair authorities. To a representative of the WESTERN ELECTRICIAN he said that his company did not propose to have anything to do with the proposed Milwaukee show and that the idea of holding an electrical exhibition next year within ninety miles of Chicago and the World's Fair was absurd.

Mr. Trumpff, in his letter, asserted that he had been informed that "the space set aside for the different electrical companies at the Columbian Fair" was inadequate for the purpose, and that the "largest concerns would not participate in consequence." He states that the association building has an area of 87,000 square feet, and then outlines the plan as follows:

In case the majority of the largest firms in the electrical business would consent to make a display with us, we would be pleased to enter in to negotiations with them to that effect. We would grant them the use of our building free, and either base the division of the receipts upon the percentage plan, or form a stock company and dispose of one-third of the stock to the different railway companies entering Milwaukee, one-third to the parties participating, and the balance to the citizens of our city. Being located so near Chicago, and with reduced railroad fares during the World's Fair, we think we could without any difficulty secure an attendance of no less than 750,000 persons to our exhibition. Unless we are assured, however, that the exhibition to be made will be a grand one, and first class in all particulars, we do not care to enter into any arrangements for the same.

In replying to the letter Chief Barrett of the department of electricity, World's Fair, said, under date of July 6th:

I do not understand how it is possible for you to assume that the arrangements for this department are inadequate and you have certainly been misinformed when you are told "that the majority and largest concerns would not participate in consequence." The newspapers have suggested from time to time the inadequacy of the space for this department and it is true that we have demands for space in excess of the amount of space available, but these facts do not necessarily imply an inadequacy, and such is certainly not the case. The building set apart for electricity at the Columbian Exposition is 700 feet long, 350 feet wide and contains a gallery 100 feet wide on all sides. There is in the building 245,000 square feet of space on the ground floor and 95,000 square feet in the gallery. By comparing figures, therefore, you will observe that in the gallery alone there is more available space than in your whole building of 87,000 square feet. In addition to this space there is in course of preparation at the present time for an electrical power plant an annex of the machinery hall 600 feet long and 150 feet wide, a total of 90,000 square feet. To occupy this space contracts have been made by the Exposition company with electrical firms at an expense of more than half a million dollars for the supply of approximately 7,000 arc lights of 2,000 candle power, 100,000 incandescent lights of 16 candle power and 3,000 electrical horse power for the operation of the machinery of exhibitors. To occupy the space available in the electrical building proper, applications are on file in this department from every manufacturer, general or special of electrical machinery of every variety in this country, and one-fourth of the building will be occupied by foreign exhibitors. I beg leave to suggest, therefore, that an entirely friendly spirit on your part to the Columbian Exposition, in which your citizens, as well as those of every community in this country are interested, would prompt you to send out a statement in line with the above information. I do not wish to interfere in any way with the spirit of enterprise which you evince, but I do not think that the arrangements which you propose could be successfully carried out without in some degree detracting from the magnificence of the Columbian Exposition.

The Western Dummy Intramural Railway company has opened a temporary working office in the horticultural building. Five bids for constructing the elevated structure were opened on Saturday, but the contract was not awarded at that time. The structure will be about three and one-half miles long, and constructed for two tracks. It will vary from eight to thirty feet in height, the average being eighteen feet. The uprights will be of Southern pine and the girders of iron, twenty-five feet long. Iron to the extent of 2,600 tons will be needed.

FIGS. 1 AND 2. RECENT THUNDER STORMS IN FRANCE.

Notes on Wiping Contact Methods for Current and Potential Measurement.[1]

By Prof. Benj. F. Thomas.

In the latter part of July, 1880, President Morton requested the writer to determine the power required to maintain the arc of a Brush arc light, supplied with current by a Brush dynamo machine.

Ammeters and voltmeters were then unknown, and among the electrical instruments in the Stevens laboratory the most convenient for the purpose seemed to be a tangent galvanometer for the current measurement, and a condenser and Thomson galvanometer for potential. The condenser was a one-third microfarad standard, and the galvanometer a 7,000 ohm, four coil astatic. As everyone knows would be the case, trouble was encountered the moment the potential readings began. The condenser being first connected to the two carbons, and then discharged through the galvanometer, the successive throws of the needle were found to vary widely, and what seemed at the

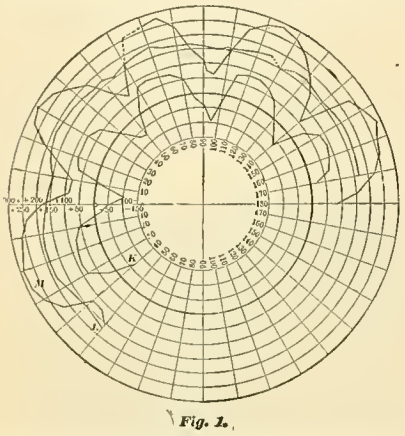


Fig. 1.

NOTES ON WIPING CONTACT METHODS FOR CURRENT AND POTENTIAL MEASUREMENT.

time most curious, the throws were sometimes to right and sometimes to left. A little reflection showed that while varying throws in one direction might be due to varying resistance of the arc, throws in opposite direction could only be produced by an actual reversal of the potentials of the two carbons. This, of course, led to the conclusion that the potential difference at the terminals of the dynamo must vary with the angular position of the armature as it revolved. Wishing to know the character and magnitude of the variation, the writer devised what is now known as the wiping contact method, the natural and only expedient for the purpose.

The condenser was joined, through the usual discharge key, to the terminals (or other points) of the dynamo by two well insulated wires. At the dynamo one of these wires was cut, and the cut ends attached to a pair of well insulated springs of flat metal, mounted on the outer end of a radial arm, the latter fastened to a horizontal rod, coaxial with the armature. A well insulated piece of metal was fastened radially on the face of a disc attached to the armature shaft, and the two brushes set so that they were lightly touched by the radial strip at each revolution of the armature. A pointer, attached to the horizontal shaft carrying the radial arm and contact springs, moved over a divided circle on the support of the arm, so that angular positions could be read. The contact device thus acted as an open circuit key, the closing of which, and the consequent charging of the condenser, could only take place when the armature was in a definite position. The process of obtaining the curve of potentials through a revolution of the armature is now so familiar that further description is unnecessary.

In carrying out the examination of the machine, a non-inductive resistance of German silver wires was prepared to avoid complications from the action of the arc lamp. When this was used as a load for the machine, the throws

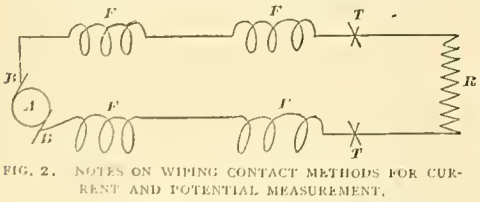


FIG. 2. NOTES ON WIPING CONTACT METHODS FOR CURRENT AND POTENTIAL MEASUREMENT.

of the galvanometer changed at once from the erratic behavior observed at first to the beautifully regular and uniform character now so familiar to all who have used the method under proper conditions.

Fig. 1 is a copy, to scale $\frac{2}{10}$, of the original curves of measurements made August 4th. The inner circle gives the angular readings of the circle over which the pointer moved. Deflections of the galvanometer, on discharging the condenser through it, are plotted radially at the angles at which they are obtained, the heavy circle being taken at zero. The scale is .2 volt per division. Curves K and L were obtained with the machine connected as in Fig. 2, in which A is the armature, B B the brushes, F F the four field coils, T T the terminals of the dynamo, and R the non-inductive resistance. The curve K gives the deflections obtained when the condenser leads and wiper were joined at T T. It will be observed that the curve is symmetrical, giving eight maxima and eight minima per revolution. The minima are below zero, and explain the several deflections observed in the first work on the arc. The resistance R being non-inductive, K is also the curve of current strength, to a different scale, and shows that the machine was an alternating current machine, although the excess of positive area over negative shows an average positive current. Curve L was taken with the machine in the same condition as before, but with the condenser leads attached to the brushes at B B. It gives the varying potential of the armature, as modified by the inductive reaction of the field, and shows the same symmetry, with less distortion. For curve M the field coils were all thrown on one side of the armature and condenser leads attached at B B, as in Fig. 3.

To ascertain the effect of an inductive external resistance on the terminal potentials of the machine normally connected, the connections used in obtaining curve K were repeated, the only change made being to insert the six coils of the large Stevens electro-magnet with the non-inductive resistance R, adjusting R to get the same current strength used in getting curve K. The resulting curve showed the same characteristics as K, but much magnified, deflections ranging from — 300 to + 550. Many other curves were taken, with the machine self-excited and separably excited, in various loads and on open circuit, but the results, though interesting, are not of sufficient importance now to occupy your time. The most interesting curves and results were presented as a joint paper by Prof. Morton and the writer, and read by Prof. Morton before the American Association for the Advancement of Science at its Boston meeting, Aug. 25–30, 1880. The curves presented and the original records from which they were prepared cannot now be found. Immediately after that meeting the writer entered on his duties at the University of Missouri, and had no opportunity to resume the use of the method until his removal to Ohio, in 1885. It was used in that year by his students in an examination of the Thomson-Houston arc dynamo, substituting a Thomson portable electrometer, with Leyden jars to increase its capacity, for the condenser and galvanometer. Since then the method has been used in this laboratory on various apparatus, and in various ways, but it is needless to recount the details.

Our experience with the method leads us to prefer the Thomson portable electrometer and Leyden jars to all other instruments for high potential curves. The electrometer is dead beat, is a zero instrument, and is easily and quickly set. As usually made, its constant is from two to three volts per division, and one can easily set to within that amount. The error resulting from an improper reading, say one division wrong, would be of course serious in reading low potentials, but these readings only occur on nearly straight parts of high potential curves, and might be entirely omitted without serious error.

Next to the portable electrometer, we prefer the Thomson electrostatic voltmeters. For low potential curves nothing has yet proven superior to the potentiometer method as used here, and described by the writer at the American Association meeting at Washington, last August.

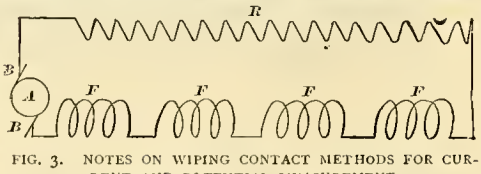


FIG. 3. NOTES ON WIPING CONTACT METHODS FOR CURRENT AND POTENTIAL MEASUREMENT.

The potential difference to be measured is balanced against that produced by a battery in a resistance, as in Fig. 4.

In this cut R is a resistance of some convenient form, with which contact may be made with a movable terminal M, or which may be varied between or beyond the terminals of the Weston voltmeter W. From these terminals wires lead through a commutator C, a sensitive galvanometer or telephone I, and the wiper D to any points A B, whose potential curve is desired. The whole being in operation and C properly placed, M or R (or both) is adjusted until I shows no current, when the potential difference existing at A B is read off directly in volts on the voltmeter W. The use of the voltmeter and telephone is due to R. D. Mershon, a graduate of the university.

Fig. 5 is a part of the potential curve recently taken from a Brush open coil motor, run as a dynamo on an inductive load. One-fourth of the complete curve is shown, and the parts not given are quite symmetrical with this. No "smoothing" is applied, but the observed points are joined by straight lines. The sharp angular form shown is due to the fact that readings were taken at intervals of five degrees, except between 25 degrees and 35 degrees, where readings were taken at each degree, to determine the character of the sharp variation between 30 degrees and 35 degrees. The change of 130 volts which occurs between 32 degrees and 33 degrees is unique and noteworthy, yet it is perfectly definite and characteristic, and has been repeatedly observed under like conditions. The use of ammeters and voltmeters or galvanometers in power measurements on such machines must, as pointed out in the paper of 1880, lead to incorrect results.

In Dr. Thompson's paper[1] reference is made to Joubert's use of the method in 1881, and in the recent edition of Thompson's "Dynamo-Electric Machinery," it is described as Joubert's method. In view of the work here described, and its presentation before the American Association in 1880 it seems proper to claim the method, which in the hands of Professor Ryan, Dr. Duncan and others has led to such valuable results, as an American discovery.

[1] Read at the general meeting of the American Institute of Electrical Engineers, Chicago, June 6, 7 and 8, 1892.

1. A Study of an Open Coil Arc Dynamo. By M. E. Thompson, Am. Inst. E. E., May 21, 1891.

A Whale Story from England.

A writer in a recent issue of the London *Electrical Review* tells a story of how a whale was killed by electricity in the year 1852. It appears, says the gentleman referred to, from a French patent, granted August 7, 1852, to Dr. Albert Sonnenberg, of Bremen, Germany, that the magneto-electric machine and accessories, forming the subject matter of said patent, had actually been used for killing a whale. This must indeed be considered a remarkable achievement at such an early date in the history of the magneto-electric machine. It is not necessary to enter into details as to the construction of Dr. Sonnenberg's machine. It is sufficient to state that it consists of a crown or ring armed with a number of armature or induced coils turning before a number of permanent field magnets, with a current collecting ring and brushes, so arranged as to be capable of giving "a whale 720 galvanic shocks in one minute."

The accessories used in connection with the current

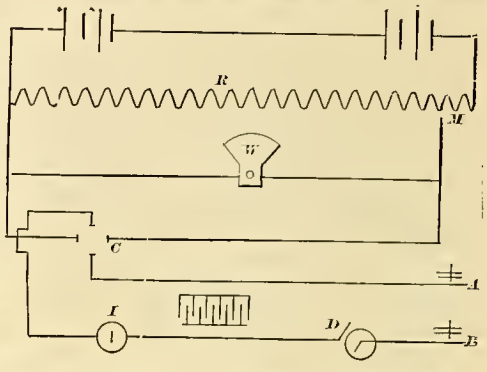


FIG. 4. NOTES ON WIPING CONTACT METHODS FOR CURRENT AND POTENTIAL MEASUREMENT.

generator are an ordinary harpoon carrying an electrical conducting wire, covered by the harpoon line and connected with one pole of the generator, so as to form one half of the electric circuit, the other half being formed by the metal-plated bottom of the boat containing the magneto-machine and the sea water.

When the harpoon is lanced into the whale the circuit is completed, and as stated in the description, the "electric fluid passes through the body of the whale, and the latter receives at each rotation of the machine 12 heavy shocks, and as the machine can make one turn per second, the whale will receive 720 shocks per minute, of such a force as to stun or render the whale unconscious, as has been proven by electrical experiment."

It is a difficult matter, continues the story teller, to refute the Bremen doctor's underscored statement that he had actually been able to make a whale unconscious (*aneantit la baleine*, in French description) by electric shocks from his machine, and so the writer must believe the "whale story" with the mental reservation, however, that the whale must have been a little one.

The following paragraph concludes the whale story. The lines will doubtless be of peculiar interest to American readers in that through them there may be had a fair idea of English electrical humor.

"Bremen being so near the North Sea, it suggests the

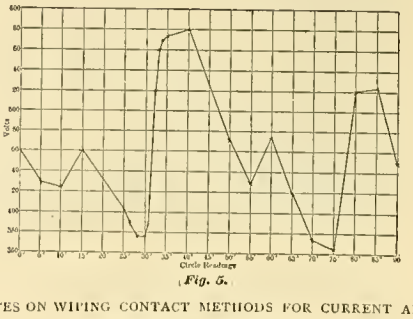


Fig. 5.

NOTES ON WIPING CONTACT METHODS FOR CURRENT AND POTENTIAL MEASUREMENT.

idea that the electrically-killed whale of the Bremen doctor might have been the one of Olivette renown. The song here goes:

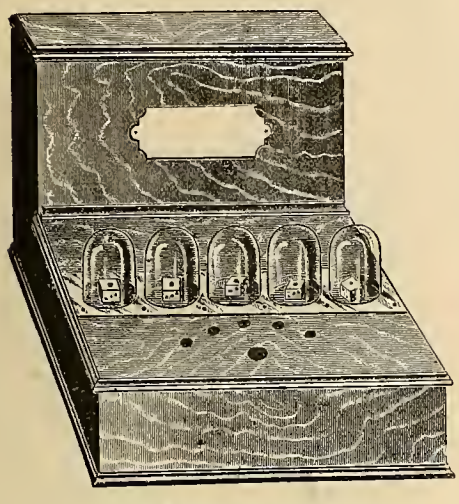
"In the North Sea lived a whale,
Who bobbed up serenely from below,
etc., etc.

"It is needless to say that when the Olivette whale learned of the fate of his mate he ceased 'bobbing up serenely,' and went to more congenial waters near the North Pole, where the 'demon electricity' cannot follow him."

Gambling by Electricity.

It is a shame to have to confess it, but gambling in Chicago from the present outlook seems destined to be a sport easy to indulge in—and the "increased facilities" too are all due to a most ingenious application of a small storage cell and several electro magnets. By means of the simple little device illustrated in the accompanying cut the gentlemen who are in the habit of coquetting with Dame Fortune under the chaperonage of the bartender or cigar man may now shake their dice in luxurious ease and with hardly the movement of a muscle.

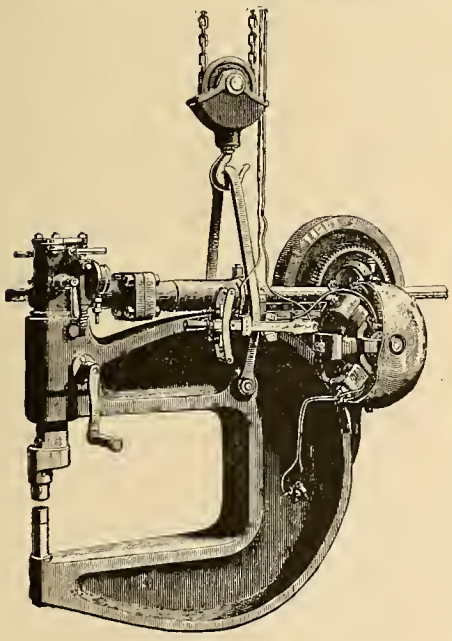
With the electric dice thrower shown, one might shake the fickle little ivories on his way to the train—pay the double price for his cigar, and yet reach the depot on



GAMBLING BY ELECTRICITY.

time. It is only necessary to press the button, and the electric thrower and the man in the white apron attend to "the rest."

This little novelty may be used in all games where dice are required. The dice are under glasses as shown, fastened to the case. Each die sets on a rubber diaphragm, which is vibrated by an electro magnet. The magnets are fastened pole-tips down just underneath the diaphragms, and each magnet armature has on one end a little rod that extends up to and carries the diaphragm or vibrating bottom. The armature is set in motion in the same manner as that of an ordinary electric bell, a storage cell in the back of the box furnishing the current, and the



ELECTRO-HYDRAULIC RIVETING MACHINE.

contacts being made through the six push buttons. When the push buttons are pressed, the dice are agitated, and while in the air revolve so rapidly that the spots cannot be distinguished.

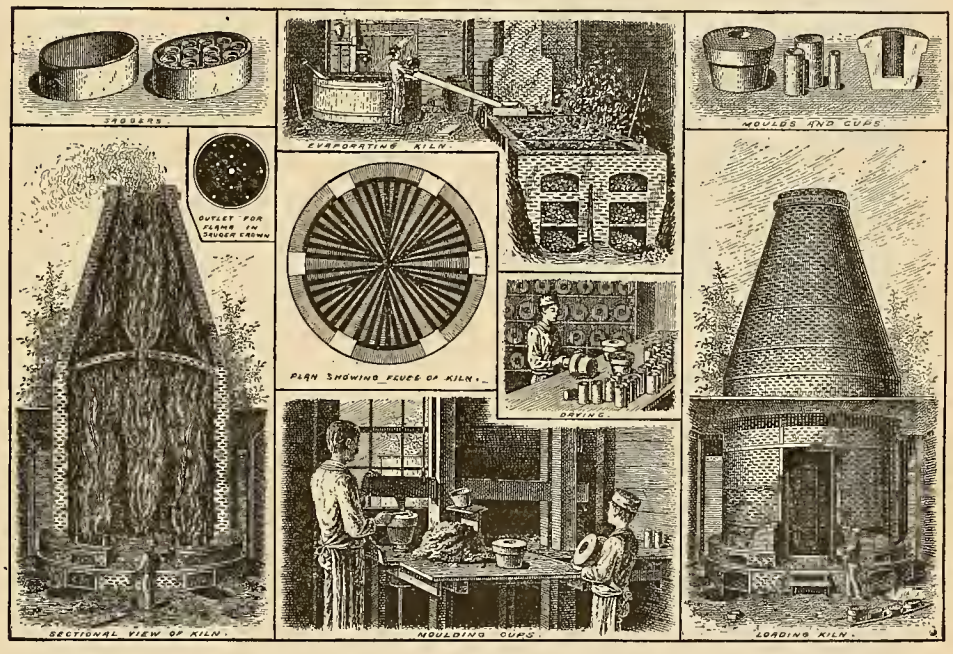
If a person should desire to throw five aces, as represented in the cut, he presses a second or two upon the large push button. If the result shows an ace in any glass the second trial must be made by pressing the individual small buttons; if other aces appear the third trial would be accomplished by pressing the remaining individual buttons.

How Battery Porous Cups are Made.

One of the most familiar objects to the youthful electrician is the battery porous cup, yet how many, even among those older in experience, know anything pertaining to its manufacture? The following from the *Scientific American* will, therefore, be of interest.

The standard porous cups which hold the carbon of galvanic batteries were first introduced by a Frenchman named Leclanche. They are made of a mixture of feldspar, kaolin, white quartz and ball clay. Feldspar is a mineral pulverized, found in Vermont and New Hampshire. Kaolin is a china clay imported from England. The white quartz which gives body and strength comes generally from Illinois.

These ingredients are first put into a large circular tub as follows: 1,440 pounds of kaolin, 1,320 pounds of feldspar, 280 pounds of quartz, and 960 pounds of ball clay, making in all about 4,000 pounds. Water is then poured on and the whole mass is thoroughly mixed together and thinned down to about the consistency of paint. It is then run through a 120-mesh lawn or sieve into the evaporating kiln. This kiln is about 5 feet in height, 12 feet in length, 5 feet in width, and about 1 foot in depth. The flooring is made of flanged tiling cemented together. These tiles are 12 inches square and 2½ inches in thickness. A coal fire is built in the ovens at the end of kiln, the flames of which pass through a number of flues underneath the tiling, heating up the liquid mass above. It is then allowed to boil and simmer for 25 hours, causing the water to evaporate out of it. The fire is then drawn and the material allowed to cool. From the kiln it is taken to the



HOW BATTERY POROUS CUPS ARE MADE.

moulder to be formed into cups. The moulds used are made of plaster Paris, the medium size turning out cups 5½ inches in height, 3⅛ inches in diameter, and ⅛ inch in thickness. These cups run from 3 to 14 inches in height. A piece of clay is first thrown in the bottom of the mould, which is taken up and placed in a hollow revolving jigger head. The moulder then draws down a wooden strip connected to which is a 12 inch cast iron rib. This rib is pressed down on to the clay at the bottom of the mould, which forces it up around the sides, forming the cup in about one minute. The mould is then taken away to the drying room, where it is left a short time to harden. The cups are then drawn out of the moulds by hand and placed into saggers.

These saggers are made of common clay, and hold about 11 medium sized cups. They are oval-shaped, and are 20 inches in length, 14½ inches in width, and 8 inches in height.

They are then placed in the kiln for burning. This improved English kiln is 38 feet high and 15 feet in diameter outside. The inside burning capacity is 12 by 13 feet. The walls are 18 inches thick and lined inside with fire brick. The kiln holds 850 saggers. After the kiln is filled, the door is bricked and plastered up and the fires started. After burning about twenty hours, the fires are drawn and the kiln allowed to cool. The saggers are then taken out and the cups packed for shipping.

The improvements over the old kilns are in the number of flues and size of mouths of kiln, also the shape of crown and the doing away with the old double wall inside of kiln. The old mouths of kiln used to be about 32 inches in width, and fewer than the new, which is about 23 inches. This new kiln has six mouths, each an equal distance apart. There are new flues introduced between each mouth, running from the circular flue around the kiln called the mid and semi-mid feather flues. These flues all lead into the 10 inch well hole into the center of the floor of the kiln. The old crown of the kiln used to be 3 feet 8 inches higher and ran straight across. The new saucer-shaped crown tends to make it burn more evenly. Over each mouth on the inside of the kiln are bags built of brick. The old bags used to be from 4 to 5 feet in height; they have been cut down to about 2 feet square and 10 inches in width. They tend to keep the heat and flame from going to the center of the kiln. The well holes on the floor of the kiln and crown are directly over each other. The heat required for burning is about 1,800 degrees. The illustrations were taken from the plant of Thomas Loughran, Marion, N. J. The cost of outfit, with 1,000 moulds and 5 horse power engine, was about $3,500. There are several establishments in this country for the manufacture of porous cups, and their aggregate production is about 1,000 cups a day.

Electro-hydraulic Riveting Machine.

Among the many interesting machines at the Crystal Palace Electrical Exhibition in England was an electrical riveter, shown in the accompanying illustration. In this device the piston is moved forward in a horizontal direction by the action of the electric motor, and compresses oil on the upper surface of the ram up to two tons per square inch. The ram, which acts vertically, has an area of 16 square inches, and therefore the pressure on the rivet punch amounts to thirty-two tons. To effect this the motor takes 25 amperes at 110 volts for a period of two or three seconds at each rivet. The motor is a multipolar machine having eight poles on each side of the armature and two carbon brushes placed 45 degrees apart. The switch for the starting is arranged so that the lever in the farthest position cuts off the current after the piston has developed sufficient momentum. In this position also a brake can be applied to the fly-wheel to suit the requirements of the work. In bringing the lever back to the intermediate position a spring carries it clear of the starting contact and places it in position ready for reversing. On reversing the motor the piston is carried back ready for the next rivet. The rivet punch is raised in the machine by a hand crank, but it is intended to perform this by the action of the motor in reversing. It is also proposed to heat the rivets by electricity, which, it is thought, will greatly improve the present machine.

In the accompanying cut the machine is shown ready for riveting horizontal webs or angle irons for girders, the rivet punch being specially fixed with a set-out from the center in order to take flush work. The machine is also adapted for upright work. Many of these machines are in practical operation in England, Germany and France, where they are giving satisfaction on heavy work like bridge building. The cut is from *Engineering*.

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CORRESPONDENCE relating to electricity, or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well-written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

PAGE.

Cyrus W. Field. With Portrait 29
Trouble with the Electric Stampers 29, 30
Magnetic Lock. Illustrated 30
Telegraph Service at the National Conventions 30
Speed Indicator. Illustrated 30
Another Close Connected Power Transmitter. Illustrated 31
Recent Thunder Storms in France. Illustrated 31
Electricity at the World's Fair 31
Notes on Wiping Contact Methods for Current and Potential Measurements. By Prof. Benj. F. Thomas. Illustrated. (American Institute of Electrical Engineers) 31, 32
A Whale Story from England 32
Gambling by Electricity. Illustrated 33
How Porous Battery Cups are Made. Illustrated 33
Electro-hydraulic Riveting Machine. Illustrated 33
Editorial 34
High Pressure Electric Discharges. Illustrated 35
Electric Lighting in Chicago 35
Siemens & Halske Company 35
Electric Cooking 35, 36
Electric Railway Motor Tests. By Prof Geo. D. Shepardson and Edward P. Burch. Illustrated. (American Institute of Electrical Engineers) 36, 37, 38
Boring Mill for Electric Machines. Illustrated 38
Electric Pumps for Mines. Illustrated 38
The City and South London Electric Railway 38, 39
Electrically Illuminated Signs. Illustrated 39

DEPARTMENTS.

Correspondence 39, 40, 41
New Incorporations 41
Electric Lighting 41
Electric Railway 41
Electric Mining 41
Telephone 41
Telegraph 41
Miscellaneous 41
Trade News 42
Business 42
Electrical Patents 42

OF course it is but natural that the daily papers should not always apply electrical terms correctly. One cannot help smiling, though, when the *Chicago Daily Globe* refers to "Trolley's system," and a *Tribune* correspondent parallels this odd designation by gravely giving some facts relating to the installation at Baltimore, Md., of the "Serres" system. But such trifling mistakes as these, although amusing, are not to be wondered at, considering the opportunities the ordinary newspaper man has to acquaint himself with electrical terms. After all, it is the rural editor who tells the marvelous story. In this connection it will not be amiss to mention the fact that the *Patriot* of Atchison, Kan., makes the revelation that "a bug an inch long in an electric light globe throws a shadow on the sidewalk as big as an elephant." If this be true, there should be "no flies" on the lights in Kansas.

IN this issue is presented an excellent portrait of Cyrus W. Field, together with a biographical sketch and a brief outline of his great work in connection with the laying of the first Atlantic cable. This gigantic enterprise, to which Mr. Field devoted the most valuable years of his life, and in which he invested his entire fortune, established for him an enduring name and made mankind his debtor. It is to such men as Mr. Field that this country owes not only its material prosperity but also its advancement in the arts and sciences. It is not surprising, therefore, that throughout the country the news of Mr. Field's death was received with general grief. He was one of the great characters of the age—respected and honored by his countrymen for his sterling qualities as well as his great ability.

IT seems from the report presented elsewhere in this issue that the underground electric road at London has proved successful beyond the expectations of its projectors. Although the electric locomotives were called upon to do much more actual service than they were built for, the operating expenses were kept within reasonable limits, and there was no serious interruption of the service.

In view of the fact that the New York Rapid Transit commission's report has been approved by the court, and that an effort will be made at an early day to build the road in accordance with the plans proposed, there will be a lively interest manifested in the operation of the London road. If it can be shown that the project will pay, there will be no trouble securing the necessary financial support. At present there seems to be a lack of information regarding the probable cost of construction and operation of an underground road, such as the one proposed by the commission.

THE importance of a cable connecting the Pacific coast of the United States with Japan, China and Australia is so obvious that every patriotic American will heartily join in the wish that the project for a submarine telegraph line from San Francisco to Honolulu will soon become an accomplished fact. This would form the first part of a most important undertaking. Following the recently surveyed route of the Thetis—considered to be most accurate of any yet made for a Pacific cable—the cable to the Hawaiian islands would be 2,060 miles in length. This would leave about 3,800 miles to connect the end of the cable with Japan, and it can hardly be doubted that once the first section of the cable was laid the other would follow in due time. The British government contemplates the building of a Pacific cable to connect its colonies in the two hemispheres, and it will be a great mistake to rely exclusively on that line. Two cables would not pay; and so the United States should be first in the field, unless, indeed, an international arrangement can be made by which the northern, or British, route can be used, the eastern terminus of the cable being in this country.

FRIENDS of the trolley system have reason to be encouraged over the progress that is being made in the introduction of the electric railway in large cities. Although there is considerable opposition to overhead wires in business districts, it is generally conceded that for residence districts of large cities the electric system is better adapted than any other. In Chicago, for instance, where there are ordinances against the stringing of overhead wires in business streets, and in spite of the fact that the cable companies, generally speaking, control the city, the trolley is rapidly gaining favor, and it is highly probable that there will be quite a net work of electric railways in the South side suburban districts before the opening of the World's Fair. Last Sunday another branch of the Calumet Electric railway was opened, connecting South Chicago with the city. The new line extends from the southern terminus of the cable line on Cottage Grove avenue, at Seventy-first street to Burnside. The old line extended from Burnside to South Chicago. As the portion of the city through which these lines pass includes several good residence districts, there is no doubt that the company will receive encouragement that will warrant it in making further extensions.

SOME time ago the Chicago city council passed several ordinances granting the South side cable company permission to equip cross-town lines with electric motors. Impatient residents along the routes which it was proposed to equip with electrical apparatus became restless and the newspapers started several reports to the effect that the company had reconsidered its determination and would not equip its lines for the present at least with the overhead system. Now, however, it is authoritatively stated that the work will be begun at once, the company having already awarded the contracts for the first installation. It is confidently expected that as soon as the initial plant is installed there will be a general demand for the electrical equipment of all cross-town lines and other feeders into the present cable system. It is not expected, of course, that the cable companies will throw aside their present costly equipments for the main lines, but it is believed that public opinion will force them to provide service on the cross-town lines and that on these routes the overhead trolley will be generally introduced. In this city alone there is an admirable field for the trolley, and no doubt as soon as the people become familiar with it they will gladly consent to extensions of the lines at present contemplated.

IT is stated that the committees on ways and means and grounds and buildings of the directory of the World's Fair are about to pay a joint visit to Jackson Park for the purpose of inspecting the actual working of the electric and steam launches before making any decision between the four competitors for the contract for operating boats on the lagoons during the exposition. This is an excellent idea. The advantages of the use of electricity for pleasure boat riding are so apparent that it would seem that the directors need only be convinced that the new method is thoroughly reliable before awarding the contract to one of the companies exploiting launches of this character. The tests that have been made should prove amply satisfactory on this point, and, when these facts have been supplemented by a pleasant and successful ride in the park, under conditions exactly analogous to those that will obtain next summer, the directors should have no hesitation in adopting the system which represents the most advanced stage of progress. Electrically propelled boats are peculiarly adapted for use on the lagoons at Jackson Park, where only moderate speed is required for pleasure riding. They are clean, and handsome, with the great advantage that the absence of smoke, heat and noise gives. They would form an attractive and novel feature of the exhibition and would undoubtedly attract more passengers than the familiar steam launches—a consideration that should receive the careful attention of the directors. Ample facilities for charging can easily be arranged, and experience with the large fleet of similar boats on the Thames, near London, has proved that they can be operated every day and all day to the complete satisfaction of the public. In its other features the exposition will be an exponent of the latest development in this electrical age, and there is no reason why an exception should be made in the case of the boats that are to ply on the lagoons.

IT appears now as though the New Yorkers had about concluded that the tunnel plan was the one best suited to fulfill the demand for increased rapid transit facilities. Last week the final objections of dissatisfied property owners were overruled by the General Term of the Supreme Court, and the report of the commissioners appointed to decide whether the public interest required the construction of the lines laid out by the Rapid Transit commission was confirmed. So now all that remains to be done is to present the scheme to the capitalists whose decision as to its being a desirable investment will make the work of the commission a success or failure. The bidding for the franchise will, of course, show whether, in the opinion of capitalists, an assurance of fair returns is to be found in the plans presented. There is a hopeful significance in the fact that already more than one syndicate of capitalists have sought for the opportunity to construct a tunnel railroad upon routes substantially the same as, or inferior to, those laid out by the Rapid Transit commission.

The general impression is that the money will be forthcoming. New York needs the additional lines. There is no other place to put them except in tunnels unless the citizens consent to the addition to the already overcrowded streets of more elevated tracks, and this, of course, is out of the question. The metropolis has been a long time reaching its present conclusion, but many minds keenly alive to the city's urgent need, and also to the difficulties in the way of success, have decided that the tunnel scheme was the only solution. It is interesting to note, too, the part that electricity played in influencing the court in favor of tunnels. Although no direct reference is made to the use of electric power for moving the trains, sufficient is said to leave no doubt but that the judges in presenting their opinion had electricity in view as the agent that would do the work not only of lighting and ventilation, but of propulsion as well.

Chicago will do well to watch New York as it progresses with this gigantic scheme, for although ahead of the metropolis in many things, in so far as rapid transit facilities are concerned the World's Fair city must follow New York. Chicago has just started to build elevated roads, and as yet but one short line is running. In time there will be more lines, and for a while the congested condition of the city's business section may be relieved. But there is a limit to the number of elevated lines that a city will permit to obstruct the light of heaven. There will be no check to the city's growth, though, and then when the cry comes for further increase in rapid transit facilities Chicago will have to turn to the older city to get the benefit of its experience.

High Pressure Electrical Discharges.

Swinburne & Co., England, exhibited some interesting high tension electrical apparatus at the Crystal Palace electrical exhibition. Fig. 1 is a general view of the firm's high pressure experimental machinery. The 130,000 volt transformer is placed in the large stoneware case, the terminal wires being led out by the corrugated ebonite pillars on the top. The transformers shown to the left convert the 2,000 volts down to 150 volts, the pressure for which the large transformer is wound. The hemispheres on the discharge table are employed for making experiments on striking distances and high pressure arcs. Fig. 2 is from a photograph of a 100,000 volt arc. The photograph was not taken instantaneously so the arc appears as a broad flame, instead of a rapidly moving narrow stream. The photograph really shows several arcs superimposed. The small alternating motor is used in an experiment which is rather striking to those who have not realized the ease with which

FIG. 3 HIGH PRESSURE ELECTRICAL DISCHARGES.

power can be transmitted at high pressures. Current at about 40,000 volts is given by the large transformer, and transmitted through an exceedingly fine wire, or through a piece of slate pencil, or a vacuum tube, and received by a small one. This transforms the pressure down to 100 volts, at which pressure it is led into the alternating motor. The motor itself is said to be the first self-starting synchronizing alternating motor exhibited in England. Swinburne & Co. do not consider this motor sufficiently perfect for commercial use yet, but it is stated that they expect it to yield a satisfactory solution of the alternating current motor question. Figs. 3 and 4 are from photographs of discharges over a glass plate. This is the experiment known as the "electric octopus." The plates are 2 feet square, so that some idea may be formed of the appearance of this experiment. The Geissler tubes can be clearly seen in the photographs, illuminated by means of one terminal only.

Electric Lighting in Chicago.

Speaking on a subject that has frequently received attention in this paper, the *Chicago Tribune* well says:

An agreement was made some months ago between the city and the South Park commissioners for an extension of the electric lighting system to the World's Fair grounds. Electric lights were to be placed on Michigan boulevard, Wabash avenue, and perhaps one or two other thoroughfares south to Thirty-fifth street, there to connect with the South Park system on Grand and other boulevards. The work on the city part of the agreement has been delayed for some reason or other. Now that public attention has been called to the fact the undertaking should be attended to and carried out without further parley. There may have been some reasons for holding off, but they do not hold good for all time, and will not justify further delay.

The principal avenues connecting the business heart of the city with the Fair must be well lighted at night all through the celebration. There is no gainsaying that statement. It is an absolute necessity that the work be done, and there is left none too much time in which to accomplish it. The many thousands of people who will come here next year to view the display in Jackson Park and vicinity will include very many who will wish to make the connection otherwise than by rail or cable car. They will want to take drives at night through the boulevard system, and take in with their own eyes the beauties of the scenes of which they have heard and read. And for those who do not care much for arrangements of trees and flowers, small lakes and mounds there must be the element of security, which only good illumination can give. During the time the Fair is open the city will be wide awake by night as well as day. People will throng the thoroughfares, and especially those of the South Division, within the first few blocks from the lake, where nearness to the Fair will join with night breezes from the water to attract the multitudes. The dim, uncertain, flickering, semi-dangerous, because half concealing, gaslight will never do, and this is conceded by every intelligent citizen who gives the subject a moment's thought and has not his judgment warped by the holding of stock in the gas companies. For this purpose the electric light is the only ac-

FIG 4. HIGH PRESSURE ELECTRICAL DISCHARGES.

ceptable one when the light of day has departed and the moon is not within a few days of becoming full in a clear sky. We cannot afford the suggestion of poverty made by gas lamps on avenues leading to the Fair.

The city now owns four electric lighting plants, enough to light the district bounded by North avenue, Twenty-second street, Western avenue and the lake, but the appropriation is such that only 1,100 lights out of a capacity of 4,000 are burned. City Electrician Barrett says that the construction of five more plants of equal capacity would equip the city with power enough to light all its streets. "The appropriations," said Mr. Barrett to a reporter, "are so small that the department cannot meet the demands for electric light extension. If the lights were paid for by special assessment, each district of the city could arrange for its own light and have plenty of it."

Siemens & Halske Company.

J. Holt Gates, who for seven years has filled various positions in the service of the Westinghouse Electric & Manufacturing company, a portion of the time as district agent at Dallas, Texas, and more recently as special agent for the territory from Chicago westward to the Pacific coast, has accepted the position of general sales agent for the new Siemens & Halske Electric company of America. Mr. Gates is considered one of the best salesmen in the electrical business and will contribute not a little to the strength of the new company. Work on the factory on Blue Island avenue is progressing satisfactorily, and it will be open in a few months. In the meantime Mr. Gates will familiarize himself with the company's apparatus and products, and be ready to take the field as soon as the goods are ready for the market. Alexander von Babo, the personal representative of Siemens & Halske, and Dr. Emil Berliner, the electrical engineer of the Chicago factory, have for some time occupied offices in the Monadnock building.

Electric Cooking.

In explaining the experiments in electric cooking recently shown in London, H. J. Dowsing, who had charge of them, says:

Suppose you took an ordinary frying pan, and coated the botton with an insulating enamel, in which you embedded the zigzag wire conveying the current, and you would have the exact form of the electrical cooker. To prevent radiation from the insulating enamel, the plate on its under surface is protected with asbestos, contained

FIG. 2.—HIGH PRESSURE ELECTRICAL DISCHARGES.

in a metal case. The wire is made of a secret alloy, and becoming very hot makes the iron plates above it, with which it is in contact, hot also (480 degrees to 500 degrees), but it is impossible that it should become incandescent, partly because the resistance increases when the wire itself is heated, and therefore becomes, to a certain extent, an automatic regulator. The wire, too, will carry a certain amount of electricity and no more, so long as the cur

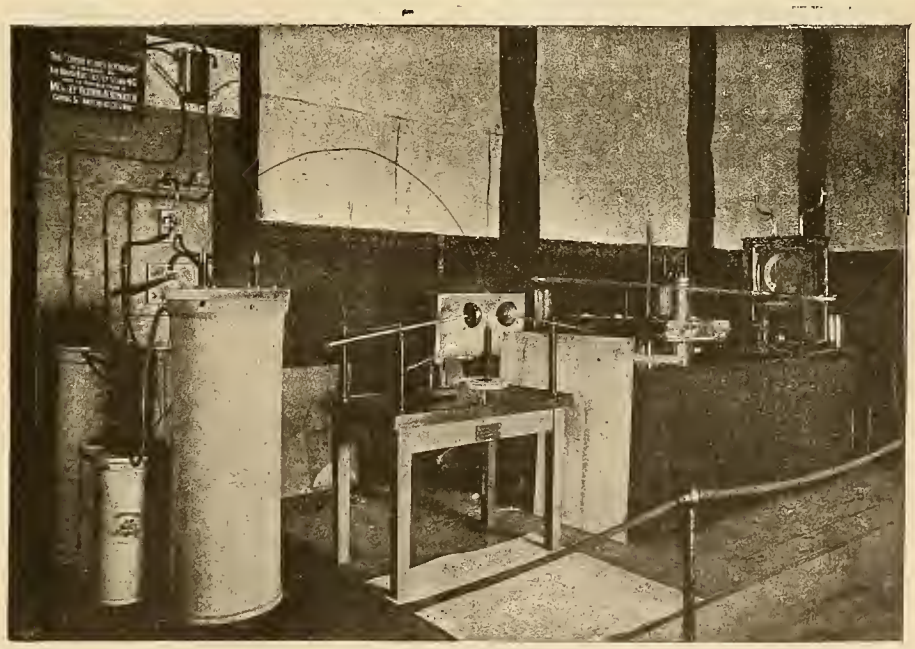


FIG. 1. HIGH PRESSURE ELECTRICAL DISCHARGES

rent remains constant. Taking the electromotive force at the usual domestic rate of 100 volts, the circular cooker, 6 inches in diameter, takes current first at the rate of three amperes, and then declines to two amperes, as the resistance increases. In other words it is equivalent to about two sixteen candle power incandescent lamps.

A householder might use either the cooker or the two lamps at the same cost. In six to ten minutes on the cooker he could do three cutlets at one time for less than one farthing, and then switch the current back to his lamps.

At the recent dinner at the Crystal Palace to electricians seven cookers simultaneously at work in the banqueting-room cooked fifty mutton cutlets, thirty chicken cutlets, and forty pancakes, and made forty cups of coffee. One great advantage is the cleanliness of the utensil, its immunity from the risk of fire, and its freedom from unpleasant fumes. The electrical kettle, constructed on the same principle, is quite self-contained. As water requires considerable heat to bring it to a boiling point, a quart will need to be in the kettle about fifteen minutes before it is ready for the teapot, and a little more electric current will be necessary than for the cooker. All that one needs to do in using either frying pan, kettle or motor is to plug the

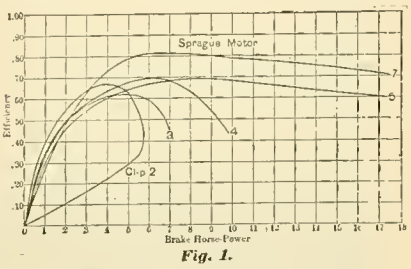


Fig. 1.

ELECTRIC RAILWAY MOTOR TESTS.

wire into connection with the main supplying the house, which can be done in an instant without any technical knowledge whatsoever.

At present the initial cost of these electrical appliances is somewhat high, the price of the cooker being £2; but it has been suggested that as other electrical fittings are obtainable on hire, the householder ought not to be put to any capital outlay whatever in order to make the fullest use of cheap electrical current.

Electric Railway Motor Tests.[1]

By Prof. Geo. D. Shepardson and Edward P. Burch.

The experiments here discussed were undertaken for the purpose of obtaining definite information about the performance of electric railway motors under various conditions. There is a diversity of opinion about the relative merits of regulation by rheostat and by commutated fields, the use of one or two motors on a car, value

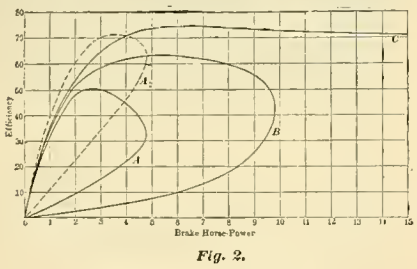


Fig. 2.

ELECTRIC RAILWAY MOTOR TESTS.

of wetting rails, causes of "bucking" and other points. It is commonly understood that electric roads using rheostat regulation require larger capacity at the generating station than those using the commutated fields. It is also known that one large road has substituted rheostat regulation for commutated fields on all its motors. One large road has reduced the pressure on the lines to a figure considerably below 500 volts, with marked reduction in the repair bill.

Much has been said and written, but the data published are meagre and in some cases misleading. It was therefore thought desirable to obtain data from careful tests under certain conditions in the hope of substantiating some of the claims made, and of bringing out some new facts. The tests were conducted for the most part by Edward P. Burch, a senior in electrical engineering in the University of Minnesota, in connection with his graduating thesis, and by courtesy of the Minneapolis Street Railway company, especially the master mechanic, William Cooper. Most

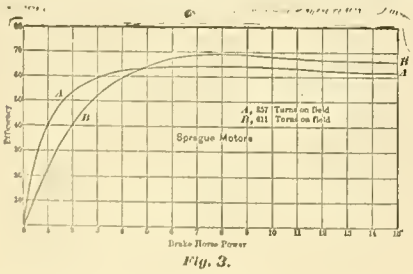


Fig. 3.

ELECTRIC RAILWAY MOTOR TESTS.

of the tests were made upon a No. 6 Sprague double reduction motor of the type described by H. F. Parshall before the Institute May 21, 1890, and April 19 1892. Some experiments were also made upon a single-reduction motor. Each machine is used at the repair shop for testing armatures, being anchored to a heavy crib sunk eight feet into the ground. Each car axle is replaced by a short shaft carrying a heavy cast-iron wheel with solid web, upon which two oaken blocks are bolted for use as a brake. This was made into a Prony brake by removing the angle irons that held it to the floor and bolting on a plank to which an iron plate was fastened, so as to give a knife-edge bearing at a distance of 63.1 inches from the center of the shaft. This plate rested upon a knife-edge supported upon a platform scale by which the turning moment could be measured. The mechanical horse power delivered at the car wheel is

$$\text{H. P.} = \frac{2\pi R P N}{33{,}000} = \frac{P N}{1000},$$

in which P is the pressure on the scale, N the revolutions of the car axle per minute. The speed was measured by a common speed indicator with soft rubber tip to prevent slipping. For slow speeds a stop watch was used, the time for five revolutions of the car wheel being noted. Current and potential were measured by new Weston instruments, about 12 feet distant from the motor.

The Sprague motor armature has 56 sections of eight turns each of No. 12 B. & S. G. wires. The speed is reduced 11,765. The field coil as used at first was in three sections, coil A 700 turns, coil B, 820 turns, and coil C, 620 turns, all being No. 12 B. & S. G wire. By means of the barrel switch these coils are thrown into the following combinations:

Clip 2. Coils A, B and C in series.
Clip 3. Coil A and B in series.
Clip 4. Coils A and B in parallel, C in series.
Clip 5. Coils A and B in parallel.
Clip 7. Coils A, B and C in parallel.

Several sets of efficiency tests were made with each com-

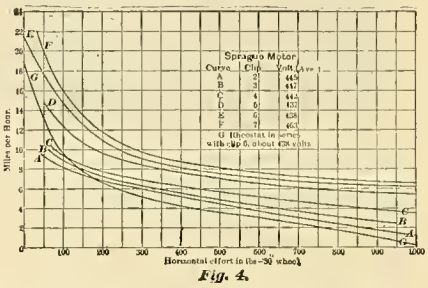


Fig. 4.

ELECTRIC RAILWAY MOTOR TESTS.

bination. The three pairs of coils were then replaced by a single pair of coils connected in series, and having several terminals so that the number of turns used might be altered. This was used in connection with a Thomson Houston rheostat. Efficiency tests were made with and without the rheostat. Only a few of the tests and curves obtained can be given in this paper. In comparing these curves among themselves and with the result of other experimenters, it should be noticed that the voltage was considerably below that for which the motors were designed, and that the power delivered was measured at the car axle. Different armatures were used on different days, and the curves in different places are not strictly comparable; but the curves given in any one plate were taken with the same armature and with approximately the same voltage. Each of these armatures had been recently repaired and although they had been well baked there may have been some leak-

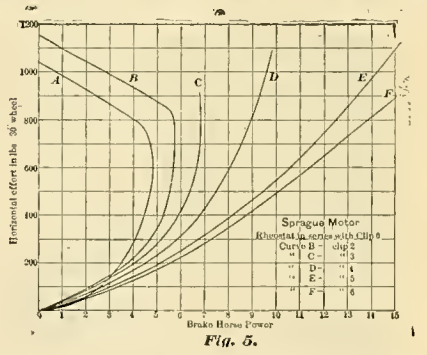


Fig. 5.

ELECTRIC RAILWAY MOTOR TESTS.

age through the green shellac. The Foucault currents in the cores were probably greater than in new armatures. With the same armature and fields the efficiency is a few per cent. higher cold than when hot. It has been the aim to run as nearly as possible at the temperature of ordinary running, so that the fields were comfortably warm but not hot. It is confidently believed that the efficiency of these machines would be considerably above 90 per cent. if taken at armature shaft and with full voltage.

Fig. 1 shows efficiency curves for the motor with different combinations of the field coils.

In Fig. 3 curves A and B show efficiency of the machine with 857 and 611 turns of No. 7 wire in the field coils. It will be noted in Figs. 1 and 3 that the motor has highest efficiency with the larger number of turns on field coils until the iron is saturated, when the better efficiency is given with smaller number of turns and consequent lower resistance in field. This shows the advantage of working on the fifth and seventh clips with barrel regulator, or of cutting out part of the turns on field when the load is heavy. On starting the car the current is very heavy and the field is saturated with a small number of turns; hence the torque with a given current is nearly the same whatever the windings of the field. The speed and counter electromotive force are small at starting; hence the potential difference at the armature brushes should be reduced until it passes only enough current to start the car without jerking. The easiest way of reducing the potential difference at the brushes is by interposing resistance, and the heat developed by the $C^2 R$ can be cared for more easily and cheaply in an open rheostat than in the field coils. Rheostats of iron and mica are cheaper and more heat-proof than cotton covered wires. This forces the conclusion that for the heavy load due to accelerating the car at starting, the field should have the smaller number of turns, and as the car reaches the normal speed, and the horse power and current become less, the efficiency

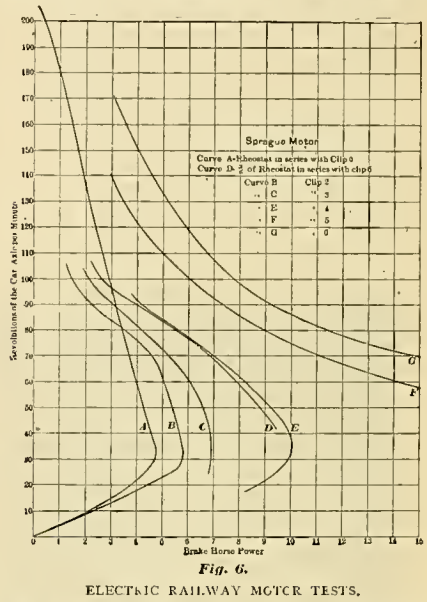


Fig. 6.

ELECTRIC RAILWAY MOTOR TESTS.

of the motor would be raised by increasing the number of turns in the field. This conclusion is exactly the reverse of the common practice of manufacturers who sacrifice some efficiency for speed at small horse powers. It is also in line with the experience of the road mentioned, that replaced the commutated fields with a single series coil of No. 7 wire, and later with No. 5 wire. This heat loss could be saved, and the average efficiency raised, by using the two motors in series at the start, and afterwards cutting out one, or putting the two motors in parallel if necessary, as the speed increases and horse power decreases. An average of 12 tests on the road shows that with two motors on a car it requires twenty seven per cent. less current if only one is working.

In Fig. 2 curve A shows the efficiency of the Sprague motor with a single pair of coils, when the whole of a Thomson-Houston rheostat is in circuit; B shows about 3·5 of the rheostat in use; and in C it is all out. The dotted line A^2 gives the efficiency as calculated from the difference of potential about the motor alone. Curve A^2 is not strictly comparable with the others on account of the necessary variations in the voltage at the motor; but it does show the increased efficiency to be obtained by utilizing the superfluous voltage in a second motor in series. In this connection it is interesting to note that the resistance of the rheostat, as calculated from current and

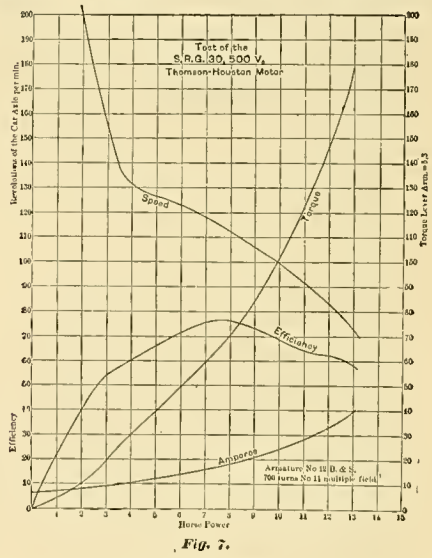


Fig. 7.

ELECTRIC RAILWAY MOTOR TESTS.

potential difference, decreases with increase of current. This is as expected, since the larger part of the resistance is due to surface contact between the plates of iron in the rheostat, these being pressed together more closely as the iron heats. A similar effect but much more marked has been noticed in earlier experiments by one of us, with alternate plates of carbon and iron.

Figs. 4, 5 and 6 show curves of torque, speed and horse power, referring to the No. 6 Sprague motor. In Fig. 5, A shows horse power and horizontal effort on a 30 inch wheel; B, C, D, E and F, clips 2, 3, 4, 5 and 7, respectively. In Fig. 6, A shows speed and horse power,

1. Read at the general meeting of the American Institute of Electrical Engineers, Chicago, June 6, 7 and 8, 1892.

with all of the rheostat in; *E* with $\frac{3}{4}$ of rheostat in; *B*, *C*, *D*, *F* and *G*, clips 2, 3, 4, 5 and 7, respectively. These may be compared with results presented by Prof. S. H. Short before the Chicago Electric club, March 28, 1892. Fig. 7 gives curves of currents, torque, speed and efficiency from a 15 horse power Thomson-Houston single reduction motor. The reduction ratio is 4.7857.

A large number of running tests were made on cars in regular service. Fig. 8 shows a run on the Interurban line between Minneapolis and St. Paul. The distance is about ten miles, the schedule time 55 minutes, cars equipped with two 25 horse power single reduction motors. Special

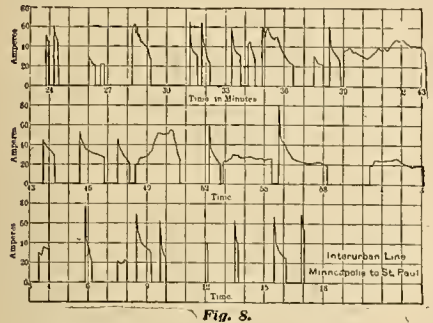


Fig. 8.

ELECTRIC RAILWAY MOTOR TESTS.

trains sometimes make this trip in 30 minutes or less. Fig. 9 shows three runs on the University line of Minneapolis on successive days, with the same car and same driver. The lower curve was taken when the rails were dry and dusty, middle curve with wet rails, and upper curve when the ground was covered with snow, eight inches deep on the level. The snow-plow had been over a part of the track about an hour before. The curves show variation of time, number of passengers being noted.

	Feb. 5.	Feb. 6.	Feb. 7.
Condition of Track....	Dry.	Wet.	Snowy.
Number of Stops.....	38	50	36
Average voltage.....	445	450	440
Average amperes	15.15	14.9	17.5
Average amperes while working	23.4	20.9	28 1

It will be noted that the current was less with wet rails, although there were more passengers. The load at the station is about the same for a rainy day as for dry, the

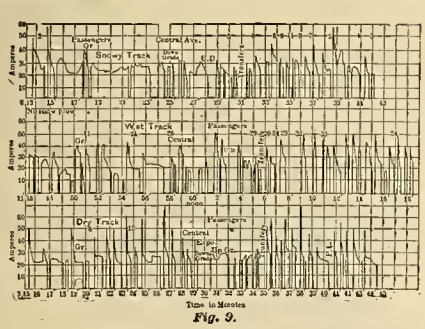


Fig. 9.

ELECTRIC RAILWAY MOTOR TESTS.

difference being probably made up by the increased leakage on the lines, and by the larger number of passengers on some cars.

Fig. 9 shows variation of current on a single car. Fig. 10 shows variation of current on a feeder to line with five cars, the average current being about 60 amperes. Fig. 10 is plotted from readings taken at intervals of two seconds. The ammeter stops some little time at the high and low points, showing that these are actual values of the current and not due to the inertia of the ammeter.

Fig. 11 gives the results of readings one second apart taken on the main ammeters in Minneapolis and St. Paul and on one feeder in Minneapolis. There were about 190 cars on the Minneapolis lines, 100 on St. Paul lines, and 32 on the one feeder.

Fig. 12 gives the daily load of the Minneapolis power house, the curves being plotted from readings of the ammeters taken at ten-minute intervals throughout the day. In this case the power units are unusually large, there being two triple expansion condensing Corliss engines, the constant loss from friction in engines, shafting and dynamos averaging 218 horse power. Indicator cards were taken simultaneously by means of electromagnetic attachments on each of the twelve indicators, the same current also giving signals to the observers at the ammeters.

A series of thirteen tests were made for ascertaining the effect of wetting or greasing the rails on a curve. Two cars were coupled by a spring dynamometer and the pull noted while rounding the curve at ordinary speed, which was kept nearly uniform by means of a brake on the motor car. The average pull on dynamometer is as follows:

	Dry.	Wet.	Greased
Outer track.....	500-800 lbs.	400 lbs	300 lbs
Inner track.....	650 "		400 "

The inner rail was wet or greased in each case; but on the inner track the greasing was not so thorough on account of the lateness of the hour. It is noticed that wetting the rail reduces the power required about one-third, and greasing reduces it one-half. Readings of the ammeters on the car correspond in general with the dynamometer readings.

The "bucking" of street car motors is a subject of considerable interest to street railroad men, although it seems never to have been discussed in public. From the silence of the books and papers, and from the ideas current among the railroad employes, the conclusion is reached that little is known about its conditions, causes or remedy. It is therefore thought wise to present the results of observation and tests, with a theory for the cause and remedy. It sometimes happens that an electric car suddenly stops as if by collision. In some cases the car refuses to go farther, but usually it goes ahead immediately as if nothing had happened. This is known among railroad men as "bucking." To explain the action it is noted that in common practice the motor fields are connected between the armature and trolley, the armature being grounded at the negative brush. If a second ground occurs on any part of the machine except between the fields and trolley, a heavy current passes to ground, giving an intensely strong field, while the armature is short circuited by reason of the two ground connections. It therefore acts as a dynamo on short circuit, and becomes a powerful electric brake that stops the car very suddenly. This agrees with the facts since a second ground, either from loose connecting wires or broken insulation always causes bucking. Evidently, if the ground occurs entirely outside of the machine, no bucking follows, since the series motor cannot excite its own fields and act as a dynamo unless the armature connections are reversed.

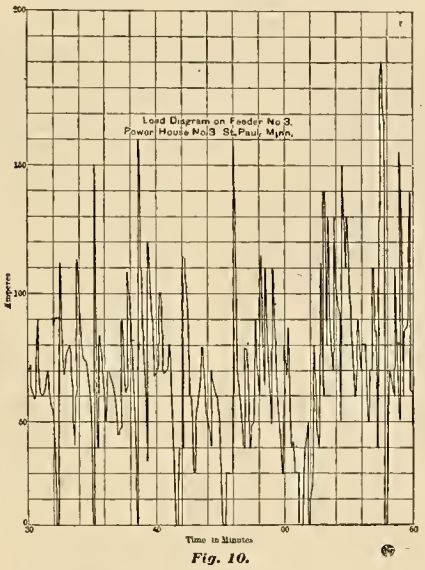


Fig. 10.

ELECTRIC RAILWAY MOTOR TESTS.

It is common practice to connect the two motors together between the fields and armature to equalize the work of the two machines. When a ground occurs in such a case, both armatures act as brakes, and the bucking is more violent than when the "equalizer" connection is not used. A loose reversing switch has been known to reverse the motors accidentally and spasmodically. There are many cases of bucking where no evidence of a second ground can be found. Doubtless some of these may be accounted for by temporary ground which burns itself out—a common method of removing grounds and crosses. This explanation will not hold in many cases. Extended inquiry was therefore made among railroad men in order to gather as many facts as possible. Some of these reports were incredible at first, but seem to be honest testimony, and were afterward corroborated by others.

It may be well to state that the term "bucking" is used with some looseness, being sometimes applied to cases where a motor acts badly for a variety of reasons, but as used in this article it is to be taken in the sense above noted. There is a tradition among the car drivers that a motor is very liable to buck if the current is full on while running downhill, but no case of this sort could be substantiated. Cases are reported of motor bucking when the circuit is opened for an instant, as may be caused by the trolley jumping on or off, or by the car passing over a dead rail or over a very dirty track. It is not plain that this is a true case of bucking, but rather of a sudden cessation and re-application of the propelling force.

Sometimes a car will buck at regular intervals. Examination of the motor shows a small bright spot on one brush which rolls to and fro at the contact between brush and commutator. This is intensely bright like a ball of melted metal and grows larger until nearly three-fourths of an inch in diameter, when it suddenly explodes with considerable noise and a blinding flash, and at the same instant the motor "bucks." The car goes on again at once, and the cycle is repeated again in the time required to run from one-half to four city blocks at ordinary speed.

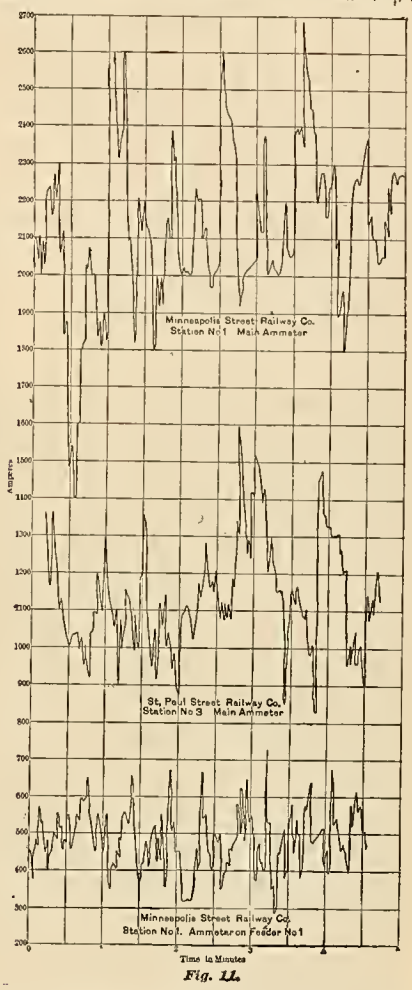


Fig. 11.

ELECTRIC RAILWAY MOTOR TESTS.

In such a case the bucking is stopped by shifting the brushes.

One case is reported where a motor bucked hard, although the brushes were removed so that the armature was entirely disconnected. Here the field was charged by being in parallel with the field of the other motor, and a cross in the armature coils short circuited it. The foreman of the repair shop where our efficiency tests were made states that on six or eight occasions he has seen a motor buck because the carbons were not properly placed in the holders. In testing armatures rapidly, the carbons are sometimes placed carelessly, so that the presser foot rests partly on the carbon and partly on the holder. This presses the carbons against the commutator so as to give good contact until the carbon wears off a little, when the presser foot no longer feeds it in. Vigorous flashing occurs, culminating in a buck, the shock of which may jar the presser foot into its proper position, when the motor

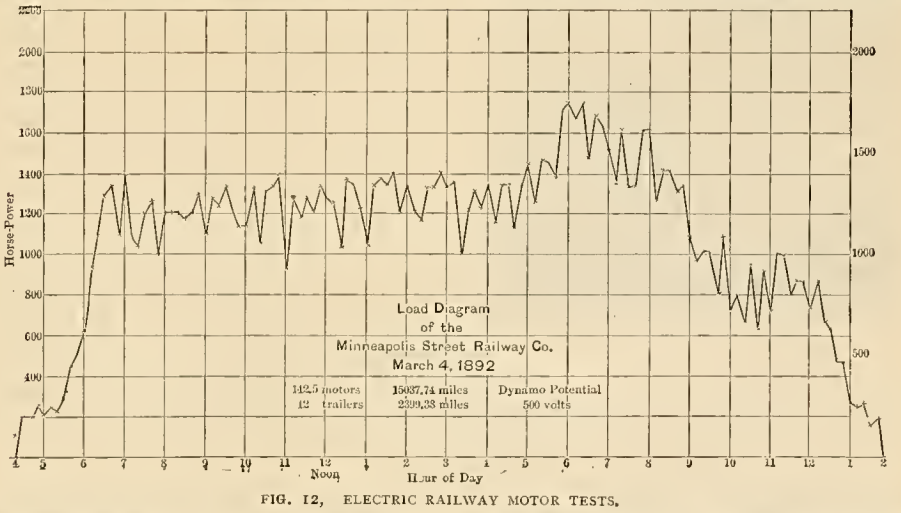


FIG. 12, ELECTRIC RAILWAY MOTOR TESTS.

runs on as if nothing had happened, leaving behind no trace to indicate the cause of the trouble.

Cases have been reported where a wire on the track touched the motor as it passed, thereby grounding it and causing it to buck. Similar grounding may be caused by water or mud being thrown upon certain parts of the motor.

The motors with Gramme ring armatures are known to buck more frequently than those with drum armatures. These buck worse when run on the "loop," *i. e.*, with part of the field coils cut out, some of them bucking regularly every time the loop is cut out. This is one reason why the use of the loop has been abandoned on this road except in a few cases. The machines with commutated fields would buck when the field coils became old, although they showed no signs of being grounded. Bucking became much less frequent when the commutated fields were replaced by a single pair of series coils.

It was noticed that bucking was very commonly preceded by flashing at the brushes, although flashing was not always followed by bucking.

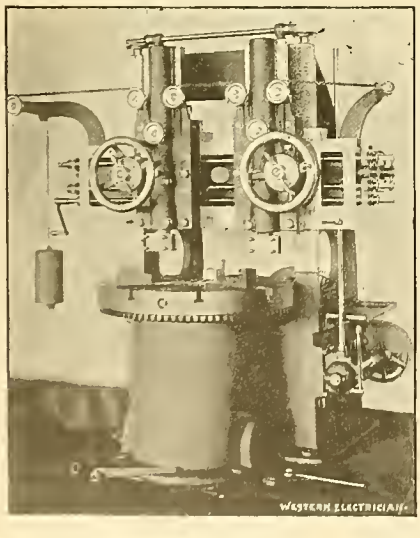
The explanations offered are various. One is that the iron in the fields varies in magnetic quality so that one motor works harder, and by some means acts upon the other as a dynamo. Another is that one motor becomes reversed while the other does not. Another is that bucking is caused by poor brushes or brush holders.

One explanation offered was that a partial break in the circuit, such as may be caused by shaking a loose connection, induces a high electromotive force that causes a flash to span the commutator.

In searching for a reasonable explanation for all these cases in which no second ground connection existed, it was noticed in each case that bucking was more liable to occur when the field was comparatively weak; also where the armature reaction was greater. In each case the neutral line is shifted and the coils under the brushes are in an active field. The large current in short circuited coils further distorts the field, and the sparking at the brush becomes excessive, causing a vigorous flashing. As soon as the counter electromotive force in the sections leaving the brushes rises above 20 volts, the arc is carried around from one brush to the other, thus grounding the positivebrush and short circuting the armature, which then acts as a dynamo and causes the motor to buck. Such bucking is usually less vigorous than when caused by a dead ground on account of the resistance of the arc. This explanation covers all the cases noted.

Such being the causes of bucking, the remedies are plain. Armature reaction must be reduced. This militates against the conclusion drawn by Mr. Parshall, in his recent Institute paper, that the strength of field is of little importance, and the windings of the armature should be a maximum. The liability to bucking would be reduced even when there is a large armature reaction, if the armature is divided into a large number of sections.

An obvious remedy for bucking caused by direct grounding would be to connect the fields between armature and ground instead of between armature and trolley. With such an arrangement a ground on the fields would simply cut out a part of the coils and cause the machine to work harder. A ground at the brush between armature and field would cause a sudden forward impulse on account of the field requiring some time to lose its magnetism, and would blow the fuse. A ground on the armature would likewise cause a sudden forward impulse and blow the fuse. With such an arrangement there would be no true bucking except in case of the flashing, as noted. An incidental advantage of this arrangement is that the difference of potential between the field and the frame of the machine is reduced to a few volts caused by the drop through the field; hence there is less danger of grounding the field. The increased difference of potential between armature and core is only a few volts and would not affect the insulation very much.



BORING MILL FOR ELECTRIC MACHINES.

Boring Mill for Electric Machines.

Now that electric lighting and power machinery is being designed in such large units necessitating the use of heavy castings and other parts, there is, of course, an increasing demand for the products of the machine tool shops. The accompanying cut will, therefore, be of interest to electrical manufacturers.

The machine represented is the 37-inch turning and boring mill of the Bridgeport Machine Tool Works of Bridgeport, Conn. This mill which was designed especially for heavy work, is known as the Bridgeport Works "double header." The table is 36½ inches in diameter and is powerfully geared. The mill has the advantage of sixteen changes of speed. Great care was taken in cutting the teeth on both the table and the pinion. A universal chuck having three jaws is built into the table. The feeds are automatic and range from $\frac{1}{16}$ to $\frac{3}{8}$ of an inch horizontally, and from $\frac{1}{64}$ to $\frac{1}{4}$ of an inch in a vertical direction. In designing this mill special attention was given to the heads, which can be set at any angle, the two bars having a movement of 18 inches and each head feeding independently of the other. The countershaft is arranged with three pulleys for a three inch belt, giving the machine a speed of from 200 to 280 revolutions. This mill does not require an expensive foundation. It weighs 7,500 pounds.

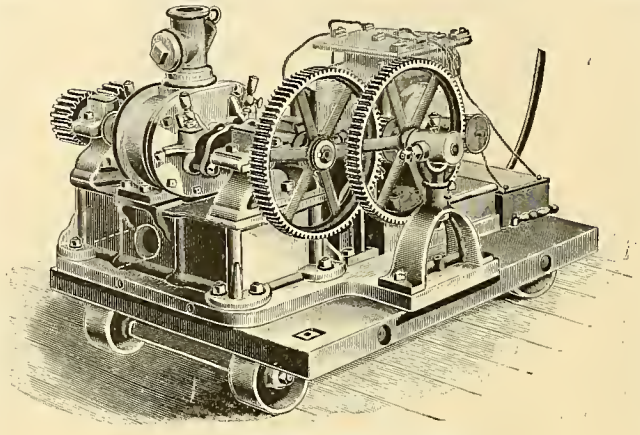


FIG. 1. ELECTRIC PUMPS FOR MINES.

Electric Pumps for Mines.

In the accompanying cuts are illustrated two distinct types of electrically operated pumps for mines. The machine represented in Fig. 1 was devised to meet the demand where it was desirable to have a portable arrangement for pumping water from one level to another, such as filling tanks or for any general line of work. This combination consists of a rotary force pump geared directly to an electric motor. The high speed at which this pump can be run and the small space occupied renders it very efficient in many places. Fig. 2 shows a vertical triplex mine sinking pump, for sinking new shafts or pumping out old ones which have been flooded. This pump is a modification of Gould's standard triplex mine pump in which motor is placed on the top of the pump so as to present as small a cross section of area as possible. It is arranged with tie rods for connecting to a windlass for lowering it. All moving parts are protected with covers. This pump is constructed with best phosphor bronze plungers, valves and seats, lined cylinders and glands, wrought iron connecting rod and bronze boxes; the main bearings are lined with phosphor bronze. All working parts are made to stand extra heavy strain and pressures. These pumps are manufactured by the Gould Manufacturing company, of Seneca Falls, N. Y.

The City & South London Electric Railway.

In the present session of Parliament no fewer than six bills have been introduced authorizing the construction of new underground railways in London to be worked electrically or the extension of those for which acts of Parliament have already been obtained. Three of these bills have passed through the House of Commons, and are in an advanced stage in the Upper House. The present time, therefore, is opportune for drawing attention to the results which have been attained with electric traction on the only railway in the world on which it has been adopted on an extensive scale, and the working of which during the eighteen months it has been open for public traffic is the basis upon which the promotors of the present scheme found their application for parliamentary powers, and from which they must in the future seek the confidence of the public. That the City & South London line has been a success in the system of traction adopted is conclusively shown by the mere fact of the present schemes having been brought forward, and has moreover been abundantly proved by the evidence given before the joint committee of both houses, appointed to consider the proposed lines from the point of view of their public utility, and also by the evidence given as the bills passed through committee in the lower house, but no authentic information has been forthcoming as to the actual results achieved, nor any explanation of any shortcomings in its working which must be obviated in the future.

The City & South London Railway company, then known as the City of London & Southwark Subway company, obtained its first parliamentary powers in 1884 for the construction of a subway from King William street in the city to the Elephant & Castle in Southwark. The success, however, of Mr. Greathead's system of constructing the tunnels, now familiar to all interested in engineering matters, had been so conspicuous that the directors obtained powers in 1887 for an extension to the Swan Inn at Stockwell. Further powers have since been obtained for an extension southward to Clapham, but this portion of the line has not yet been constructed. It was originally intended that the subway should be worked on the cable system, and contracts were actually entered into for this purpose, but the progress of electrical traction in the interval made it necessary to reconsider the system of traction to be adopted. The Bessbrook & Newry Tramway (more correctly described as a railway) had been equipped with an electrical plant by Mather & Platt, and had been running with perfect regularity for three years. The weight of the trains on this line were but little less than the weight of the trains proposed for the South London line, but the cost of haulage had been proved not to exceed 4d. per train mile, although the mileage was small, and consequently fixed expenses high in proportion. The success attending the Bessbrook line induced Messrs. Mather & Platt in 1888 to approach the directors of the City & South London line and to make definite proposals to them for working their line electrically instead of by cable. After long consideration the cable system was finally abandoned and Mather & Platt's scheme accepted in its entirety. Their proposal was accompanied by an offer to work the line for a limited period or to guarantee the cost of traction for two years. The locomotives were to be designed for drawing trains consisting of three carriages accommodating 100 passengers, and weighing four and a quarter tons each, and the generating plant was to be sufficient for working a service of twenty trains per hour. A contract was entered into with Mather & Platt in January, 1889, and their guarantee accepted that the cost of haulage exclusive of driver's wages should not exceed 3½d. per train mile for the maximum service proposed, viz.: 384,800 train miles in the half year, and according to a sliding scale, if the mileage were more or less, increasing up to 7½d. per train mile for 188,666 miles, the actual miles accomplished. The works were completed in November, 1890, and on November 4th were formally inaugurated by the Prince of Wales accompanied by the late Duke of Clarence. On December 18, 1890, the line was opened to public traffic and has now completed eighteen months' running. During this time Mather & Platt's locomotives have run more than 500,000 miles and

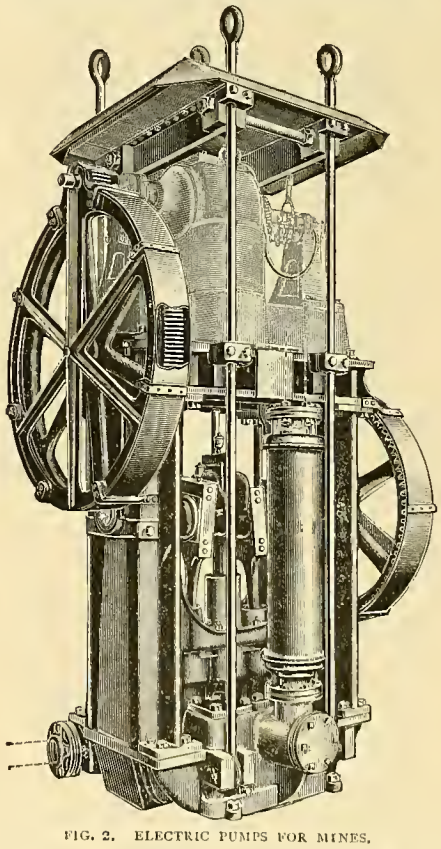


FIG. 2. ELECTRIC PUMPS FOR MINES.

have provided for a traffic of more than 7,000,000 people; but this statement alone does not fully represent the work which has been demanded from them. Owing to the carriages being made stronger and heavier than originally designed, the actual load of each carriage being 7 tons instead of 4¼ tons, the weight of the loaded train was increased to 42 tons or more than 40 per cent. heavier than the trains for which the locomotives were designed. Of this great increase in the loads which their locomotives were to draw, Mather & Platt had no intimation until after all the locomotives were constructed and delivered, and arrangements had been made for the opening of the line. Under such unexpected circumstances the locomotives have at times been overstrained, and delays to the traffic resulted, and the wear and tear has proven somewhat greater than originally anticipated, yet the record of work done by the electrical locomotive in comparison with the work done by steam locomotives is extraordinary. Leaving out of consideration one of the locomotives of special type made for the purpose of testing its comparative efficiency, the average mileage made by the remaining thirteen locomotives during the first year of work exceeded 27,000 miles. On the Metropolitan District railway the yearly average of their locomotives appears to be less than 20,000 miles. The cost of working has proved equally satisfactory. Although the formal guarantee of Mather & Platt was not taken up on account of the carriage failing to comply with the specifications upon which they were requested to base their calculations, yet their estimate of cost has been amply justified. During the second six months of working according to the published half yearly accounts the cost of locomotives and generating power, including wages, repairs and renewals was £6,199 for a mileage of 188,666, or less than 8d. per mile. If allowance be made for the drivers' wages, which were excluded from the original estimate, this is equivalent to about 5¼ d. per train mile, 25 per cent. less than the amount guaranteed, although the weight of the train has been increased 40 per cent. These facts are the more striking when the difficulties of adequate or regular inspection of the rolling stock of a line entirely underground are considered; difficulties which do not obtain in the case of any ordinary railway, and when it is further remembered that the entire system of working was novel, to which the employes of the company were unaccustomed, and for which they had received no special training.

The distinguishing feature of Mather & Platt's locomotive is that the armature is constructed directly upon the axle, and the magnets supported partly upon the axle and partly upon the frame. Probably this design obviating all gear and reducing the mechanics to the simplest elements has contributed more than anything else to the successful working. For the heavier trains which will be required for the working of the new lines there will be no difficulty in designing heavier and more powerful locomotives on the same principle. In the scheme now under consideration Mr. Greathead is proposing large tunnels 12 feet in diameter instead of 10 feet, as in the case of the City & South London line. This will greatly facilitate the construction of larger locomotives and more commodious and comfortable carriages, which are the chief points necessary to secure the success of the new undertaking.

Electrically Illuminated Signs.

The adaptability of the incandescent light for ornamental sign work was recently impressed upon the President of the Long Island railroad and he immediately decided to take advantage of this opportunity in a novel way.

On the corner block of Twenty-third street, formed by the confluence of Broadway and Fifth avenue, New York, stands a small building behind which rises an overtowering construction nine stories high, exposing a plentiful surface of blank wall over the top of its dwarf neighbor. This surface sixty feet wide by sixty-eight feet high has for the past two evenings been the object of much curiosity. Upon the surface of this wall is erected perhaps the largest illuminated sign in the world, and certainly the largest and most conspicuous electrically illuminated sign. By means of this, Mr. Corbin brings on these hot days, to the attention of a sweltering public the fact that the Coney Island of the well-to-do-Manhattan Beach is swept by ocean breezes, and emphasizes the special attractions to be found at that pleasure resort.

In this sign, there are 107 letters, some six feet, some four feet and some three feet high, each one of which is, in reality a box of galvanized iron. In the interior of these boxes arranged in the outline of the letters are a number of small Edison porcelain series plug cut-outs which are here used as lamp receptacles. At the lower end of each letter is a small sliding door, giving access to a plug cut-out which serves to protect the lamps in that letter. Each letter is suspended and clasped top and bottom to two iron rods formed of strong steam piping, which are securely attached to the wall by expansion bolts.

The illumination of the sign is obtained by the use of no less than 1,457 16 candle power Edison lamps of different colors —white frosted, red, blue and green. The current is taken from the mains of the Edison Electric Illuminating company. There are seven sentences, each of which is on a separate and distinct circuit controlled by a lever switch. The switches are arranged temporarily on a rough wooden frame, and as the primary object of the sign is to keep the different sentences constantly appearing and vanishing, the operator is in a state of constant agitation from dusk until 11 o'clock at night. It is a strange fact, but true, that so long as the changes are being rung the public is attracted and stands watching the sign, but as soon as the whole seven sentences are lighted and allowed to remain so, the people move on their way and the crowd disperse. The number of possible changes on these seven sentences is 5,040.

From the switch-board along the roof of the smaller building the line is led to the base of the wall, whence the different wires shoot into the air to their respective sentences.

At the end of each line is a small platform and between each line a long rod of bicycle steel, each fastened securely to the wall, as are the letter supports, by expansion bolts. A flying ladder 8 feet long, with small wheels fit top and bottom to two of these rods and enables the attendant to run himself along each line and replace any broken or burnt out lamps or blown fuses, in a very few minutes.

As an additional protecti onto the wires outside, they are run through conduit tubes thoroughly tapped at their junctures, and are carried up the wall on porcelain insulators.

The great difficulty with this sign, as in the case with all outside electric lighting work is in preventing the deleterious effects of rain and moisture. This has been overcome by fastening to the galvanized iron box letter covers, over each hole through which the lamps are thrust into the receptacles, small pent-houses of iron which project out over the lamps, and carry off the rain, without interfering in any way with the effects of the sign. Any rain which might collect on the lamp surface is prevented from running down in the receptacle by a small projecting brass ring fastened to the outside of the lamp near to the screw shell.

Each sentence is painted a different color so that during the day the only thing lacking is the brilliancy of the illumination.

The entire work was completed in about fifty days. It was designed by, and constructed under the supervision of F. R. Upton, A. D. Page and Mr. McAllister of the lamp works of the Edison General Electric company, Mr. Corbin having practically given them carte blanche.

This illuminated sign is not only a commercial success, but when all the lamps are lighted is really a magnificent sight. Its splendor is visible from far away up town, and its glow on the sky can be easily seen from the East and North Rivers. It is an immense step forward in the evolution of the electric light.

ELECTRICALLY ILLUMINATED SIGNS

Arthur J. Arnot, chief electrical engineer for the city of Melbourne, and instructor in the Electrical Engineering Workmen's College of that city, was in San Francisco recently on a tour of the world. Mr. Arnot's purpose in coming to America is to study the various electrical methods of lighting cities. The authorities of Melbourne recently decided to light that city by electricity, and Mr. Arnot has been selected to ascertain what conduit system would be most satisfactory. He will spend some time in Boston, and go from thence direct to London, Paris, Berlin, Rome, and via Suez to Australia.

CORRESPONDENCE.

New York Notes.

NEW YORK, July 9.—If the electric light man, instead of being on the winning side, was like the gas man, he would now have a fine opportunity to vent his spite. It seems that escaping gas in Elizabeth, N. J., has been destroying a large number of the finest elms in New Jersey during the last few weeks. North Broad street is the most fashionable thoroughfare in Elizabeth, and has long been famous for the beauty of its vegetation. The leading society people of Elizabeth have their homes on it and for some time past have been mystified by the manner in which the splendid shade trees that form the most attractive feature of the street have been dying. It is said that in two weeks forty-three grand trees have decayed and others are suffering. At last suspicion fell on the gas main of the Metropolitan company as being the source of the trouble, but the company's officials indignantly denied it. The property owners, however, secured an injunction restraining the company from operating its main until the gas pipes could be examined, and an expert was appointed to superintend the investigation. The gas main was uncovered for its entire length through the street, and it was found that the leakage was forty-eight cubic feet per hour, when the normal leakage ought not to be greater than three feet. The wrath of the property owners was aroused against the gas company when the facts became known, and Alderman Campbell, one of them, served notice on the Metropolitan managers that he intended to at once bring suit for $5,000 damages for the destruction of his trees. Several other residents intend to follow his example, and the Metropolitan company may have to pay heavily for its neglect to properly lay its gas mains. This disclosure, by the way, should lead to an investigation by the Board of Health.

Trenton, N. J., has caught the underground fever, and from present appearances that city will be likely to ape its big neighbor and prevent the erection of overhead electric wires. On Wednesday the New Jersey Electrical Subway commission held an important meeting and made its first decisive move toward carrying out the law to further restrain the erection in the state of overhead wires. This act was passed last winter. During the commission's sitting it received a number of petitions for permission to erect wires overhead. Two resolutions were passed bearing direct upon the execution of this new law. One resolution was to the effect that, since corporations have placed electric wires and cables over the streets and highways in cities of the state without permission of the board, in direct violation of the act that created the commissioners of electrical subways, the secretary was authorized to notify all electrical wire and cable companies that the placing of such wires over the streets without permission from the board was illegal, and that the commission would henceforth meet every Tuesday at the state house to receive applications from such corporations. The commissioners also require that each one of these corporations stringing wires overhead must before the first day of September next, furnish a statement

showing the number of miles of wire used by them in the state. The commission also took into consideration the placing of all wires underground, and in this connection passed a resolution that the secretary of the board notify the corporations owning wires above the streets in Jersey City and Newark that the board will meet on Tuesday, September 6th, for the purpose of hearing arguments by them and their representatives why such wires should not be placed under ground.

The good work for greater facilities for rapid transit on the island that our great city covers, is progressing slowly but surely. On Thursday the general term of the Supreme Court approved the report of the three commissioners appointed to review the work of the original Rapid Transit board. It now remains to test the financial feasibility of the scheme. With relation to the money side of the question the judges say: "We are of the opinion, upon an examination of the facts, that the success of the enterprise is not a question of engineering but a matter of finance; that the engineering problems can be overcome without any difficulty, providing the money is behind the engineer, and that under the plan of construction adopted by the Rapid Transit commissioners most if not all of the objections which have been raised to the fact of the railroad being constructed in a tunnel, will be obviated.

"In the first place, there will be no combustion in the tunnel in the production of the motive power, which is a main cause of the vitiation of the atmosphere in the tunnel. In the next place, the cars will not be lighted either by gas or oil, and hence this source of pollution will be avoided. And, furthermore, in consequence of the rapid movement of the trains it will be impossible for the air in the tunnel to stagnate, which is another prolific source of pollution, and there seems to be no difficulty whatever in successfully coping with the problem of ventilation."

The Rapid Transit commission has appointed John Bogart, ex-state engineer and surveyor, chief engineer of the commission. This office has been vacant since the adoption of the general plans, when William E. Worthen, author of the scheme, having completed his work, was appointed consulting engineer. Mr. Worthen will retain his relationship to the commission as consulting engineer.

W. F. O.

Milwaukee, Wis.

MILWAUKEE, July 9.—A week ago to-day the Milwaukee & Wauwatosa rapid transit line was formally opened. The first car left the corner of Third street and Grand avenue at 2 o'clock in the afternoon. It had on board Henry C. Payne, Eugene S. Elliott, Captain Pabst, Managers Lynn, Hommell and Stickney, and more than a score of other people. The Rapid Transit line has been leased by the Villard syndicate, and Mr. Payne was there to take possession of it. Cars are now run each way every half hour. They leave the corner mentioned, run north on Third street to Walnut street and thence west to Wauwatosa over the Villard and Rapid Transit tracks. For the trip between Wauwatosa and the city double fare is charged. The track consists of T rails. The power house is located at Wauwatosa and is a very substantial plant.

Electrical Engineer Louis Gibbs, of the Milwaukee Street Railway, was "shocked" the other day. He and an assistant were repairing a break in a wire from which the current had been turned off. The current was suddenly turned on again and the two men were first doubled up and then knocked down. Their injuries consisted of badly burned hands.

Steps have been taken to appeal the case of Charles F. Pfister and August Vogel against the Milwaukee Electric Railway company to the Supreme Court. It was in this case, it will be remembered, that Judge Johnson, of the circuit court, held that the hypothecation of the company's bonds to the plaintiff, Pfister, was contrary to the statute requiring that no bonds should be issued at less than 75 per cent. of their face value. The bonds issued to Pfister were of the face value of $250,000 and were given to him to secure a loan of $125 000. The attorneys have held a meeting and agreed upon the form of the circuit court's decree, in order that the case may be presented to the Supreme Court in proper shape.

For some time trouble has been brewing between the West Side Railway company and its patrons on one hand and James O'Donnell, a contractor who is improving the upper part of Wells street, on the other hand. The street railway people claimed that Contractor O'Donnell was doing his work in such a manner as to cause them the greatest amount of trouble. The contractor took a different view of the matter and asserted that the street cars were being run in such a way as to interfere with his work. The people who ride on the street cars complained to the Board of Public Works and so did the contractor. The board submitted the matter to the city attorney, who decided that the contractor, while he was doing the city's work, could close the street altogether if he wanted to and prevent the operation of street cars or any other traffic upon the thoroughfare. Last Tuesday, however, the West Side Railway company instituted legal proceedings against Contractor O'Donnell and secured a temporary writ restraining him from "unnecessarily" interfering with the running of street cars on Wells street. The writ being worded so guardedly, the contractor was in a quandary. He finally decided that the wisest thing he could do was to stop work on the street altogether until the case was decided.

A dispute has arisen between the Wisconsin Telephone company and the common council of Racine. Some years ago the company was granted authority to erect poles and string wires in Racine. The city, during that time, has been paying full rates for its telephone service. Recently, however, Racine has put in the police patrol system, and, finding that a dozen or more telephones were needed in this service, asked the company to furnish them gratis. The company refused. Then Mayor Case informed the company, after it had finally offered the telephones at $15 a year, that if the instruments were not furnished free or at working cost, the city would compel the company to remove the poles from the principal streets and place the wires underground. The directors of the company will consider the matter. In the meantime a resolution to compel the company to use the underground system has been introduced in the Racine council.

The common council of Marshfield has granted Col. W. H. Upham a franchise to build water works and an electric light plant in that enterprising city. A provision of the ordinance inserted at Col. Upham's request authorizes the city at its option to buy the system at its completion upon very liberal terms.

Col. James T. Barber and other gentlemen have asked the Eau Claire common council for an electric light franchise. The Fond du Lac Street Railway, Light & Power company, composed principally of eastern capitalists, occupies the Eau Claire field now, and will vigorously oppose the Barber scheme. Mr. Barber is interested in the Eau Claire gas works, and Attorney H. H. Hayden, who represents the established electric railway, asserts that the application for an electric light franchise is made for the purpose of compelling his clients to buy out the gas works. Col. Barber denies this.

The Sheboygan Electric company has already contracted to furnish power to five manufacturing establishments at that place. These establishments will discard their steam plants and use electricity altogether. The electric light plant, it is expected, will be installed in a week or ten days, and the company will then be able to furnish nearly 200 horse power.

A company is being formed to build an electric railway between Sheboygan and Sheboygan Falls. The distance is about five miles, and the company will have a capital of about $75,000. The projectors of the road will plat about 200 acres of residence land along the line, charge a low fare and endeavor to make Sheboygan Falls a suburb of Sheboygan. A survey of the proposed line has already been made.

Mayor J. I. Case, of Racine, has made application to the common council of Green Bay for a franchise to build an electric railway in that city. He will probably succeed in securing the franchise.

A statement issued by the North American company shows that that company's interest in Milwaukee electric railways is the largest item in its list of assets. The interest consists of stock and bonds. The North American holds $2,887,000 of the Milwaukee Street Railway company's stock. The stock is put in at 25, giving it a valuation of $721,750. Of the bonds, $3,276,000 are put in at 90, giving a valuation of $2,948,400. The sum of $301,500 has been paid toward the purchase of the West Side railway and the balance will be paid in the fall. It is explained that the stock is appraised on the basis of sales made on the New York Exchange. The amount expended in reconstructing the Milwaukee lines appears to be $626,658. Fully a million more, however, will be expended before the system is perfected. The statement, which was prepared by Henry Villard, goes on to state that in order to meet these expenses it has been found advisable to borrow money at current rates rather than press the sale of the bonds. The report shows what your correspondent asserted several months ago, that the Villard syndicate has secured possession of street railways in Cincinnati. It states that practical experiments with electric locomotives will be undertaken within a year. It adds that two systems, overhead and surface, will be tried.

The Postal Telegraph company has purchased the telegraph line between Milwaukee and Chicago, which has been operated for five years under contracts with the builders of the line. The owners were associated under the name of the Postal Telegraph Cable company. By the terms of the lease the Postal Telegraph company had the privilege of purchasing the line at the end of five years. The time expired and the sale was agreed upon last March. Chicago and New York capitalists built the line.

The Milwaukee Street Railway company is trying a large double truck open car on its Farwell avenue line. The car, which was made by the Jones company, contains ten rows of seats and can easily seat fifty people. It turns the curves easily, rides smoothly and makes little noise. On a pinch it could easily carry a hundred people.

C.

St. Louis, Mo.

ST. LOUIS, July 9.—D. G. Hamilton of Chicago, president of the Consolidated Cass Avenue Street Railway lines is in the city, and stopping at the Southern. He is in consultation with the local management regarding the change in motive power from horses to electricity, preparations for which are now in active progress.

The city council of Pinckneyville, Ill., has granted an electric light franchise to H. W. Dunkworth, who will at once proceed with the installation of a plant.

W. N. Matthews, vice-president of the St. Louis Electrical Supply company will leave on Sunday night for an extended Southern trip. He will be absent about two months.

The Edison Electric Light & Power company of Kansas City, has increased its capital stock from $150,000 to $250,000.

A scheme is on foot to establish a belt electric railway around Forest Park, covering all the points of interest and connecting with all existing lines to the city. The Board of Public Improvements proposes to offer the franchise for sale to the highest bidder.

The Alton & Suburban Electric Railway company has been incorporated at Alton, Ill., with a capital stock of $50,000. It is understood to be backed by St. Louis capitalists, who will build the new lines into the suburbs of Alton, and connect with existing lines. Negotiations are said to be on foot looking to a consolidation with the present street railways in Alton, and the building of an electric system throughout.

The city council of St. Charles, Mo., has just levied a special tax of ten cents per $100 for electric lighting purposes. The city operates its own arc light plant, and the last report of the city treasurer showed a balance of $2,489.75 to the credit of the electric lighting fund.

Supervisor of city lighting, Andrew J. O'Reilly, reports the following, as the number of public lights now rented by the city, including all recently ordered: In buildings, 3,708 16 candle power incandescents, and 51 2,000 candle power arcs. In streets, alleys and parks, 1,817 30 candle power incandescent and 2,248 2,000 candle power arcs. The arcs are all furnished by the Municipal Electric Light & Power company and the incandescents jointly by the Missouri Electric Light & Power company, and the Laclede Gas Light company. Fifty additional 30 candle power incandescents have just been ordered erected in O'Fallon Park, and thirty in Forest Park.

The Jefferson Avenue Street Railway company, now operated in conjunction with the Union Depot lines, recently secured permission to change its motive power from horse to electricity. It is now reported that this work has been deferred till 1895. This line will shortly be the only one in the city operated by horses, except in the suburbs, which are also preparing for the change to electricity.

The Benton Bellefontaine Street Railway company has discontinued its connection with the station of the Municipal company, and is depending wholly on its own resources. The second Corliss engine, with its two 350 horse power Thomson-Houston generators is now ready for regular service.

The Laclede Gas Light company's electric light station at the foot of Mound street, is undergoing some radical changes and improvements. A 250 horse power compound condensing Armington and Sims engine, and a 2,500 light. Brush alternator have recently been started up, and an 80 kilowatt C. & C. generator for power purposes, has just been received.

The large combined engines and generators for the Consolidated Cass Avenue lines are each to be of 1,000 horse power capacity, instead of 100 as heretofore reported.

The Suburban Electric Light & Power company has contracted with the Municipal Electric Light & Power company of St. Louis, to extend its main to Webster Groves via Shrewsbury Park, and Old Orchard. The most dis-

tant points reached will be nearly ten miles distant from the company's power house.

The mayor has signed the Clayton and Forest Park Railway franchise authorizing the company to build and operate a passenger railway between Forest Park, in the western suburbs of St. Louis, to the city limits, from which point it is to be extended westward to Clayton, the county seat of St. Louis county. At Union avenue a junction will be made with the St. Louis and Suburban Railway company's tracks, over which a connection or direct route may be had into the heart of the city. The new company is authorized to operate either by cable, electricity, conduit, storage battery or overhead wire systems. It is understood the latter will be used. The maximum speed allowed in the city limits is fifteen miles per hour. The franchise expires in 1925. It is understood that the work of construction will begin at once. Robert E. Carr of St. Louis, is president of the company. W. H. B.

Detroit, Mich.

DETROIT, July 9.—The Detroit Electrical Works, which have the contract to furnish the motive power for the rapid transit line on Jefferson avenue, have begun putting in the plant in the barn of the Detroit Citizen's Street Railway company. The plant will be located in the basement of the building and will be cut off entirely from the barn proper. Three 150 horse power boilers, engines and dynamos will be put in, each set to run independent of the others. The machines will be capable of propelling from 20 to 25 motor cars, each one drawing two or three trailers. The work will probably be completed early in August. The work of setting poles on this line is nearly finished. It was intended to have the system in operation by July 4th, but it will be necessary to extend the time two or three weeks. G.

PERSONAL.

Chicago Electric club members will be interested in knowing that C. Villeneuve has been appointed club manager.

J. B. Wood, who for the past two years has occupied a prominent position with the Great Western Electric Supply company, has resigned and accepted a position with the Knapp Electrical Works.

E. R. Crolius, who has, until recently, been connected with the Globe Light & Heat company, Chicago, has been appointed manager of the Chicago Electric Manufacturing company, vice E. W. Hammer resigned.

Fred H. Angell of the Utica Electrical Manufacturing Supply company, Utica, N. Y., was in Chicago on Monday of last week. Mr. Angell is making an extended western trip for his company, and will not return east for some time.

J. A Hanna has been appointed general traveling salesman of the McGuire Manufacturing company, Chicago. Mr. Hanna has for eight years been connected with the J. G. Brill company of Philadelphia, and has a host of friends in the electrical fraternity who wish him success in his new position.

Charles D. Shain, formerly eastern district manager of the Edison company, and at present in charge of the supply department of the General Electric company, New York, has resigned from the latter position, his resignation taking effect September 1st. Mr. Shain is one of the most capable and best known men in the electrical business. His record with the above mentioned companies has been an enviable one.

NEW INCORPORATIONS.

Worcester & Shrewsbury Street Railway company, Worcester, Mass.; capital stock, $20,000; to operate a street railway.

Standard Electric Light & Power company, North Tonawanda, N. Y.; capital stock, $100,000; producing electricity for light, heat and power.

Berlin Electric Light company, Portland, Me., capital stock, $50,000; generating, producing and distributing electricity for light, heat and power; H. R. Virgin, Portland, Me.

Northern Light company, Chicago, Ill.; capital stock, $100,000; to operate an electric light and power plant and all machinery necessary for same; Lewis Lusk, Antigo, Wis.

Eastern Automatic Lighting & Extinguishing company, Portland, Maine; capital stock, $300,000; street and commercial lighting; Franklin C. Payson, Portland, Maine.

Peoples Electric Light & Power company, Evansville, Ind.; capital stock, $100,000; to generate electricity for the purpose of light, heat and power; C. C. Miller, Fort Wayne, Ind.

Ashland Lighting & Street Railway company, Ashland, Wis.; capital stock, $200,000; operating and maintaining a lighting plant and electric railway; Tompkins & Miller, Ashland, Wis.

Ceramic City Light company, Newark, N. J.; capital stock, $50,000; transmitting electricity for the purposes of furnishing light, power and heat, etc.; J. V. Bacot Jersey City, N. J.

Delta Electric company, Cairo, Ill.; capital stock, $150,000; to operate electric light, heat and power plants, railroads, fire alarms, and all business incidental; H. Schulze, Cairo, Ill.

Elevated Suspension Railway company, Chicago, Ill.; capital stock, $4,000,000; to operate and build electric elevated suspension and dummy railways; G. I. Ladd, 2128 Michigan avenue, Chicago, Ill.

Chillicothe Electric Railway & Lighting company, Chillicothe, O.; capital stock, $100,000; building and operating electric street railway, furnishing light and power; L. T. Neal, Chillicothe, O.

Denison Electrical Manufacturing company, Portland, Maine; capital stock, $500,000; to manufacture and deal in articles composed of mineral or vegetable substances; Josiah H. Drummond, Portland, Me.

United States Wire and Cable company, Schenectady, N. Y.; capital stock, $1,000,000; to manufacture and sell wire, cables and conductors and every kind of wire used in connection with electrical apparatus.

Kalispell Water & Electric company, Kalispell, Mont.; capital stock, $250,000; to deal in water power and electricity for manufacturing, mining or mechanical business, lighting, heating, and other useful and industrial purposes.

Municipal Improvement & Investment Corporation (incorporated in W. Va.;) New York, N. Y; capital stock, $500,000; to acquire by purchase, lease or otherwise, street railways, water works, gas and electric light plants, etc.; Jno. Ferguson, 52 Broadway, New York N. Y.

Port Gardner, Lake Stevens & Eastern Railway company, Everett, Wash.; capital stock, $250,000; to build, own and operate a railroad in Snohomish county and telegraph and telephone lines, gas and electric light plants; Pritchard, Stevens, Grosscup & Seymour, Tacoma, Wash.

North American Gas company, Chicago, Ill.; capital stock, $500,000; to manufacture and supply illuminating and fuel gas and electricity for light, heat and power, from natural and artificial products; John D. Cameron, 1394 Chamber of Commerce building, Chicago, Ill.

New Kensington Traction company, New Kensington, Pa.; capital stock, $2,000; construction and operation of motors and cables or other machinery for supplying motor power to passenger railways and the necessary apparatus applying to same; Lyon, McKee & Sanderson, Pittsburg, Pa.

New Kensington Heat, Light & Power company, New Kensington, Pa.; capital stock, $2,000; supplying light, heat and power in the township of Lower Burrell, Westmoreland county, Pa., and to persons, partnerships and associations therein, etc.; Lyon, McKee & Sanderson, Pittsburg, Pa.

Claflin & Kimball, Boston, Mass.; capital stock, $135,000; to manufacture and sell electric dynamos, motors, batteries, arc and incandescent lamps and all kinds of electric appliances, and to act as manufacturers' agents for the purchase and sale of such goods; Jos. Walker, 53 State street, Boston, Mass.

Wattsburg Light & Power company, Wattsburg, Wash.; capital stock, $25,000; to own, operate and maintain power machinery for the generation of light, heat and power; own, operate and maintain electric light plants, telephone and telegraph lines and street railways; John. C. Onderdonk, Spokane, Wash.

ELECTRIC LIGHTING.

An electric light plant is to be established in Deadwood, S. D.

The electric light company of Huron, Mich., will build a $3,000 addition to its station.

The capacity of the plant of the Ironton, O., electric light company is being greatly increased.

The Ithaca, N. Y., electric lighting company's plant is being greatly improved and enlarged.

The Kansas State university buildings are now lighted by 400 incandescent lamps, put in by the electrical engineering students.

By a vote of 436 to 78 the citizens of Lansing, Mich., have decided to bond the city $60,000, for the establishment of a municipal electric light plant.

The electric light station at Wapatah, Ind., was recently destroyed by fire. The loss is between $10,000 and $12,000, and the insurance was $4,000.

The Suburban Electric Light company of Newport, Ky., has changed hands. Col. Stewart of the Thomson-Houston company has purchased the plant.

Charles Ffrench of London, Eng., proposes to construct an electric light and power plant in Wichita, Kan., if the city council will give him a franchise.

The Cumberland Electric Power & Lighting company of Nashville, Tenn., will erect a new station at Front and Whitesides streets at a cost of $20,000.

The Water, Light & Power company of Superior, Wis., has secured the contract to equip the whaleback steamers Pillsbury and Washburn with a complete electrical plant. Thomson-Houston 150 light incandescent dynamos will be used.

It is now considered probable that the United States Electric Lighting company will be given permission to lay a number of miles of conduits in Washington, D. C. The district attorney has given an opinion favorable to the company, and it is likely that the district commissioners will act in accord with this opinion.

ELECTRIC RAILWAYS.

Racine, Wis., will soon have an electric street railway

The new electric railway in St. Cloud, Minn , has been formally opened for public use.

An electric railway is to be built to connect Denver, Colo., with the outlying village of Brighton.

The substitution of electrical for animal power on the Citizens' street railway of Kansas City is proposed.

A project for building an electric railway from Cadiz to Gracey, Ky., a distance of about twenty miles, is being pushed by capitalists, and it is stated that the road will be built.

B. F. Stewart, Chicago representative of the Westinghouse Electric & Manufacturing company, has been awarded the contract for 25 double equipments, single reduction motors, for the south side cross town lines of the Chicago City Railway company.

Weymouth, Mass., will probably have an electric railway soon. It is the intention of the Weymouth & Hingham company to build a road from North Weymouth to East Weymouth railroad station, and thence to the railroad station at Weymouth Landing.

The first trains over the new lines of the Calumet electric street railway, in Chicago, were run on Sunday from South Chicago and from Cottage Grove avenue at Seventy-first street to Kensington. The road consists of two lines—one extending from the southern terminus of the South Side cable road, Cottage Grove avenue and Seventy-first street south to Ninety-third street and east on Ninety-third street to South Chicago; the other from Cottage Grove avenue west on Ninety-fifth street to Michigan avenue, south on Michigan avenue to One Hundred and Nineteenth street, passing through Roseland, Kensington, Burnside, Dauphin Park and Grand Crossing.

ELECTRIC MINING.

The mill now building in Ruby Hollow, says the *Salt Lake Tribune*, will use the Gervase-Brown process. The process is a new one and is said to work very well. The smelting will be done by electricity and only the fuel needed for steam power will be used. The mill will have a capacity of fifty tons in twelve hours. The treatment of ore is estimated at $1.75 to $2 per ton, and 97 per cent. of the gold and silver can be saved. The process will also save the copper and lead, and zinc and silica do not act as a base.

TELEPHONE.

Omaha and Fremont, Neb., are now in telephonic communication, a metallic circuit being used.

S. I. Kimball, general superintendent of the United States life-saving service, is advertising for proposals for telephonic supplies for the construction of a telephone line on the coast of Virginia, from Cape Charles to Assateague island. Bids will be received at the treasury department in Washington until 2 P. M. on July 21st. Forms of proposal, with specifications containing full information, can be obtained from the inspector of life-saving stations, 24 State street, New York city.

TELEGRAPH.

The opening of independent offices at Buenos Ayres, Mendosa and Villa Maria, Argentina, by the Central & South American Telegraph company, via Galveston, insures direct communication and avoids the difficulties formerly existing when the receipt and delivery of messages were made through government and other lines.

MISCELLANEOUS.

An elaborate electric fountain will form a prominent feature of the decorations at Denver during the conclave of Knights Templar.

George E. Fisher, manager of the Commercial Electric company, Detroit, Mich., has been appointed chief of the electrical division of the Detroit exposition for 1892, which promises to be quite an elaborate affair. The buildings and grounds occupy 72 acres, and the exposition will open August 23d and close September 2d. The Commercial Electric company has the contract for the electric lighting, which will require 300 arc lights and 1,000 incandescents.

TRADE NEWS.

The Eddy Motor company, of Windsor, Conn., is rapidly pushing the large addition to its factory, and hopes to have it completed by August 1st.

P. C. Ackerman, resident manager of the American Electrical Works, New York, will shortly make an extended trip through the West and South.

In view of the great amount of trouble experienced this season on electric roads from lightning, the Railway Equipment company, Chicago, states that it is about ready to place on the market a new lightning arrester for station, car and line use.

The Great Western Electric Supply company is doing an unexpectedly heavy business so far this month. Business in all departments is far in excess of that for the cor-

responding period last year, with an excellent outlook for the balance of the month.

The Chicago office of the Mather company is probably of more importance to the parent company, as far as profits are concerned, than any other office. The contracts so far this year have been satisfactory, and at present there is a large amount of business in sight.

The McGuire Manufacturing company, Chicago, has closed several large contracts of late for truck equipments, including the following: South Chicago City Railway company, Kankakee Electric Railway company, Toledo Consolidated Street Railway company, and Pueblo City Railway company, Pueblo, Colo.

G. M. Angier, general agent of the Mather Electric company, has just returned from a business trip South and West. Mr. Angier has established a number of agencies and reports the outlook for business good, especially in power transmission and isolated lighting plants of which the Mather company makes a specialty.

The American Battery company has contracted with an English syndicate for the sale of the foreign patents on the Morrison storage battery. The representatives of the syndicate have just left for New York, and it is expected that the final money will be paid inside of sixty days. It is said the purchase price will approximate one million dollars.

The National India Rubber company, of Bristol, R. I., is very busy filling the orders on hand for its seamless rubber insulated wire which is well known both in the East and West. On account of the large increase in business the company has been obliged to install extra machinery. A large order for braiders from the New England Butt company, of Providence, R. I., is now under way.

The Western Electric company, Chicago, has recently closed a contract to light the Henrietta Theater, Columbus, O., using the Western Electric direct current system. The Henrietta is an elegant new theater, built as an addition to the Chittenden Hotel, and is to be fitted throughout in the best possible style. Four thousand incandescent lights will be installed with special switch-boards, etc., for the stage effects.

The Porter-Leavitt Electric Motor company, of Providence, R. I., is busy with orders for its gravity battery motor. This motor is mounted on a polished cherry base, provided with a two-point switch, brass binding posts for connections, and the parts are all interchangeable. Embedded in the base there is a resistance coil which is employed to close the circuit when the motor is not in use, thus preserving the battery in good working condition.

The Ball Electric Light company of New York, is sending to the trade a very handsome little pamphlet with illustrations of its celebrated dynamo. The catalogue contains a number of valuable testimonials, and a partial list of Ball plants which are in operation in this country. The Ball Electric Light company is represented by H. M. French, Equitable building, Boston; E. O. Partridge, Rookery, Chicago; Enterprise Construction & Supply company, New Orleans; Novelty Electric company, Philadelphia; Pioneer Electrical company, Aberdeen, S. D.; George W. Finch, Escanaba, Mich.; Martindale & Lake, Chattanooga, Tenn.; Ball Electric Light company, Toronto, Ont.; T. L. Pickle, Abingdon, Va; A. J. Myers, Oakland, Cal.; Skilton & Son, New York. The Ball company also has agents in Central and South America, Cuba and the West Indies.

Julius Lefmann, 2200 North Second street, St. Louis, Mo., manufacturer of the three-joint iron and steel electric railway poles and overhead electric railway line supplies, has just issued a new catalogue. Mr. Lefmann makes a specialty of the three joint pole. This style of pole is well appreciated, to judge from the number of roads that have adopted it. Following is a list of railways that use three-joint poles: Benton-Bellefontaine Railway company, Lindell Railway company, Missouri Railroad company, St. Louis Railroad company, South St. Louis Railway company, St. Louis & Suburban Railway company, Union Depot Railway company, all of St. Louis, Brooklyn & Coney Island Railway company, Eckington & Soldiers' Home Railway, Washington, D. C., Fulton County Railway company, Atlanta, Ga.; Jacksonville Railway company, Jacksonville, Ill; Minneapolis, Minn., Street Railway, St. Paul, Minn., City Railway company, West End Railway company, Boston, Mass.; Citizens' Rapid Transit company, Nashville, Tenn.

BUSINESS.

Word comes from the Detroit Electrical Works to the effect that one of the old type machines furnished to the Posselius Bros. Furniture company of Detroit, was fitted with carbon commutator brushes, and after 16 months' use, the machine running for a number of hours each evening, the original set of brushes was still in use and not one-third worn out. The commutator itself, although glazed by long use, showed no signs of wear.

The Central Electric company, Chicago, has just received a consignment of Lundell fan motors, and they are already making a breeze. This company reports sales of okonite wire for the past week as almost equal to the sales of the preceding week, which were the largest in the history of the company. It also reports a very lively demand for arc light carbons. The Washington carbons for which it has the general western agency, are giving general satisfaction.

General Manager G. P. Mackie of the Electric Secret Service company, New York, has just returned from Denver, Colo., after an absence from home of six weeks, and he states that over 100,000 miles of railroad were represented at the Denver meeting of the railway telegraph superintendents. Mr. Mackie closed a number of contracts for his company's Leonard interlocking block signal system. This new method of signaling is worthy of a careful investigation by all those interested in the safe running of trains. In brief it may be said that this system is intended to make both operators responsible for the trains in a block; the signals can only be worked by the co-operation of both block operators. The Electric Secret Service company has issued a circular explaining in detail the operation of the Leonard system.

The Bridgeport Machine Tool Works, of Bridgeport, Conn., have long been known for the excellent quality of apparatus which they have produced. From a very small beginning, this concern has grown to be one of the largest of its kind in the country. The factory is fitted throughout with the best class of machinery, and the rapid increase in business during the last year has necessitated the building of an 80x100 feet two-story addition to the already large plant. The new structure is entirely fire-proof, the iron work being done by the Berlin Iron Bridge company, of East Berlin, Conn. A Yale & Towne traveling crane will be placed in the new building. General Manager H. Bullard is to be congratulated on the healthy growth of the business with which he has been so closely identified.

"Electric sand" is the name of a new substance for which some extraordinary claims are made. Word has been received from the Wright Universal Electric company of New York, that after many years of investigation and experiment, it is now enabled to present to the trade a new product. "Electric sand" is described as a simple compound resembling sand, but which is as soluble in water as sugar. When the Wright battery is charged with the sand and water, the generation of the current is instantaneous. It is stated by the company that the chemical action on the zinc and carbon plates is not attended with the formation of crystals, thus obviating the cessation of action of the battery by reason of insulation due to crystallization. The current generated by electric sand, this company claims, is absolutely and perfectly harmless in any of its appliances. Although the Wright Universal Electric company is new to the trade, it states that it has orders on hand for electric sand, which will keep it busy for some time.

The fuse wire department of the Sperry Electric Mining Machine company, Chicago, is discovering many interesting facts in testing its product. Any person familiar with the fuse wire market cannot have failed to notice the very material difference in the length of fuses recommended by different makers. For instance 100 ampere links may be found on the market varying from one to eight inches in length, and there is a corresponding disparity in other sizes. Doubtless the shortest fuse which will act perfectly under all circumstances is the one to be recommended, but just what relation the length bears to the fusing point is a feature in fuses that the Sperry company has been investigating. To show the actual variation in fusing point for different lengths the following examples are given: Wire rated as 5 ampere safe carrying capacity in 1¾ inch length, fuses at 10 amperes, while in ¾ inch length at 19 amperes, 10 amperes in 2¾ length fuses at 18 amperes, in ⅜ inch length at 29½ amperes, 50 amperes in 3 inch length fuses at 72½, in 1 inch length at 110 amperes, 200 amperes in 4⅜ inch length fuses at 244 amperes, in 1 inch length at 316 amperes. It will be seen from the above that in the small sizes a large percentage of allowance is made between safe carrying and fusing points, as the danger element is small and the unnecessary blowing of a fuse troublesome. As the capacity increases the percentage is lowered, until at 500 amperes but 10 per cent. of allowance is made. It must be understood, however, that the results in case of the short fuses are dependent in a large measure on the terminals, and this element of uncertainty is inevitable whenever such fuses are used since it is impossible for the manufacturer to anticipate what sized terminals will be used by the station superintendent.

ELECTRICAL PATENTS.

Issued July 5, 1892.

478,086. Electric Cyclometer for Velocipedes. Joseph Butcher, Melrose, Mass.

478,097. Electric Measuring Instrument. Sydney Evershed, London, England.

A small mass of magnetic material is attached to one side of an arbor lying parallel to the axis of the coil and the magnetic field is unequalized by means of beveled blocks of metal; the magnet in moving to the strongest point of the field turns the arbor and actuates the index fingers.

478,098. Apparatus for the Measurement of Electrical Resistances. Sydney Evershed, London, England.

This instrument is devised for the measurement of large resistances, and consists of a large coil in series with the resistance to be measured and surrounding a pivoted magnetic needle, in combination with two shunt coils whose axes are at right angles to and intersecting the axis of the series coil, and an index finger traveling over a graduated scale.

478,104. Brush Holder for Dynamos and Motors. Merrill H. Hathaway, Springfield, Mass.

478,135. Railway Train Signal Apparatus. Charles Selden, St. Louis, Mo.

478,138. Electric Mine Car. Elmer A. Sperry, Chicago, Ill.

The invention consists in improved means for transmitting power from the motor to the traction wheels on the truck, and the transmission of draft between the trucks and the frame, while permitting deflection of the trucks.

478,139. Electric Locomotive. Elmer A. Sperry, Chicago, Ill.

478,140. Trolley Wire Splice, Elmer A. Sperry, Chicago, Ill.

478,142. Dynamo Electric Machine or Motor. Elmer A. Sperry, Chicago, Ill.

478,145. Electric Arc Lamp. Elihu Thomson, Lynn, Mass.

A constantly running electric motor, whose speed depends directly on the condition of the arc, acts to feed the carbon when the speed is accelerated and to separate the carbons when retarded.

478,149. Incandescent Electric Lamp Socket. Henry E. Werline, Lancaster.

478,152. Device for Reproducing Characters. Henry C. Bridger, Wood Ridge, N. J.

A message is written upon an insulating material with metallic ink and carried upon a table moving beneath a transmitting point, the table having a continuous to-and-fro motion and a step-by-step lateral motion.

478,155. Electric Alarm Clock. George C. Darche, Chicago, Ill.

478,175. Electric Railway Conduit. Milton Shoemaker, Sioux City, Ia.

478,180. Time Switch for Electric Circuits. Benjamin E. Waters, Brockton, Mass.

478,182. Electrical Distribution for Cars. Samuel Young, Morris Moskowitz, Leon D. Adler and Joseph Loewenberg, Newark, N. Y.

The invention is designed to utilize the waste energy from one or more of the car wheel axles for operating an air compressor, which in turn drives an air engine, causing the latter to drive a dynamo.

478,183. Electric Car Lighting System. Samuel Young, and Morris Moskowitz, Newark, N. J.

478,186. Electric Lighting System. Edward T. Cooke and William H. Mackay, St. Louis, Mo.

The invention embodies means for lighting and extinguishing one or more lamps in a circuit from different points.

478,201. Electrical Brazing Device. Willis Mitchell, Malden, Mass.

478,204. Illuminated Advertising Sign. Charles R. McGimsey, New York, N. Y.

478,230. Secondary Battery. James H. Gerry, Brooklyn, and Charles E. Long, New York, N. Y.

478,237. Time Registering Apparatus for Electricity. Henry H. Pattee, Monmouth, Ill.

The object of the invention is the production of means whereby the current shall, by its passage, momentarily throw into operation suitable time registering mechanism and instantly thereafter cut it out of circuit.

478,242. Electric Locomotive. Sidney H. Short, Cleveland, O.

The invention relates to electric cars, in which the armature is mounted axially with reference to the driving axle, and is directly connected to it by self adjusting arms, forks and spring pads.

478,245. Magnetic Lock. Henry V. Smith, South Yarra, near Melbourne, Victoria.

478,274. Electric Indicator. William E. Decrow, Boston, Mass.

478,275. Suspension Bar for Electric Lamps. Thomas Dillon, Indianapolis, Ind.

478,276. Rheostat. Winslow P. Eayrs, Nashua, N. H.

478,324. Indicator for Electrical Signaling Systems. Charles F. Gillette, New York, N. Y.

478,344. System of Electrical Distribution. Harry W. Leonard, New York, N. Y.

The invention embodies a method of varying the speed of an electric motor which consists in maintaining its field magnet at a constant strength and connecting its armature terminals with different constant potential sources.

478,346. Electric Railway. Frank Mansfield, New York, N. Y.

478,367. Electric Cable. William H. Sawyer, Providence, R. I.

The object of the invention is the construction of a cable employing air between the conductors and the covering to render the electrostatic capacity low.

478,383. Lightning Arrester. Charles S. Van Nuis, New Brunswick, N. J.

478,475. Electric Motor. Jerome B. Secor, Bridgeport, Conn.

478,477. Electric Locomotive. Sidney H. Short, Cleveland, O.

The invention consists in the combination with the axle of a car, of an electric motor comprising two or more armatures having their bobbins relatively arranged so as to impart continuous propelling action to the car.

478,485. Electric Battery. Charles F. Waldron, Boston, Mass.

478,493. Microtelephonic Apparatus for Divers. Robert Wreden, St. Petersburg, Russia.

The invention consists in apparatus which will enable a diver to hold conversation with persons on the surface.

478,510. Electric Arc Lamp. Rudolph M. Hunter, Philadelphia, Pa.

One feature of the invention consists in arranging the two carbons at an angle to each other and feeding one of the carbons at an angle to the other to compensate for the combined consumption of both carbons.

478,515. Apparatus for Cutting Pile Fabrics. John J. Mann, Salford, England.

478,518. Insulator. Louis McCarthy, Boston, Mass.

478,529. Dynamo Electric Machine. Charles W. Thomas, Jersey City, N. J.

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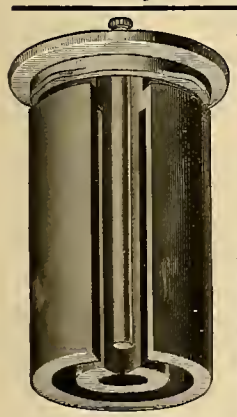

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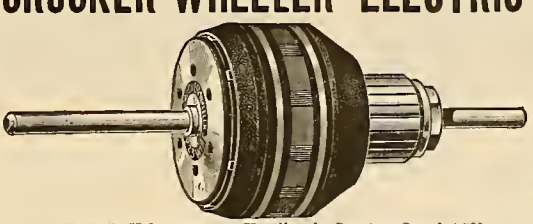

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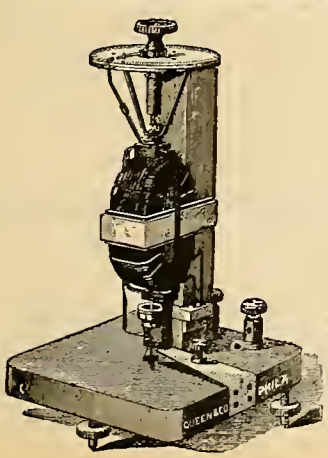

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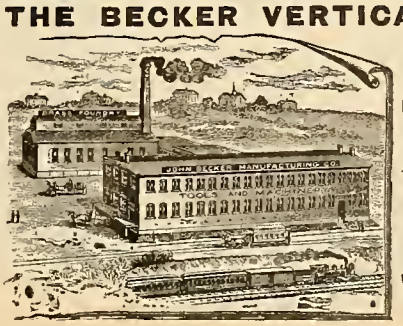

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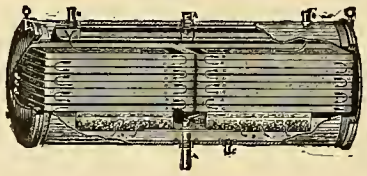

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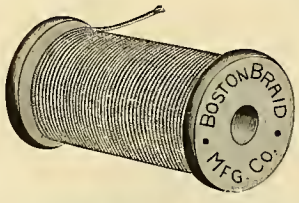

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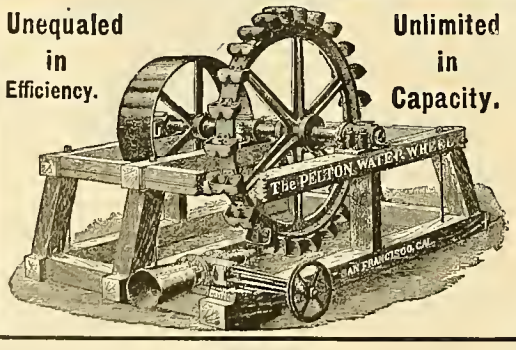

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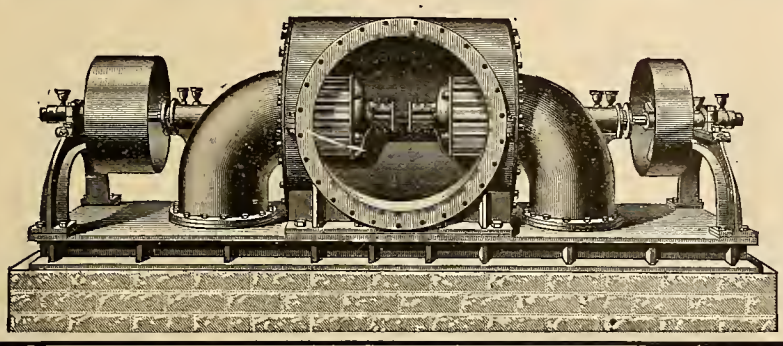

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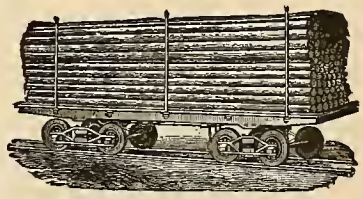
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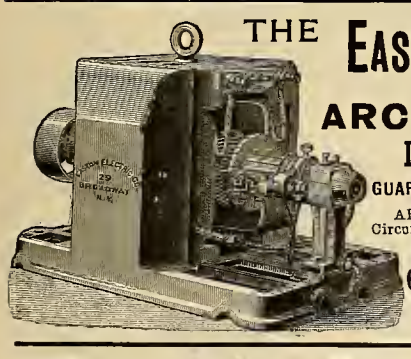

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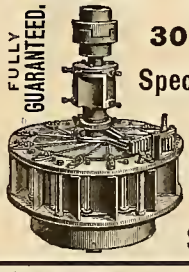
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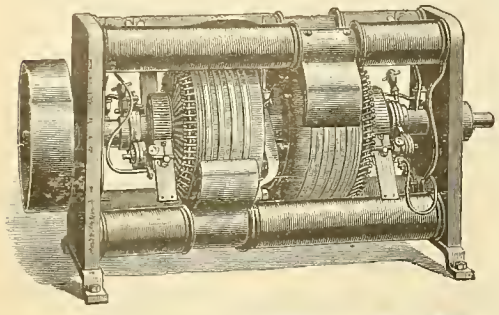

In what? In the preposterous **"Combine"** which has lately been formed to make legitimate business the cat's-paw of a stock-jobbing operation. The BALL ELECTRIC LIGHT COMPANY is opposed to any and every combination that seeks to do business upon other than a fair and straightforward basis. An enormous capitalization signifies excessive expenses and decreased dividends; and, invariably, the balance sheet must be against the public.

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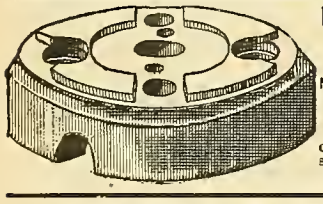

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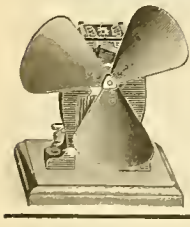

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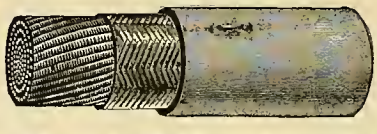

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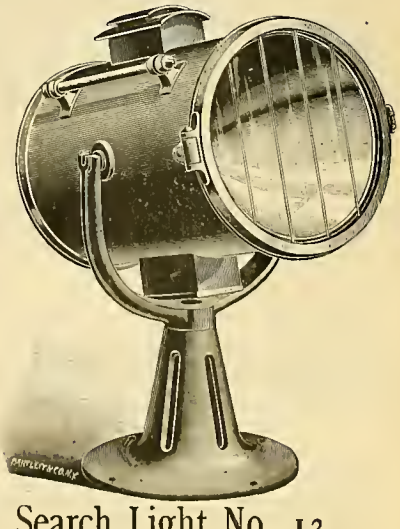

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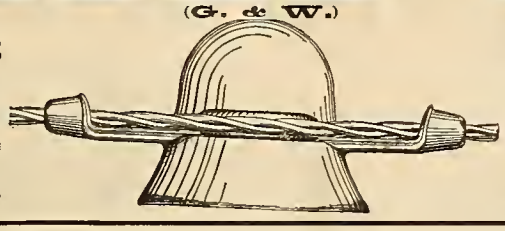

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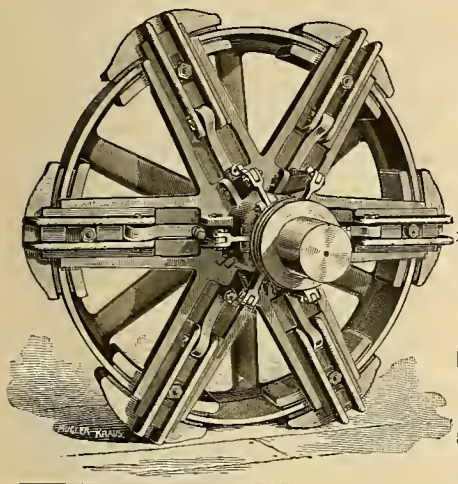

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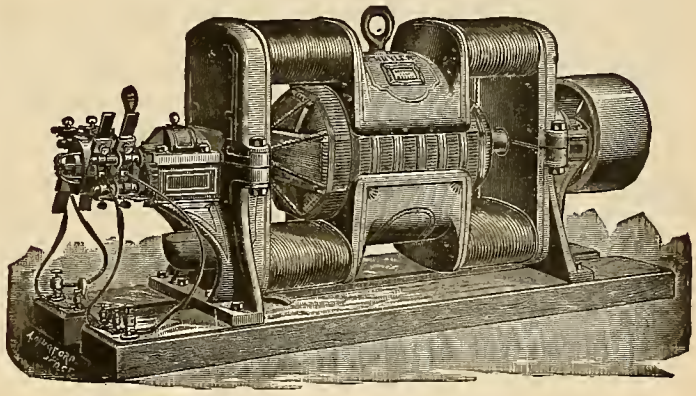

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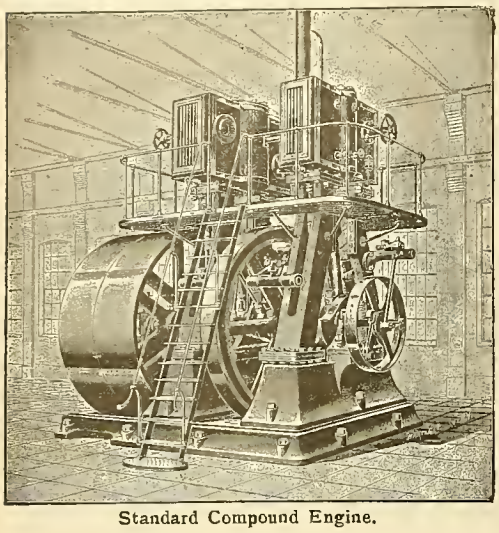

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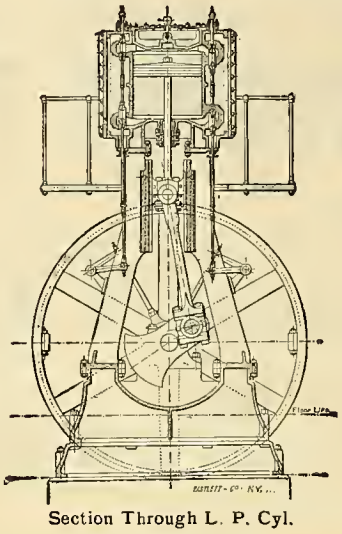

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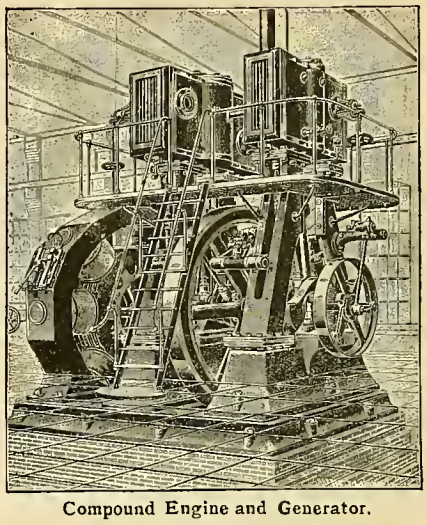

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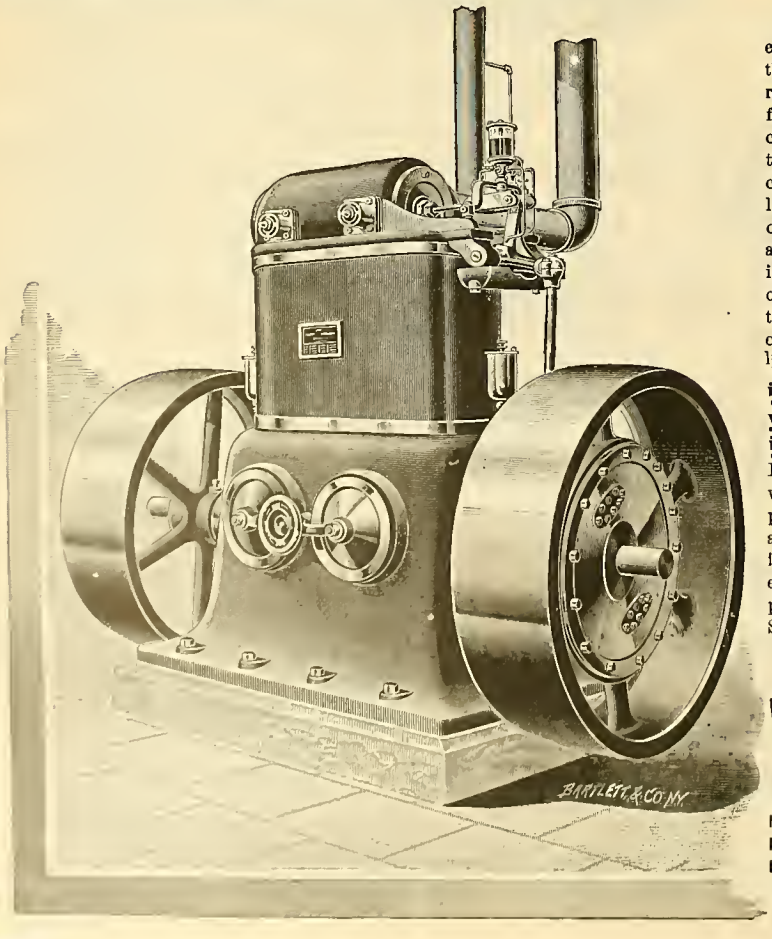

The Compound Engine, when non-condensing, so far from possessing an economy superior to the Simple Engine, has been decisively proven, "much to the disgust of the stockholder," to show normal economy only at or about its rated power, and to fall off in economy faster than a Simple Engine as the load falls off; moreover, very much faster under the extreme light loads that are common in Electrical Generation. This point is at last reluctantly admitted by the more candid builders of such engines, most of whom now advise against compounding for variable loads. The reason is in their inability to divide the load and range of temperature proportionately and automatically between the cylinders at all points of cut-off. Hence, the low-pressure cylinder expands its steam below atmosphere under a moderately early cut-off, thus converting itself into an Air Pump, and becoming a load upon the high-pressure cylinder instead of a co-laborer with it. This point was distinctly foreseen by the designers of the Westinghouse Compound Engine, and an entirely new principle was worked out, making expansion below atmosphere impossible under any load, however light. **For the first time in the history of Steam Engineering, either Simple or Compound, is built an Engine which maintains essentially uniform economy, irrespective of load,** and hence for the first time the Compound Non-condensing Engine has been made practicable. The results, demonstrated by test, show that where an ordinary Compound will range from 25 lbs. to 70 lbs. water per H. P per hour from full to quarter load, the Westinghouse Compound, between the same limits, will range from 23 lbs. to 29 lbs. We have not deceived ourselves in this matter, and propose that the facts shall be understood. To those interested in the nicer points involved, we will be pleased to send a reprint of the paper read by Mr. F. M. Rites on this subject at the late meeting of the American Society of Mechanical Engineers, at San Francisco.

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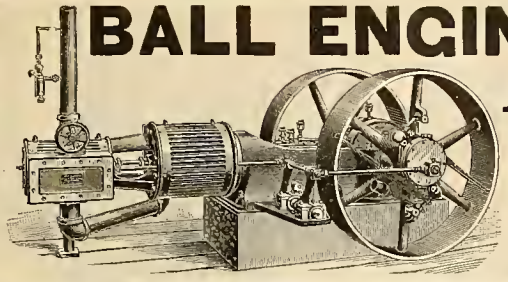

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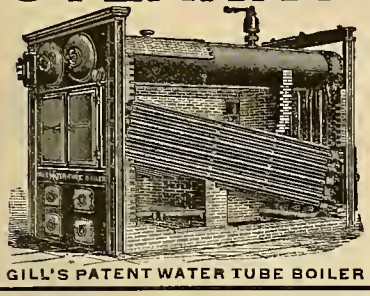

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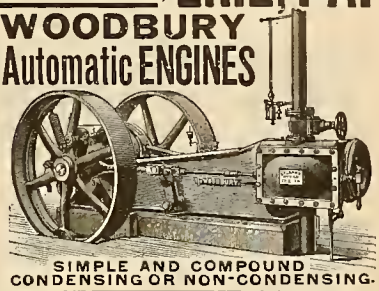

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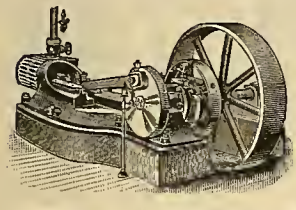

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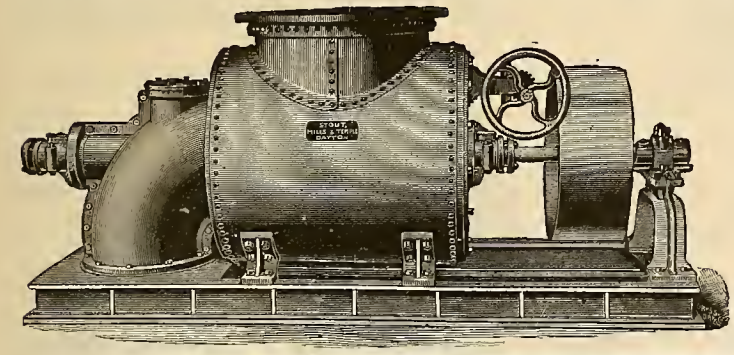

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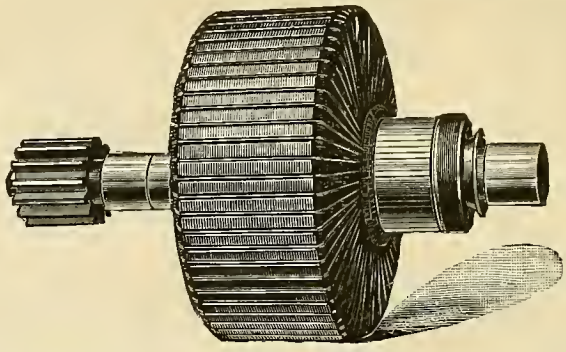

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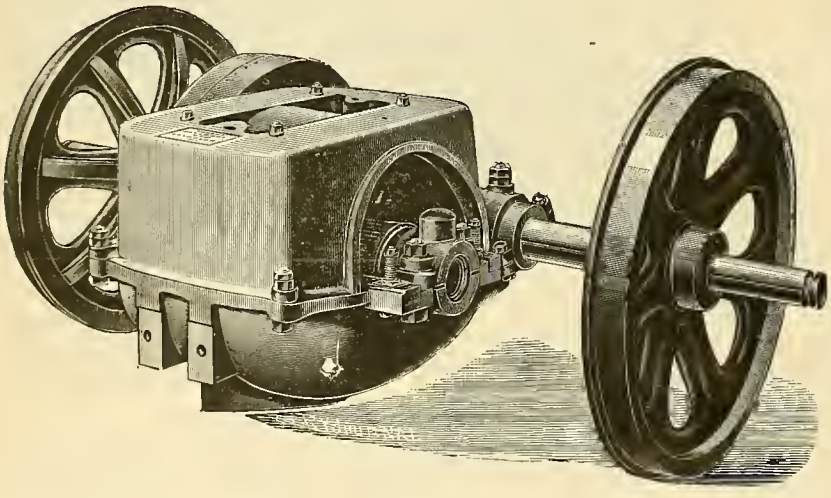

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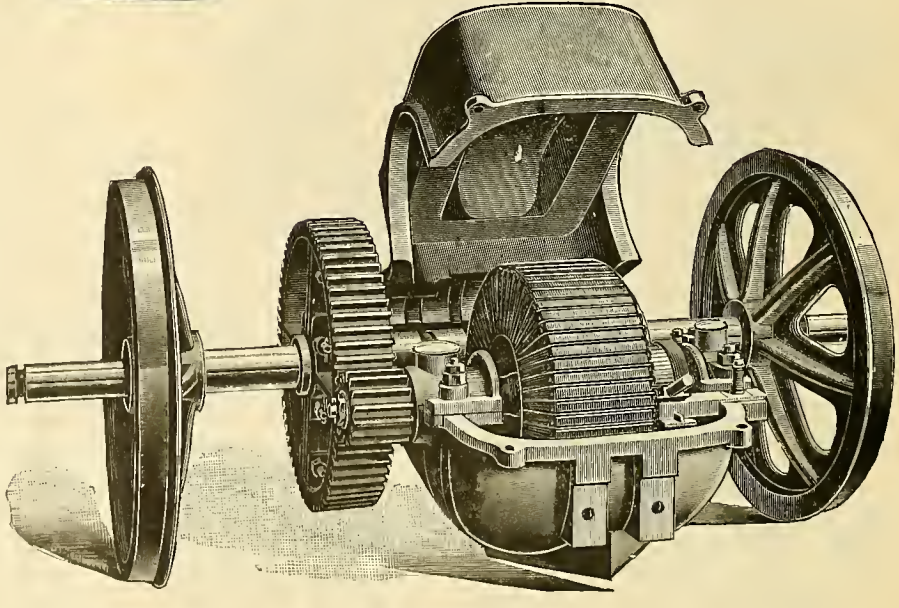

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Betty Dobson's Story.

"No—it haint no sickness"—

"T'laws sakes! S'manthy I'm back."

"And bin clar to Chicago?"

"Yes, yes, we've bin there." And a satisfied smile lit up her wrinkled features. Semantha gazed at her in wondering silence. For years she had longed to make just such a trip, but it was almost as good to see and talk to some one else who had actually been there. After a while the most natural question came.

"Well! well! and what did yer see?"

"Laws sakes," this was a familiar by-word with old Mrs. Dobson, "peers to me I can never remember everything, but we seen er heap." "We" included Silas, Mrs. Dobson's husband, but it was Mrs. Dobson that held the reins at "the farm" and Silas had accompanied her on this visit, not because she needed him, but simply as a necessary evil. She was afraid to leave him at home alone. She had paid two notes which Silas had been bunkoed into signing, and the house and barn looked like a pincushion, there were so many lightning rods up.

"Hearn tell Jemima Fifer lived there," said Semantha, "most like yer didn't see her?"

"No, I didn't see her, never set eyes on a livin' soul 'et we knowed, but we see some 'er the queerest things."

"I reckon."

"Yes, the cyars don't have horses to 'em like them at Pikeville."

"Steem, most likely?"

"No, 'twern't that, they call 'em grips."

"Mercy me that's what killed Jephtha Weener—sick nigh on a month and...."

"No—it haint no sickness, it's the way they hitch 'em to a cabul...."

"Cabul?"

"Yes, seems like they've got a sort'er blind ditch under the track, full of wheels and things as yer can't see, and they make a queersome mumble...."

"I'd be afeerd of 'em."

"But they wasn't the queerest thing we see." Here Mrs. Betty Dobson softly chuckled to herself, her fat sides shaking like a mould of quince jelly.

"No hit was"—the chuckle grew into a broad smile and the smile into a broad laugh, "Hit was—ho! ho! he-he-he-tee-hm!"

Semantha didn't join in the laugh. Semantha never had laughed since she choked on her false teeth.

Mrs. Dobson wiped her eyes.

"Doo tell!" said Semantha.

"Well, it were in one of them taverns 'ets got so many garrets to 'em yer had to git in a box and go shootin' up like a balloon at the fair."

Semantha sighed.

"Yes, 'peers like they have the curiousest lights...."

"Pianner lamps? they've got one to Moberlys," volunteered Semantha.

"No, they was just little things no bigger than a gourd, jest like they were a hangin' from the vine, but they shined like a rory-bory-allis."

"That's them northern lights, aint it?"

"Yes, but these was moonshine, 'er Sunbeam, 'er sumthin like; well, we got a room that had one in and a bathy tub. Silas is allus gittin inter trouble, the first thing he did was to set down on the aige of it; seems he pulled the cork out"—here her fat sides gave evidence of going to pieces again—"he pulled 'er string when, oh Lordy! he! he! Oh my! ho! ho!" Mrs. Dobson laughed at the recollection until she cried.

"Twant one 'er them rain machines, war it?" asked Semantha.

"Might ez well 'er bin, they was two kinds of water, from three places squirted onto Silas and him holler'in like he were possessed; I drug him out, but he vowed he were froze up one side and par-biled down t'other, and his clothes all wet; he were a sight."

"He were a sight"

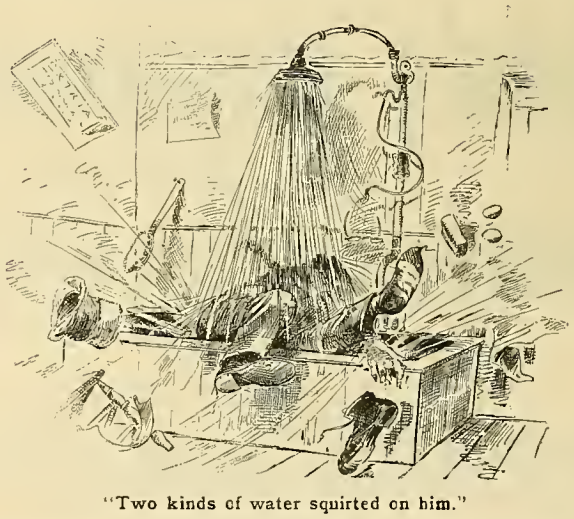
"Butter milk 's good fer scalds."

"Yes, but we didn't have any. Last we was ready fer bed, but when I tried to put out the light we couldn't; we blowed and pestered at the thing, seemed like an hour. Silas said he'd cut the string an' tie it on agin in the mornin'. He climbed on a chair and begin ter cut—well! I low'd I was a widder then and there, there was the awfullest leak o' lightning that doubled Silas up wus than rumatiz, and sumthin in the ceiling popped like a shootin' cracker—we was plumb in the dark then, 'cept the moon a peerin' in at the windy—

"Were he dead?"

"No, he came to in a little and we went to bed in one 'er them fold up mantel pieces, mighty glad we was alive yet."

* * * * *



"Two kinds of water squirted on him."

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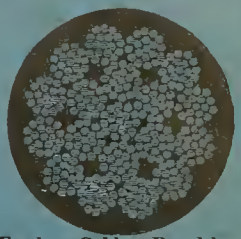
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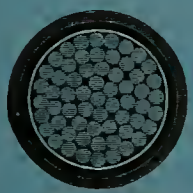
Underground Core, N. J. Central R. R.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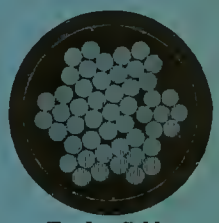
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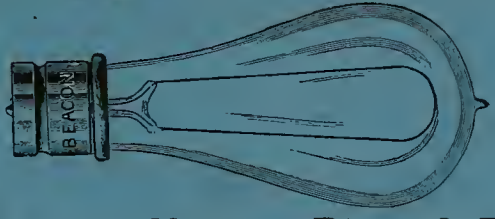

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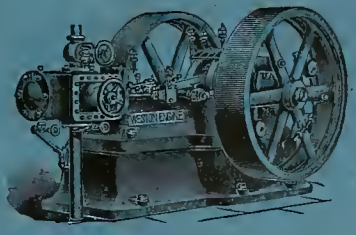

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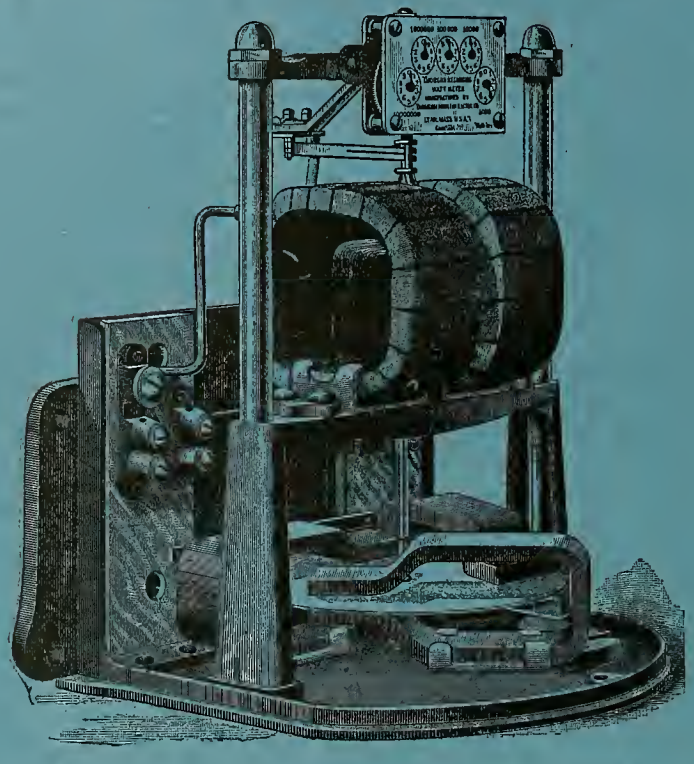

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GERMANTOWN ELECTRIC LIGHT CO.,

(Signed) Chas. M. Allen, Supt.

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Yours truly,

LANSING ELECTRIC LIGHT & POWER CO.,

(Signed) E. F. Cooley, Supt.

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INDEX AND CLASSIFICATION OF ADVERTISEMENTS.

ALPHABETICAL LIST.

American Battery Co.....xvi
American Desk & Seating Co..——
American Engine Co..... xii
Andrae, Julius..... xii
Andrews & Co., A. H..... ... xiii
Babcock & Wilcox Co., The.... i
Baggot, E xiv
Ball Electric Light Co..... xvi
Ball Engine Co.....xix
Ball & Wood Co., The i
Beacon Vacuum Pump & Elec. Co.i
Becker Mfg. Co., John.....——
Beggs, J. E., Mch. & Supply Co. x
Bernstein Electric Co..... iv
Boston Braid Mfg. Co..... xv
Bowers Bros..... xvi
Bristols' Mfg. Co..... .. i
Brookfield, Wm..... xii
Brush Electric Co viii
Bryan, W. H..... xiii
Bryant Electric Co.....——
Buckeye Electric Co., The..... ix
Butler Hard Rubber Co..... x
Carpenter Enamel Rheostat Co. xvi
Central Electric Co..... ... v
Chicago Electric Motor Co.....——
Chicago Rawhide Mfg.Co..... xix
Consol. Elec. Mfg. Co., The.. i
Crescent Ins. Wire & Cable Co. xiii
Crocker-Wheeler Electric Co.. xiii
Cushing, F. W..... vii
Cutter, Geo.....——
Cutter Electrical & Mfg. Co... xvi
Dayton Globe Iron Works Co..xvii
Densmore Typewriter Co.....——
Detroit Electrical Works..... xxiv
Diamond Electric Mfg. Co.....——
Dixon Crucible Co., Jos..... xiii
Dudley & Co., W. W..... xii
Duplex Electric Co., Ltd..... xii
Eastern Electric Cable Co..... xiii
Easton Electric Co.....——
Edison General Electric Co.....viii
Electric Cons. & Supply Co... xvi
Electric Engr'g & Supply Co .. ix
Electric Secret Service Co..... ix
Electrician Pub. Co.....xviii
Electrical Construction Co.,The. xii
Elec. Eng. & Sup. Co., The.... xiii
"Electrical Progress"..... xiii
Electrical Supply Co., The... xxii
Elektron Mfg. Co.....——
Emerson Electric Mfg. Co..... ix
Empire China Works..... xv
Enterprise Electric Co..... xv
Falls Rivet & Machine Co..... ix
Ferracute Machine Co.....——
For Sale..... x, xii, xiii
Fort Wayne Electric Co..... xxiv
General Electric Co..... ix
Gravity Purifier Co.....——
Greeley & Co., The E. S.....I
Gregory, Chas. E..... xii
Hart & Hegeman Mfg. Co..... x
Heisler Electric Co..... vi
Hill Clutch Works.....——
Hine Ellminator Co..... xii
Holmes, Booth & Haydens.... xiv
Illinois Electric Lamp Co..... xv
India Rubber & G. P. Ins. Co. xxiii
Institute of Technology..... xiii
Interior Conduit & Insulation Co. x
International Okonite Co..... i
Jewell Belting C o..... i
Johns Mfg. Co., H. W.....——
Kartavert Mfg. Co..... xvi
Keller & Degenhardt..... i
Kelly Brothers xix
Knapp Electrical Works..... xxi
Lake, J H. & D., Co .....——
Lake Erie Engineering Works.xviii
Lane & Bodley Co..... xiv
La Roche Electric Works..... x.x
Law Telephone Co..... xiii
Leclanche Battery Co., The .. xvii
Lefmann, Julius xv
Leffel, & Co., Jas xvii
Leonard & Co., H. W..... xvii
Link Belt Machinery Co..... xv
Loud, H. M. & Sons Lumber Co. xiv
Lovell Mfg. Co., Ltd..... xiii
Mather Electric Co..... iv
Morse & Co., A. M..... .. xiv
Munsell & Co., Eugene.....xiii
National Carbon Co..... xiv
National Electric Mfg. Co v
New York Insulated Wire Co. x
New York & Ohio Co..... I
Ostrander & Co., W. R..... xix
Page Belting Co.....——
Partrick & Carter Co.....——
Pearson & Co., W. B.....xviii
Pelton Water Wheel Co..... xiv
Perkins Elec. Switch Mfg. Co.——
Phoenix Glass Co.....——
Pierce, Jr., Joslah..... xvi
Pioneer Armature Co.....xiii
Porter-Leavitt Elec. Motor Co.——
Powell Co., The Wm..... xix
Premier Electric Co., The.....——
Queen & Co..... xiii
Racine Hardware Mfg. Co..... xii
Rae, Frank B..... xiv
Railway Equipment Co..... x
Riea Electric Specialty Co..... x
Rockford Electric Mfg. Co....——
Roebling's Sons Co., J. A ....——
Rose Elec. Light Supply Co.. ——
Rose Polytechnic Institute....——
Royal Electric Co..... xii
Samson Cordage Works. xii
Sawyer-Man Electric Co..... xi
Schindel & Schindel..... xv
Schuyler Electric Co..... vi
Sechrist, Albert..... xvii
Short Electric Railway Co..... lv
Shultz Belting Co.....——
Siebert, G..... xiii
Sioux City Elec. Supply Co., xiv
Sioux City Engine Works.... xix
Smith, A. T..... xiii
Smith, Thos. G. Jr..... xix
Somoff, J. L..... xv
Sperry Elec. Mining Mach. Co. xvi
Standard Electric Co..... vi
Standard Paint Co x
Stanley Electric Mfg. Co.....——
Star Electrix Co... xv
Stearns Mfg. Co..... xix
Sterling, W. C..... xv
Stilwell & Bierce Mfg. Co. xiv, xv
Sunbeam Incand. Lamp Co...xxiii
Taylor Engine Co..... xiv
Thomson-Houston Elec. Co.. ii, xx
Union Hardware Co..... xii
U. S. Electric Lighting Co.. xi
Utica Elec. Mfg. & Supply Co. x
Van Nuis C. S.....——
Vulcanized Fibre Co..... xv
Waddell-Entz Company..... xii
Wannopee Pottery Co..... xiii
Wanted..... xiii
Western Electric Co.....xiv
Westinghouse, Church, Kerr & Co..... xvii
Westinghouse Elec. and Mfg Co——
Weston Engine Co..... i
Woodhouse & Rawson, Ltd....——
Worthington, Henry R.....——

CLASSIFIED LIST.

Annunciators.
Central Electric Co.
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Standard Electric Co.
Thomson-Houston Electric Co.
Westinghouse Electric & Mfg. Co.
Western Electric Co.

Arc Light Cord.
Knapp Electrical Works.
Samson Cordage Works.

Batteries.
American Battery Co.
Central Electric Co.
Detroit Electrical Works.
Electrical Supply Co.,The.
Greeley & Co., The E. S.
Leclanche Battery Co., The.
Partrick & Carter Co.
Premier Electric Co., The.
Western Electric Co.

Battery Jars.
American Battery Co.
Central Electric Co.
Detroit Electrical Works.
Electrical Supply Co., The.
Law Telephone Co.
Leclanche Battery Co., The.
Western Electric Co.

Bells, Electric.
Central Electric Co.
Detroit Electrical Works.
Electrical Supply Co., The.
Greeley & Co., The E. S.
Knapp Electrical Works.
Ostrander & Co., W. R.
Partrick & Carter Co.
Western Electric Co.

Bells, Magneto.
Central Electric Co.
Detroit Electrical Works.
Greeley & Co., The E. S.
Knapp Electrical Works.
Partrick & Carter Co.
Western Electric Co.

Belting.
Chicago Rawhide Mfg. Co.
Jewell Belting Co.
Link Belt Machinery Co.
Page Belting Co.

Boilers.
Babcock & Wilcox Co., The.
Lane & Bodley Co., The.
Stearns Mfg. Co.
Weston Engine Co.

Books, Electrical.
Electrician Publishing Co.

Brass Goods.
Powell Co., The Wm.

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Detroit Electrical Works.
Electrical Supply Co., The.
Greeley & Co., The E. S.
Knapp Electrical Works.
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Cables.
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Cables, Electric. (See Insulated Wire), **Copper, Sheet and Bar.**
Roehlings Sons Co., J. A.
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Brush Electric Co.
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Electrical Supply Co., The.
Knapp Electrical Works.
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Smith, Thos. G. Jr.
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Ball & Wood Co., The.
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Lake Erie Engineering Works.
Lane & Bodley Co., The.
La Roche Electric Works.
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Leonard & Co., H. W.
Mather Electric Co.
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Pearsen & Co., W. B.
Racine Hardware Mfg. Co.
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Royal Electric Co.
Short Electric Railway Co.
Sioux City Engine Works.
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Standard Electric Co.
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Westinghouse Electric & Mfg. Co.
Westinghouse, Church, Kerr & Co.
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Cutter Electrical & Mfg. Co.
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Electrical Supply Co., The.
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Hart & Hegeman Mfg. Co., The.
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Perkins Elec. Switch Mfg. Co.
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Utica Elec. Mfg. & Supply Co.
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Diamond Electric Mfg. Co.
Duplex Electric Co., Ltd.
Easton Electric Co.
Electrical Eng. & Supply Co.
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La Roche Electric Works.
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Mather Electric Co.
National Electric Manufacturing Co.
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Royal Electric Co.
Schuyler Electric Co.
Standard Electric Co.
Waddell-Entz Company.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

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Detroit Electrical Works.
Edison General Electric Co.
Rae, Frank B.
Short Electric Railway Co.
Thomson-Houston Electric Co.
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Greeley & Co., The E. S.
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Electrical Supply Co., The.
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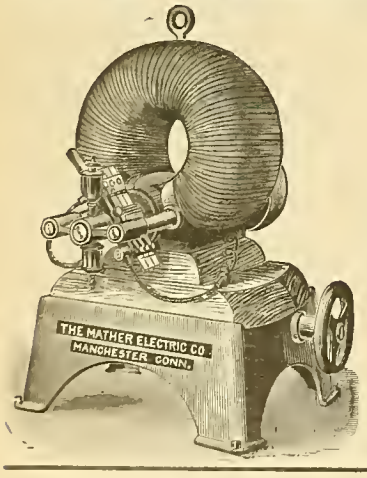

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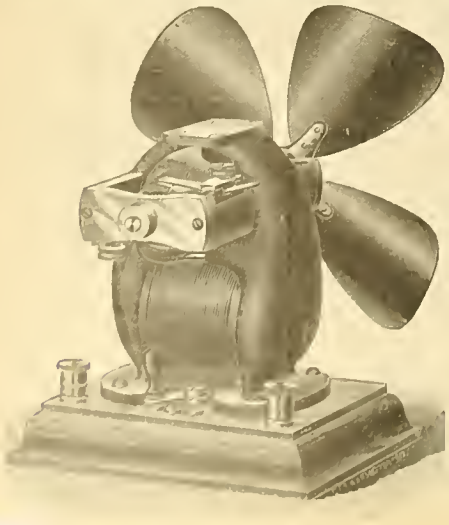

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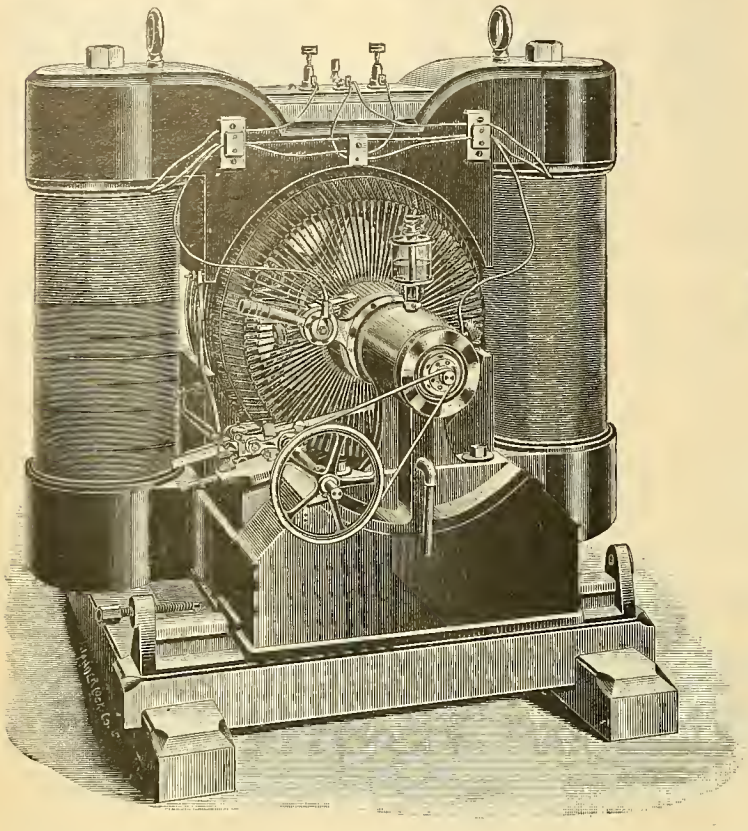

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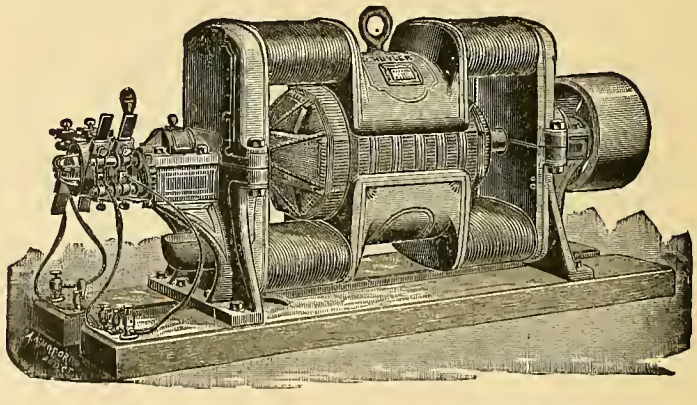

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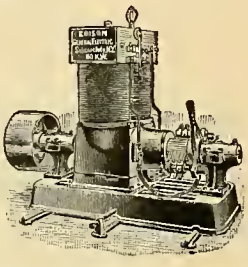

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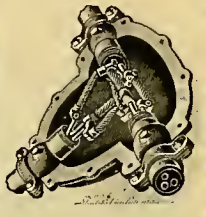

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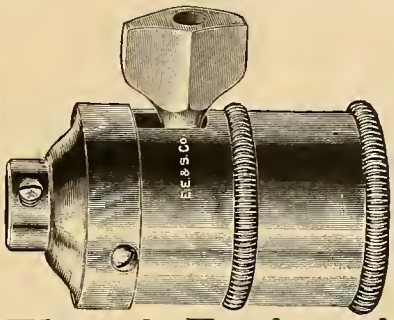

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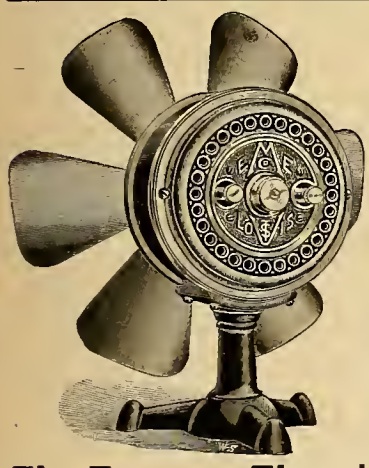

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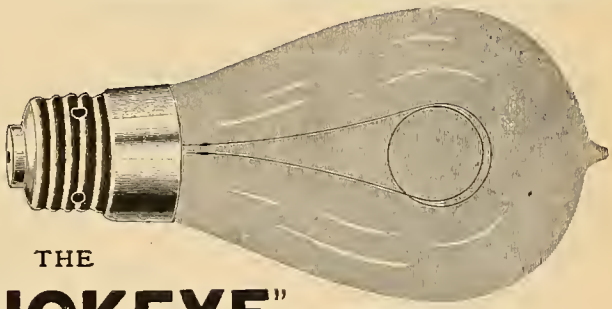

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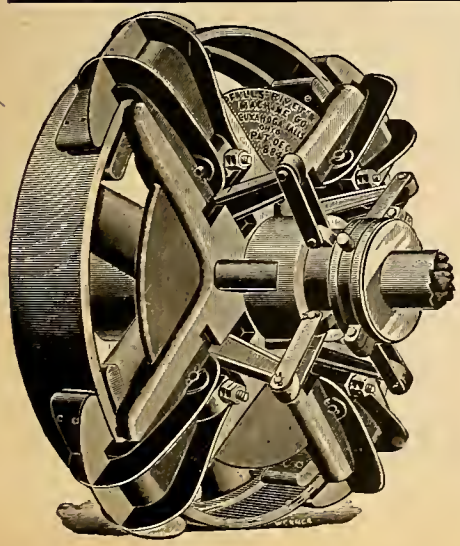

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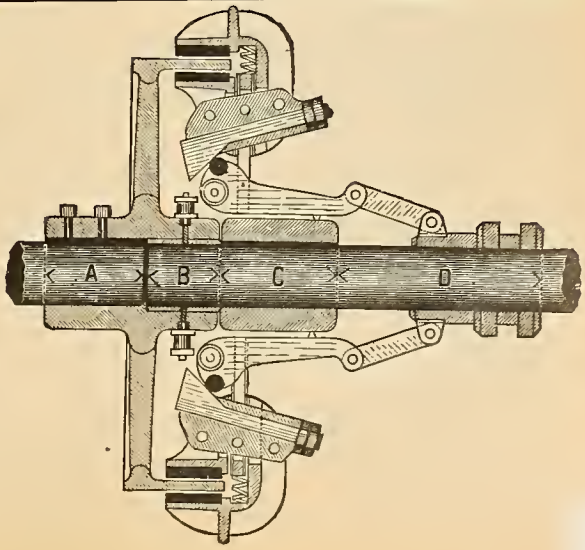

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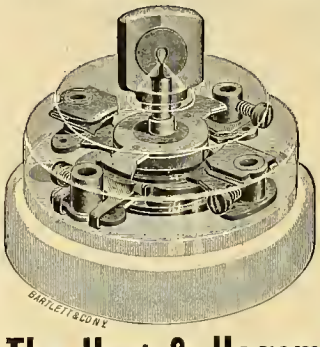

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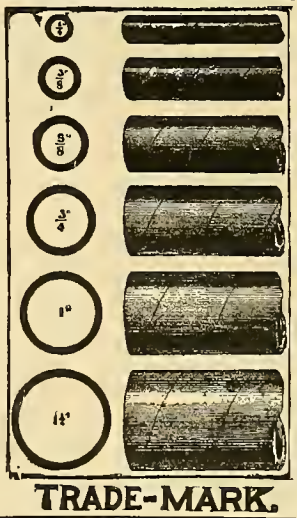

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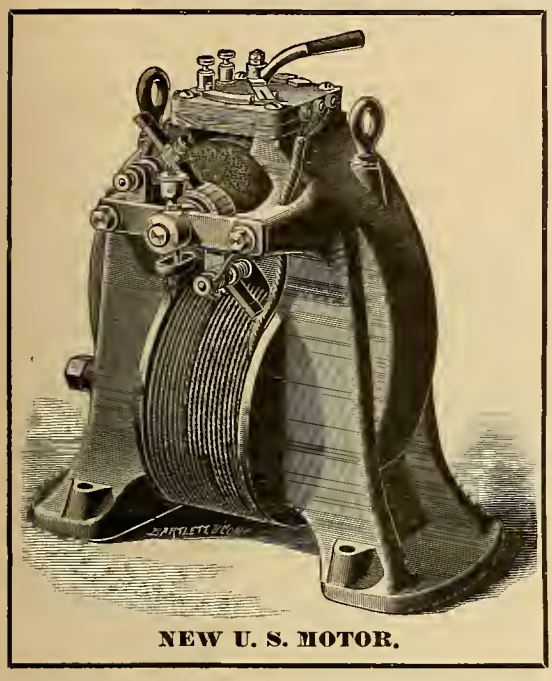

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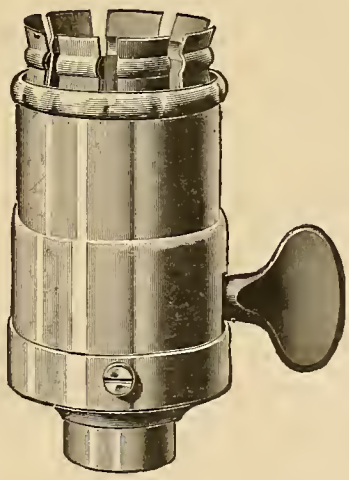

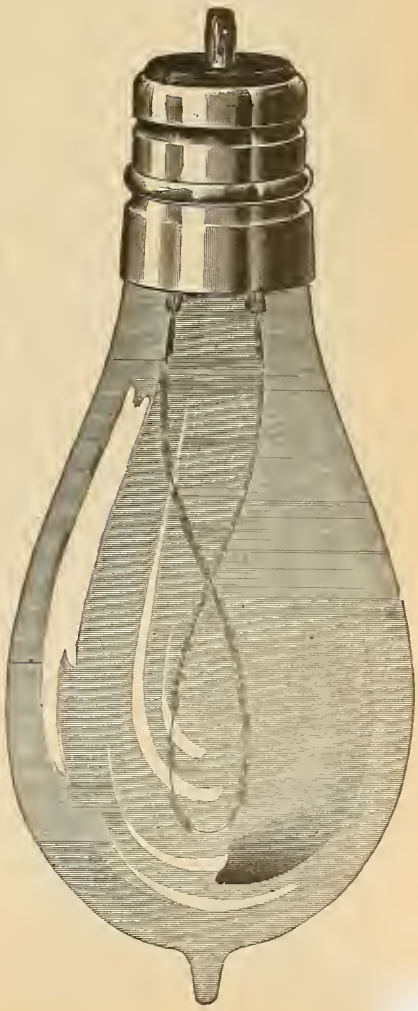

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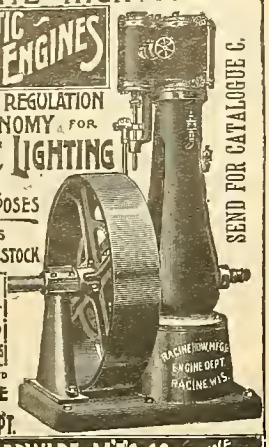

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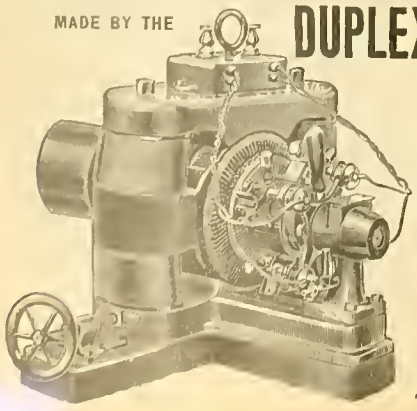

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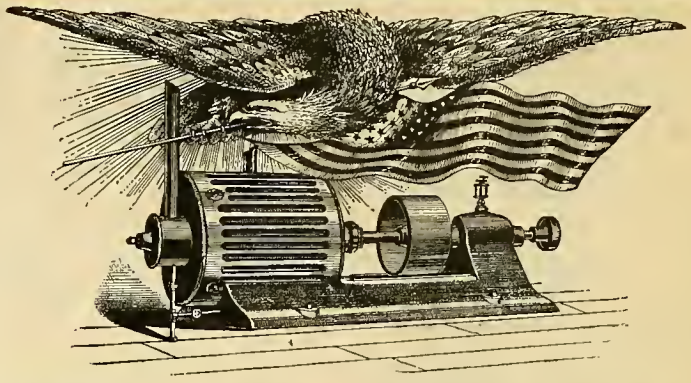

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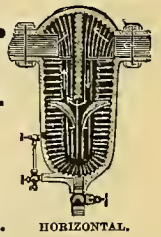

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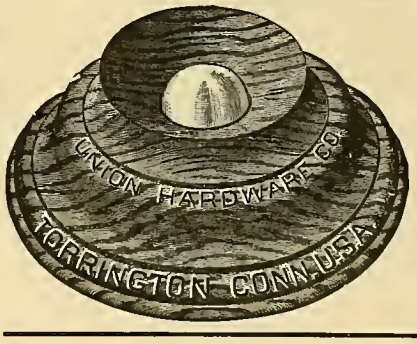

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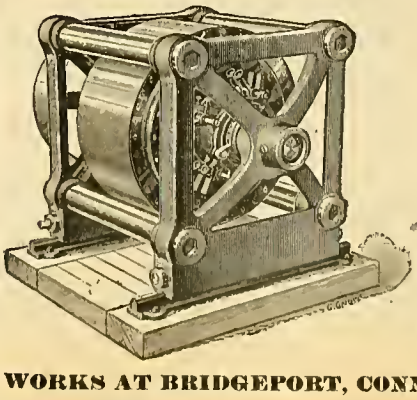

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WORKS AT BRIDGEPORT, CONN.

Western Electrician.

EVERY SATURDAY.

Vol. XI. CHICAGO, JULY 23, 1892. No. 4.

Utilizing Electricity in Organ Blowing.

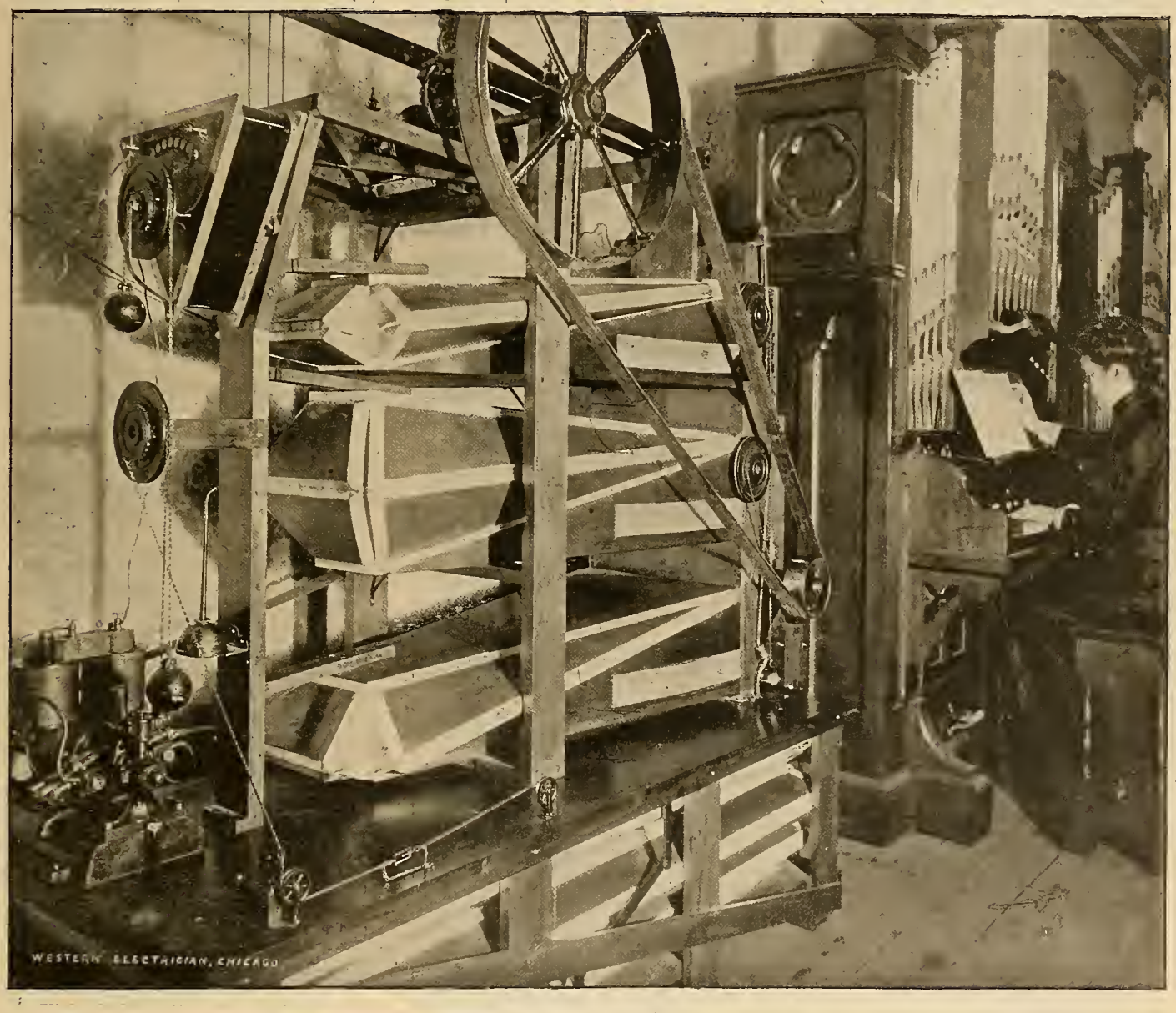
It is generally conceded by organ builders that electricity furnishes the ideal motive power for blowing these instruments, and there is no doubt now but that wherever it is possible to obtain a suitable connection with a central station the electric motor will be used in preference to any other motor.

Among the firms that have paid special attention to devising a mechanism through which the electric motor might be applied to organ blowing in an efficient manner is Lyon & Healy, Chicago. This concern has been working at the problem for some time, and the result of its experiments is now on exhibition at its Chicago salesrooms on State street, corner of Monroe. This equipment, illustrated in the accompanying cut, was devised by Jarvis Peloubet, superintendent of the Lyon & Healy factory, and was put in operation at the store about five weeks ago. As at present arranged the blowing plant is connected so that any one, or two, or three of eleven organs can be played from a common supply pipe. The blowing outfit is at the farther end of the room at the end of the line of organs with which it is connected. The organs range in size from seven registers, single manual, to twelve registers double manual and pedal. The cut gives a very clear idea of the relative locations of the electric blower and the line of organs. A close inspection of the illustration with a few words of explanation will make clear the electrical and mechanical details of the blowing plant and its operation.

The power is furnished by a ½ horse power C. & C. 110 volt motor connected with the Edison house service. The motor, designed to run at a maximum speed of 2,100, is belted to a countershaft which operates, as indicated, a set of three "feeders." These feeders, it should be mentioned, may be placed either behind or at the end of the organ, or may be out of sight in another room. They are designed to do the maximum of work with the minimum of power, and are noiseless in action. The mechanism of the feeders is such that there are no dead centers and no lost motion, and the valves of the feeder itself are made with "outfold," giving all the advantages of the lateral wind pressure.

There is employed in the outfit, in addition to the motor, the usual starting resistance box and controlling box; the former, though, being behind the feeders, does not appear in the cut. The box in the foreground is the controlling box.

The action of the equipment is simple. A slow movement of the starting switch turns the current into the motor, thus operating the feeders and drawing the air out of all the bellows in the line of organs. The reservoir bellows, shown in the cut in the base of the frame beneath the feeders, then comes into action. As the pumping continues the weighted bottom of the reservoir, lifted by air pressure from without, pulls upon the chain which connects with the contact lever on the controlling resistance box. This movement lowers the motor's speed and the feeders pump slower. The result of this arrangement is a very slight to-and-fro movement of the reservoir's bottom, which maintains the constant suction so necessary to purity of tone. The chains and pulleys on the blower frame at the end next to the organ constitute a simple connection between the reservoir bottom and a relief valve. When the reservoir bottom is sucked up beyond a certain point it pulls a chain which lifts the relief valve. Lyon & Healy fully appreciate the fact that the electric motor is destined almost entirely to supersede other power engines, and have fitted up their large factory with an electrical supply system through which they are enabled to run motors in various points of the works. The motors in the factory are now doing excellent service in tuning and other testing work,



UTILIZING ELECTRICITY IN ORGAN BLOWING.

The Electric Heater in Canada.

It may be that the energetic electricians of the United States are ahead of their Canadian brethren in so far as general electric lighting and power construction are concerned, but in one branch of the art, at least, it will have to be conceded, that the Dominion has shown a more rapid development. On this side of the line it has been fondly imagined that the electric heater has been worked up to a greater state of perfection here than elsewhere. A glance at the accompanying illustrations, through, will establish the fact that it will be a decidedly difficult task for any one to

FIG. 5. THE ELECTRIC HEATER IN CANADA.

find in the United States an electrical system in which the electric heater plays as prominent a part as it does in a certain Canadian plant.

The Ottawa, Ont., electric railway, operated by the firm of Ahearn & Soper, the builders of the road and its owners, is a line consisting of eight miles of double and four miles of single track. The system was constructed in seven weeks, and cars were put into service in the latter part of June last year. The equipment consists of sixteen cars of the vestibuled type, and the electric system employed is that of the Westinghouse Electric & Manufacturing company, single reduction motors of 20 horse power each being used. The power house of the Ottawa road is located at the famous Chaudiere Falls, where two 175 horse power turbine water wheels drive two 100 horse power Westinghouse compound dynamos, and a third machine is kept in reserve. The wheels are under 15 feet head of water, and the dynamos are belted to a main shaft driven by the turbines. The difficulty in supplying steady current by water wheels was at first a matter of serious difficulty as, owing to the frequent stopping of all or nearly all the cars at the same instant, the water wheels were liable to race. By an ingenious mechanical arrangement the water wheel gates are now raised and lowered instantly, and by the introduction of a novel electric device, described in the WESTERN ELECTRICIAN April 16, 1892, sufficient load is kept on the dynamos at all times to hold down the speed of the water wheels.

It is in connection with the water driven system of the Ottawa road that the electric heater has proved itself to be a valuable adjunct, serving most profitably to steady the load on the system, and likewise to increase the company's revenue through the sale of the additional current.

Through the courtesy of T. Ahearn the WESTERN ELECTRICIAN is enabled to present drawings and reproductions of photographs showing the various forms of heating apparatus that have been introduced on the cars of the electric road and in other places in Ottawa.

It was during the last winter that a series of four 125 volt electric heaters was first tried in a car of the Ottawa railway. The rigorous Canadian climate, however, proved too severe a test for these heaters. Appreciating that a good practical heater would be a most valuable piece of apparatus to operate on this particular system in connection with the power machinery, Mr. Ahearn set to work to develop the improvement. His first production was a 500 volt stove shown in Fig. 1. This stove replaced the coal stove in general use, and is seen in position in the car in Fig. 2. The stove is cylindrical in form, being in fact an iron tube within an iron tube. The inner tube is wound with the resistance wire, and the space between the inner and outer tubes is filled with whiting. As the stove is placed two inches from the floor, the cold air rushes from the floor upward through the center of the stove, and this movement of the air increases with the temperature, and thus makes a vigorous circulation of hot air. According to Mr. Ahearn, with six amperes of current this stove proved equal in heat-giving power to the ordinary coal stove, and in addition possesses all the other well known advantages. This stove was wound to permit of the use of a constant current throughout the day, thereby requiring no attention on the part of the conductor. Three cars have been equipped with this form of stove since February.

A cross-section of the electric boiler for car heating is shown in detail in Fig. 3. It consists of a shell or tube 2 of oval cross-section, within which is placed another similar but smaller shell 3, the two having their ends suitably joined to form a water space between them, nozzles being provided for the circulating pipes. The vessel thus formed has its exterior surfaces insulated with strips of asbestos 4. A core 5, also insulated with strips of asbestos, and wound with a resistance coil R of German silver is inserted in the inner vacant space of the shell 3, and is of such a size as to press the wires R against the insulation of the shell 3. A similar resistance coil R is also wound upon the insulated shell 2, the terminals of the coils projecting. The vessel thus formed is placed in a casing 6, the terminals of the coils passing through insulators, and all the vacant spaces inside the casing are

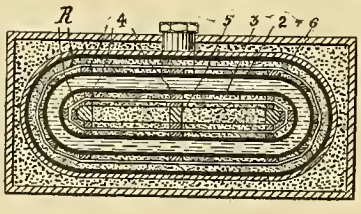
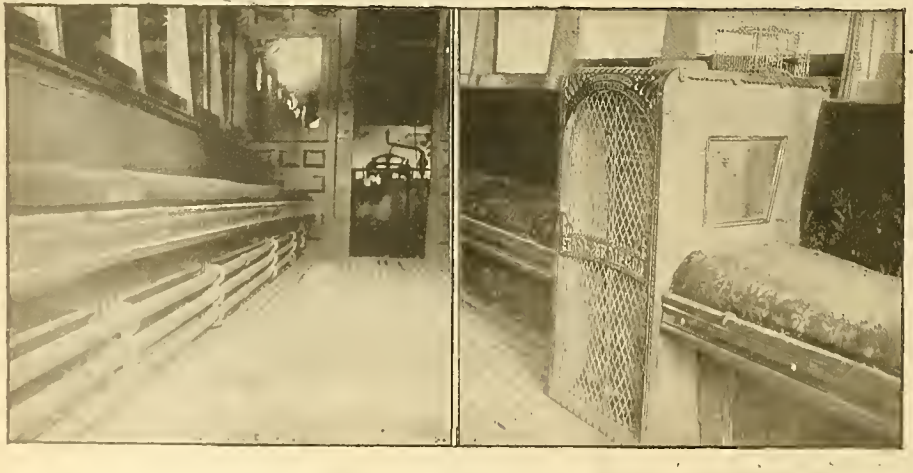


FIG. 3. THE ELECTRIC HEATER IN CANADA.

filled with powdered whiting. This casing is then wrapped in sheets of asbestos and inclosed in a wooden box secured to the under side of the car floor, Figs. 4 and 5. Two of the boilers are used in each car, being placed in diagonally opposite corners, each supplying a set of circulating pipes. The resistance coils are placed within the car circuit. The nozzle in the upper side of the boiler is connected with an upright supply pipe; from this the radiating pipes C branch off, running to the other end of the car, where they are connected with another upright pipe. From this last mentioned upright pipe a return pipe passes through the floor and enters the boiler by the lower nozzle. A water reservoir D is placed under the seat and communicates with the flow and return pipes to keep the circulating pipes full of water and to compensate for evaporation. An expansion tank E is placed at the end, away from the boiler, one in each set of pipes. This tank being high and flat, is concealed in the end panel of the car, and it provides for the variations in the level of the car and the water.



FIGS. 8 AND 2. THE ELECTRIC HEATER IN CANADA.

The liquid heater shown in Fig. 6 was next devised. This heater is of handsome design, with a water glass on its side showing the height of the water within it. This type is wound for all voltages, and has, it is stated, been used for the last three months with most satisfactory results by patrons of the Chaudiere Electric Light company of Ottawa, which company uses the Westinghouse alter-

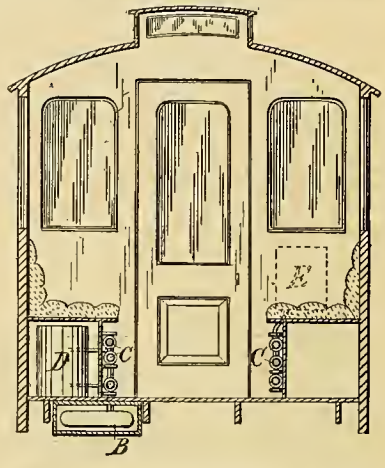


FIG. 4. THE ELECTRIC HEATER IN CANADA.

nating system. These heaters are used by barbers, druggists and for domestic purposes. A livery stable keeper uses a three gallon heater, the hot water being applied to clean harness and bathe horses' feet. The heater shown in Fig. 6 requires 3½ amperes at 50 volts. Such is its construction that when in use in barber shops the water in it is found sufficiently hot for shaving in the morning, although the current has been off all night.

In March last Mr. Ahearn had constructed and put in operation in the residence of ex-Alderman Johnstone the electric furnace shown in Fig. 7. This outfit has been in successful and continuous operation since being installed, and has attracted much attention. The large coal furnace abandoned for the small perpendicular electric furnace shown in Fig. 7 suggests immense possibilities for electric heating. The heated water passes upward into the 63 gallon tank in the corner, from which it flows to the two upper stories of Mr. Johnstone's residence, supplying three bathrooms and one kitchen sink. The fact that hot water is being constantly drawn off, and cold water taking its place, is a much more severe test upon the furnace than if the water was being used for heating purposes only, as in the latter case the same water is being circulated always. Mr. Ahearn has applied this principle to the hot water apparatus employed for car heating.

Fig. 8 shows a portion of the interior of an electric car equipped with hot water apparatus. The piping on both sides of the car connects through the floor with the furnace, which is shown in Fig. 5. Seven amperes at 500 volts is used in this furnace.

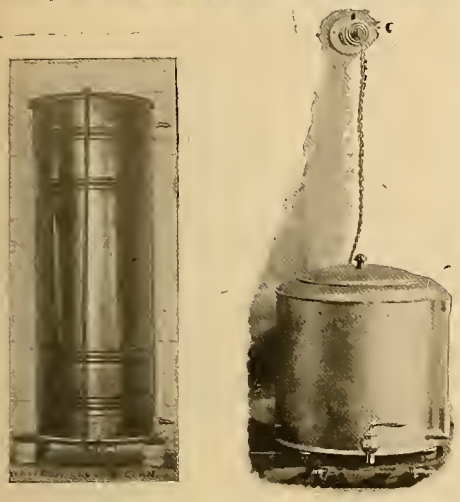
The need of artificial heat during the summer months for drying out repaired armatures or field coils of car motors suggested the drying kiln shown in Fig. 9. This kiln was put in operation in the car shops at Ottawa a month ago and has proved a great success. To economize space the kiln was put on top of the steam heating furnace which was used during the last winter for heating the premises. Its situation makes it appear somewhat bulky, but it simply consists of the small furnace with pipes running into the kiln four deep, thence back to the furnace. The door of the kiln is shown partly open. A water tank is placed on top of the kiln to supply the furnace. The hot water circulating through the pipes in the kiln heats the air to 120 degrees, the current from the trolley wire being used; 4 amperes do the work.

Mr. Ahearn, who is the general manager of the Ottawa electric railway and who, with his partner, W. Y. Soper, is one of the principal owners of the road, proposes this year to equip all the cars, the car shops and the new power house, with his new system of electric hot water heating. He has also arranged with C. F. Sise, president of the Bell Telephone company of Canada, to heat the new telephone building now being erected in Ottawa. This installation alone will require 6,000 feet of pipe. For this undertaking the 50 volt alternating current will be used.

The new owners of the Wheeling and the Citizens' street railways of Wheeling, Va., contemplate reconstructing the lines, changing from the double trolley to the single trolley system, adding new equipment, etc., at an estimated outlay of $250,000.

Electricity at the World's Fair.

The work of preparation for the electric lighting at the World's Fair is steadily progressing. The main subways are about finished and some six miles of ducts for arc light conductors have been laid. In a few days work will be begun on the arc light wiring for the horticultural, transportation and mining buildings. A design for the arc light posts for the grounds has been submitted, but it has not yet been officially adopted. These posts will probably be about eighteen feet high and constructed in



FIGS. 1 AND 6. THE ELECTRIC HEATER IN CANADA.

such a manner that they will readily lend themselves to the arrangement of groups of lights as well as the support of single lamps. The task of laying out the incandescent lighting of the wooded island will soon be undertaken. About 150 or 200 32 candle power lamps will be used, and these will be distributed about the island on ornamental posts about seven feet high in consonance with the landscape effects of this beautiful portion of the park. Fifteen of the dynamos for the permanent arc light plant have arrived on the grounds and have been stored until the central station in machinery hall shall be ready for occupancy. Each is a 50 light machine and supplied with a full complement of lamps and globes. Ninety arc light machines will be required to fulfill the existing contracts with the Thomson-Houston, Western Electric and Standard companies. Work on the general incandescent plant is also being pushed with vigor. Superintendent Keller now has a force of fifty men working under his direction, including a number of draughtsmen. Some discussion

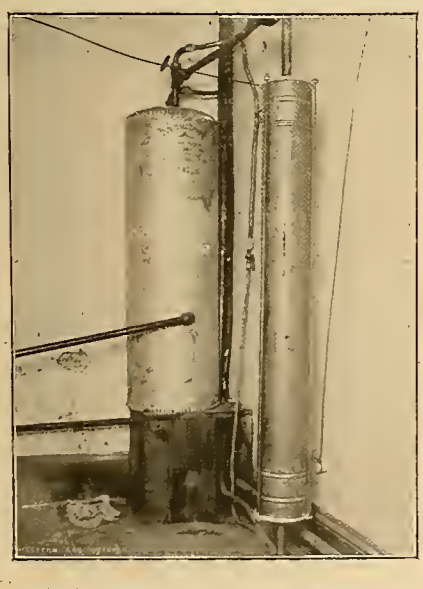


FIG. 7. THE ELECTRIC HEATER IN CANADA.

has arisen in relation to the converter pits for the Westinghouse system. In accordance with the specifications these receptacles are being placed outside the buildings. They are simply large wooden boxes lined with tin sunk in the earth, with about a foot of the top projecting above the surface. The landscape architects object to this arrangement on æsthetic grounds, while the insurance men insist that the pits must not be placed inside the buildings. It is not unlikely that some arrangement will be made whereby the tops of the boxes will be made less ugly by ornamentation.

About twelve of the World's Fair officials, principally members of the ways and means committee, visited Jackson Park on July 14th and inspected the launches entered for the competitive tests. The boats passed in review before the visitors in two positions—one in the basin, where there is plenty of water, and the other in the narrow lagoons, to compare the size and handiness of the craft. After that the entire party rode in each of the boats in turn. The reports of the tests were in Chief Burnham's hands by Saturday of last week, and the final decision of the directors is expected in a few days.

Down at the temporary power house the "boys" are marveling at the queer freak of an arc machine armature. During one of the recent storms an Edison arc dynamo was struck by lightning and the commutator was badly burned. A new commutator was attached and the machine started up again, but in a minute or two the smoke began to pour out from the armature at a furious rate. The armature was removed and an effort was made to locate the burned-out insulation by the magneto test but without success. For two weeks the discarded armature lay in the station, and then Mr. Ward, the superintendent, determined to locate the short circuit definitely by replacing the armature in the machine and burning it out in such a decided fashion that the defect could be easily placed. The dynamo was started up with a small load. To the great surprise of everybody, however, the machine generated current without the least complaint. Other lights were added until a total of 68 had been thrown on the machine, which was rated as a 50 lighter. No signs of a burn-out could be detected, and the dynamo has been running ever since.

Frederick Sargent returned from the East on Friday of last week.

The recent heavy rains have flooded the sewers at Jackson Park, and a 15 horse power Edison motor has proved very efficient in furnishing power for pumping them out, supplanting a steam engine formerly used for that purpose.

On Saturday of last week the Electrical Construction company of Chicago filed a bill in the Circuit Court against the New York Insulated Wire company to compel the specific performance of a contract. Under the contract in controversy the complainant claims the right to wire and do the construction work for the incandescent lamps to be used at the World's Fair grounds. It is claimed that the defendant agreed, if it received the contract to furnish the wire for the Westinghouse company, to sub-let the wiring and construction work to the Electrical Construction company. This has not been done. An injunction is sought to restrain further work until the contract is adjusted.

The contract for the building of the elevated structure of the Western Dummy Railway company at the World's Fair has been awarded to Remington & Co. of Chicago. The papers were signed on July 14th, and the work must be finished within six months from that date. The cost of the structure will be about $280,000.

The Western Electric company has been allotted 10,000

FIG. 9. THE ELECTRIC HEATER IN CANADA.

square feet of space on the ground floor of the electricity building and is now preparing an elaborate exhibit, showing every article that it manufactures. The American Bell Telephone company will have an adjoining section, and in its display an historical exhibit will be included.

New Chicago Theatrical Lighting Plant.

One of the handsomest of the Chicago buildings of 1892 is the lofty edifice of the Schiller theater, which is now nearly finished. This structure is located on Randolph street, between Clark and Dearborn, and attracts general attention by the symmetry and beauty of its design. The theater, which will be largely devoted to the German drama, will be one of the most elegant in the city and will be supplied with all of the manifold appliances considered essential to the modern play-house. Among these the electric lighting equipment will have a prominent part. The theater will be supplied with about 2,000 incandescent lamps, so arranged that there will be a diffused light throughout the auditorium, while the stage will be bril.

liantly illuminated. The hall will be constructed much on the same principle as the Auditorium, but there will be no rows of lights on the overhead arches as in the older building, which was planned by the same architects, Adler & Sullivan. It has been found that this arrangement is dazzling to the eyes of the spectators, and in the new theater an effort will be made to conceal the lamps as much as possible, giving a more subdued light. On the stage, however, there will be a flood of light, and it is claimed that the regulating mechanism will not be excelled by that of any theater in the country. The footlights will consist of rows of colored and plain lamps, and the former will be

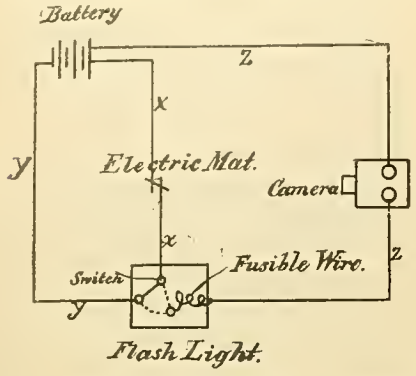


FIG. 10. PHOTOGRAPHING TWO THIEVES BY ELECTRICITY AND THE FLASH LIGHT.

so arranged that they can be lowered out of the way when not in use, in order to avoid interference with the reflectors.

Current will be supplied by an isolated plant in the basement of about 5,000 lights capacity. The entire electrical equipment will be furnished by the Western Electric company, which secured the contract after an active competition. The general plant will consist of one 100 kilowatt dynamo, two 60 kilowatt machines and one of 33 kilowatts. In addition the building will be supplied with six electric motors—one each of 60 horse power, 40 horse power and 30 horse power, and three of 15 horse power. These motors will be used principally for driving ventilating fans. The generators will be driven by two Reynolds-Corliss engines, and powerful steam pumps will also form a part of the plant. The building, aside from the theater, will be supplied with about 2,000 lamps and will be wired on the convertible system. The switch-board will be of marble and so arranged that the building can be readily thrown on the down-town station of the Chicago Edison company in case of an emergency. Should the

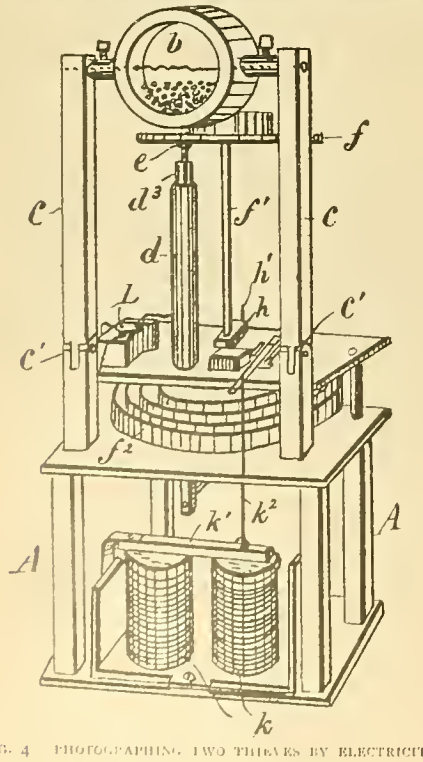


FIG. 4. PHOTOGRAPHING TWO THIEVES BY ELECTRICITY AND THE FLASH LIGHT.

steam plant break down this would be done, and the 60 horse power motor is so connected that it could easily be used to drive the pumps. Work is now progressing on the plant, and it is expected that it will be ready for operation by October 1st.

Photographing Two Thieves by Electricity and the Flash Light.

A most ingenious and scientific piece of detective work was recently reported from Toledo, O., by which two young boys who had been engaged in petty thieving were taught a lesson and given a scare that will, it is hoped, mark the turning point in their careers.

One reads a great deal about how the camera may be utilized as an aid in the work of thief catching, and numerous indeed are the burglar detector schemes of the wily electrician who seeks to find through the combination of his art and that of the photographer that ideal apparatus which will make the life of the thief, like the lot of the policeman, "not a happy one." It is not often, though, that these brilliant ideas amount to anything when put in practice. The apparatus "wouldn't work" because the thief "didn't do what he was expected to do"—is generally the explanation of most of these failures. For this reason the story of the recent successful experiment in Toledo is highly interesting.

It seems that Gus Triquet, who keeps a barber shop at Toledo, O., next door to St. Paul's church, for the past month has, once or twice a week, missed cigars from the case in his shop. At first but few cigars were taken, but by and by the thieves became bolder, and at last began taking whole boxes. On several occasions Mr. Triquet watched for the thieves but all in vain. They effected an entrance through a back window, and some time ago, when the window was fastened, they broke the glass and were then enabled to turn the catch. To save further annoyance Mr. Triquet employed detectives, but, after watching the shop for a couple of nights, during which time one of the officers contracted a severe case of rheumatism while secreted in a damp place watching for the thief, they gave it up.

At last Mr. Triquet heard that W. H. Harbeck, assistant

FIG. 2. PHOTOGRAPHING TWO THIEVES BY ELECTRICITY AND THE FLASH LIGHT.

secretary of the waterworks, had a flash light camera which would assist in detecting the thief that was taking his cigars. Accordingly Mr. Harbeck was called upon, and as a result the detector was set in the barber shop.

Mr. Harbeck arranged his camera so as to cover the cigar case, connecting the flash light apparatus and the camera by wires with the sliding door of the cigar case so that when the door was opened the wires would be brought together, forming a circuit which would act to produce a flash, thus securing instantaneously a picture of the thieves.

For twelve days and nights the device watched faithfully, and on the morning of the thirteenth day, at 6:35 A. M., Wednesday, June 1st, the thieves, two small boys, called again and were caught in the trap.

In the morning when Mr. Triquet came to his place of business the room was filled with smoke, and he rightly conjectured that his visitors had been there. The back window was wide open, showing that the trespassers were in such haste to leave that they did not take time to close the window. The cigars were not disturbed.

Mr. Harbeck was notified, and he developed the plate, when the picture, as presented in Fig. 1, was brought out.

It should be explained that the illustration, Fig. 1, obtained through the courtesy of Mr. Harbeck, is an exact reproduction of the flash light photograph which was taken on this occasion, and in it the two little thieves are imprinted as they appeared in the act of stealing the cigars. It should be noted, too, that the picture recorded even the time as given by the clock on the wall of the barber shop.

On being shown this photograph Mr. Triquet at once recognized one of the boys, and placed the matter in the hands of a detective. The culprits were arrested, and have since been placed in the Reform School at Lancaster, the judge complimenting the detector from the bench.

This is the second time Mr. Harbeck has succeeded in capturing criminals by the aid of the electric flash light camera. Fig. 2 is a reproduction of another detector picture. It shows a negro who was photographed about a year ago by the same machine while trying to burglarize an office in Toledo. The occupant of the office, however, was a kind hearted old gentleman who took compassion upon the negro and refused to prosecute him, thereby depriving the machine of the notoriety which it has received in the case of the two boys.

The diagrammatic cuts presented herewith will give the reader an idea of the details of the electric flash light cam-

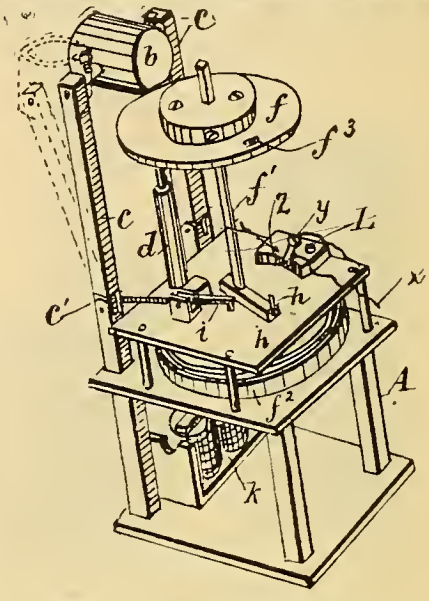


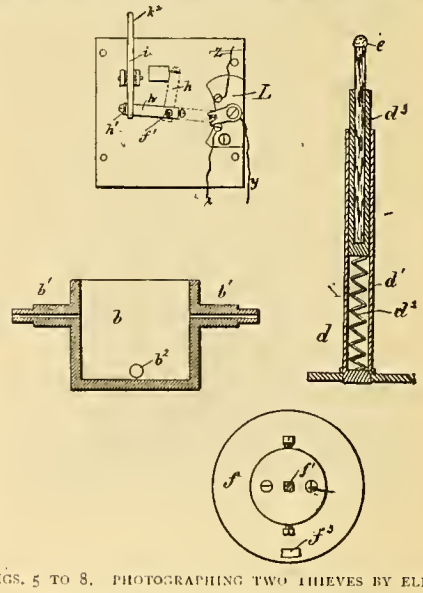
FIG. 3. PHOTOGRAPHING TWO THIEVES BY ELECTRICITY AND THE FLASH LIGHT.

era. A description of the manner in which the wires and machine are set in practice is withheld, as the publication of these details might enable those for whom the trap was set to avoid it.

Fig. 3 is a rear view of the flash light mechanism. Fig. 4 is a front view, and Figs. 5, 6, 7 and 8 show details of the camera. In Fig. 9 there is a front view, showing the shutter, with the flash light device in place on the camera; also a side view from the left, and a plan view, too, of the interior of the back part of the camera. Fig. 10 is a diagram of electrical connections. Like letters represent like parts in the several views.

The flash light device, Figs. 3, 4 and 9, is ordinarily kept in a box, but for convenience of illustration is shown removed from its case.

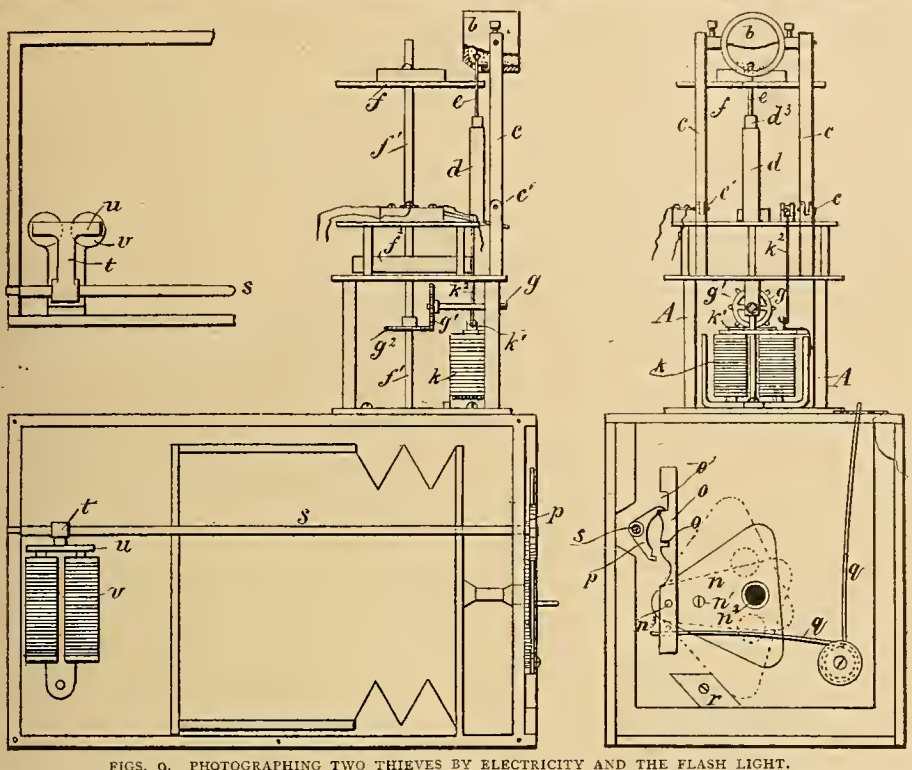
At the upper part of the frame of the flash light device there is a swiveled powder-cup *b* of brierwood or clay to hold the flash light powder. The posts *c*, upon which the cup swings, are hinged at c^1 to permit the cup to be swung forward out of its case for convenience in filling.



FIGS. 5 TO 8. PHOTOGRAPHING TWO THIEVES BY ELECTRICITY AND THE FLASH LIGHT.

The cup is suspended upon trunnions b^1, which are pierced horizontally to receive a piece of fusible wire, as shown in the enlarged sectional view of the cup, Fig. 7. For the fusible wire it has been found that a bit of lightly twisted tin foil answers the purpose admirably. The cup has an opening, b^2, through its side, near the bottom, in such position that when the cup is adjusted for operation the opening is at the under side of the cup. Immediately be-

neath the cup is a matchholder d, Fig. 6, which consists of a vertical tube, d^1, containing a spiral spring, d^2, which supports within the tube a sliding socket piece, d^3, designed to hold a common lucifer match e. The match has vertical motion in line with and can enter opening b^2 in the powder cup. Between the powder cup and the match there is interposed the disk f, Fig. 8, which rotates upon a vertical shaft f^1, which, at its lower end, engages a coiled spring j^2. Fig. 4. The under side of this disk has a roughened surface and is provided with an opening f^3, which, at a point in its rotation coincides with the match e, so that the match being pressed upward by its supporting spring against the rough lower side of the disk, is ignited by contact with the disk and then passes up through openings f^3 in the disk and b^2 in the powder-cup and ignites the flash light powder contained in the cup.



FIGS. 9. PHOTOGRAPHING TWO THIEVES BY ELECTRICITY AND THE FLASH LIGHT.

In setting the device for operation the spring f^2 may be wound up, and the shaft f^1 and the disk f, rotated by means of a common clock key placed on the end of shaft g. Fig. 9, on which is pinion g^1, engaging pinion g^2, fixed on shaft f. Projecting radially from shaft f^1, there is an arm h, Fig. 5, which, when the device is set for operation is held in place by a detent-lever i, which is disengaged from arm h by the downward pull of electro-magnet k upon armature k^1 through cord k^2.

L is a switch adapted to be thrown by arm h as it rotates with disk and shaft ff^1, by means of a projecting pin h^1 on the arm, which engages a notch in the end of the switch arm l.

Camera m is provided with shutter n, pivoted at n^1, Fig. 9, and having opening n^2, coinciding with the lens of the camera, and being at n^3 pivoted to and actuated by a vertically sliding bar o. This bar is provided with notches o^1 and o^2, in one of its edges. These notches are engaged in turn a by tilting dog, p. When the bar is depressed and the shutter raised, the lower arm of dog p engages notch o^1. When the dog is tilted the bar is released and is pressed upwardly by spring q, but is caught and detained by the upper arm of the dog engaging notch o^2 at a point in the throw of the shutter where its opening coincides with the lens of the camera. When the dog is again tilted to its first position, the bar is released and completes its upward throw, completing the exposure by carrying the shutter down to its final position against stop r. Dog p is fixed to one end of and is tilted by shaft s, which carries at its opposite extremity an arm t, to which is attached armature u, actuated by magnet v.

Magnet k, Fig. 10, in the flash light apparatus, is in circuit $x\,y$. When the switch L is thrown by the release of arm h, magnet k is thrown out of circuit, and the circuit now is through $z\,y$, including the camera magnet, posts c c in the flash light device, and the fusible wire in cup b.

It has been found in practice that one is enabled by the adjustability of the powder cup to throw the flash in the direction of the object to be photographed, and thus obtain a stronger light and better results than when loose powder is flashed in the open air in the usual way.

The operation of the device is as follows: Circuit $x\,y$ is closed by means of an alarm-mat, a burglar-alarm, or other suitable circuit-closing device. Magnet k pulls down armature k^1 and cord k^2, tilting detent-lever i, which releases arm h. Coiled spring f now rotates shaft f^1, carrying with it friction-disk f, lighting match e, which is pressed against the disk by spring d^2, and which passes through opening f in the disk and opening b in the cup, igniting the flash light powder in the cup. At the same instant arm h throws switch arm i, and the current is thus shunted through circuit $z\,y$, including the fusible wire in cup b and magnet v. The pull of magnet v on arm and armature $t\,u$, through shaft s tilts dog p, releasing shutter n from its first position, permitting the shutter to fall so that its opening coincides with the lens, the tilting-dog n catching and holding the bar o in this position by means of the continued pull of magnet v on the dog through arm t, armature u, and shaft s. The fusible wire is now consumed by the heat of the flash light, the circuit $z\,y$ is broken, magnet v lets go, shutter n falls, and the exposure is completed. Thus it will be seen that the exposure and the flash light must be simultaneous, and that the exposure is completed by the action of the flash itself.

Dinner in Honor of Samuel Insull.

On Monday evening, July 18th, the Union League club, Chicago, was the scene of a dinner given in honor of Samuel Insull, late vice-president of the Edison General Electric and General Electric companies and now president of the Chicago Edison company, by B. E. Sunny, western manager of the General Electric company. In addition to the host and the guest of the evening, there were present C. H. Wilmerding, F. S. Terry, John I. Beggs, F. E. Degenhardt, John L. Martin, W. A. Kreidler, J. W. Johnson, Theodore P. Bailey, D. H. Lauderbach, J. P. Ord, S. A. Barton and J. Martin Insull. The dinner was an elegant one, the floral decorations being especially attractive, and at its conclusion Mr. Sunny made a brief address, welcoming Mr. Insull to Chicago. The latter responded in fitting terms, and then Mr. Sunny put the gathering in charge of Mr. Degenhardt, who, as toastmaster, succeeded in getting a speech from nearly every gentleman present. The occasion was a delightful one, and will be long remembered.

Photographed by Lightning.

A religious paper published at Waterloo, Ia., publishes this story with the statement that it comes from a reliable source: A strange freak of electricity occurred in Thayer county, Nebraska, during a recent storm. Miss Annie Holsinger had gone to the well for water, and upon returning to the house saw, as she supposed, her mother looking at her through a window. She thought nothing of this; but when later she went to the well and saw her mother again watching her, she was much perplexed, especially as she found her mother sitting just as she had been when the daughter left the room. Upon investigation it was found that Mrs. Holsinger had not left her chair, and that which the daughter had seen was a life-size picture on the window pane. It had been photographed there by the lightning. The portrait remained for a few days on the glass, and then faded away.

A Roumanian Locust Exterminator.

The secretary of the interior has received from Andreas Schmidt of Bucharest, Roumania, a description of a device for the destruction of locusts by electricity. One method of applying the invention consists in the erection of a rampart of earth a foot high, surrounding the infested area, a ditch being left by the removal of the earth to form the said rampart. Along the top of this earthen wall and inclining over the ditch run two conductors, positive and negative, insulated from each other by a thin strip of rubber The idea is that, the current being on, the little pests wil

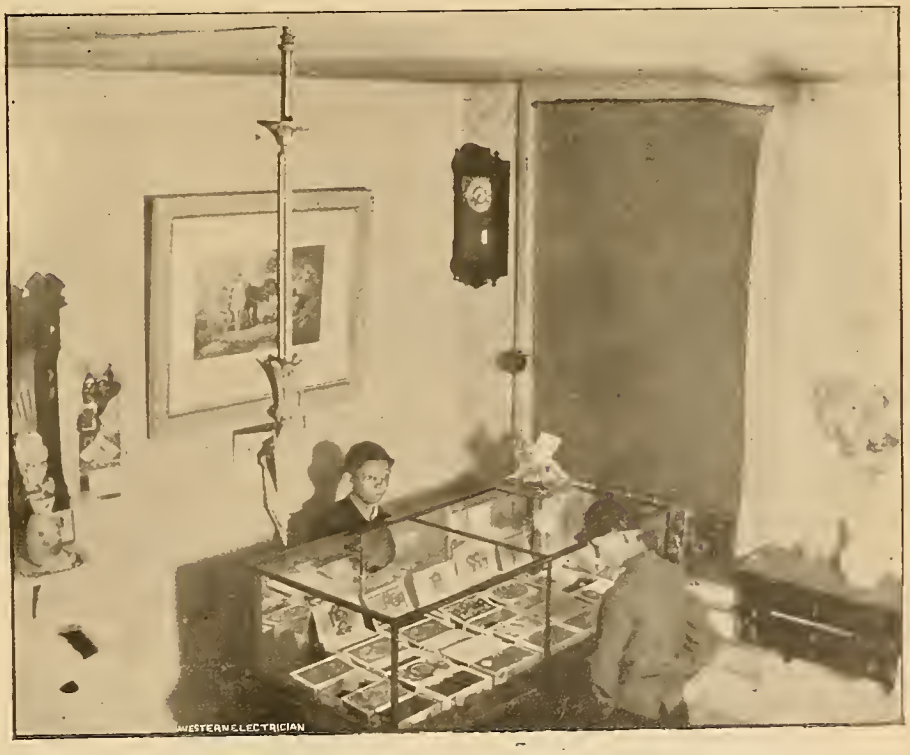


FIG. 1. PHOTOGRAPHING TWO THIEVES BY ELECTRICITY AND THE FLASH LIGHT.

crawl up the wall, compelte the circuit by their own bodies, and instantly drop dead into the ditch. Flags are placed at intervals along the top of the wall to give warning of its presence. In another application of the same idea the locusts crawl up the inclined plane formed by a sheet of cloth sloping to the ground. If the positive and negative conductors can be brought so close together that the grasshopper's body will form a bridge from one to the other every time, death is certain.

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CONTENTS OF THIS NUMBER.

PAGE.

Utilizing Electricity in Organ Blowing. Illustrated..... 43
Electric Heater in Canada. Illustrated.....44, 45
Electricity at the World's Fair..... 45
New Chicago Theatrical Lighting Plant.....45, 46
Photographing Two Thieves by Electricity and the Flash Light. Illustrated.....46, 47
Dinner in Honor of Samuel Insull..... 47
Editorial..... 48
McTighe's Rail Bond. Illustrated..... 49
New Chicago's Aurora Borealis..... 49
A Novel Trial 49
The Ford-Washburn Storage Battery. Illustrated..... 49
A Method of Extinguishing Arc Lights. Illustrated..... 49
Rhode Island Clam Bake..... 49
Railway Problem of Chicago..... 50
First Atlantic Cable..... 50
Large Electric Water Power Plant..... 50
Cables under the Pacific..... 51
Gravity Copper Anchor. Illustrated..... 51

DEPARTMENTS.

Correspondence.....51, 52, 53, 54, 55
New Incorporations..... 55
Electric Lighting..... 56
Electric Railways.....55, 56
Telegraph..... 56
Telephone..... 56
Miscellaneous..... 56
Trade News..... 56
Business..... 56
Electrical Patents 56

THE great telegraph companies are fairly entitled to credit for the excellent manner in which they handled the immense volume of business thrown upon them preceding and during the sessions of the recent national conventions at Minneapolis and Chicago. The tax upon the resources of the companies was particularly noticeable in the case of the gathering in the former city, but all the demands for service were met.

CHICAGO'S boulevards leading to the World's Fair are still lighted by gas lamps, and thus far there are no indications of active steps toward introducing electric lighting. It is the intention of the park commissioners to light all of the boulevard approaches by electricity before the opening of the great exposition, but as yet not the first step has been taken toward putting down the plant or preparing the conduits for the wires. Attention has repeatedly been called to the necessity of prompt action in this matter, and now that the time for opening the fair approaches it behooves all who may be responsible for the condition of affairs to bestir themselves and lose no further time in this matter. It is one of the most important questions which confront the city authorities. When Chicago welcomes visitors from all parts of the world it must be prepared to display its many attractive features to the best advantages. The beautiful South Side drives, lined with magnificent homes, should be brilliantly illuminated during the fair, and Chicago, as the typical American city, should be lighted by the modern method of illumination. No doubt the boulevards will be ready for the fair, but it should be remembered that, to prevent disappointments, delays and breakdowns, plenty of time should be given the engineers who are to design and install the plant.

ENCOURAGING signs of brighter days for the storage battery people are coming from New York. The application of the officers of the Second avenue surface road for permission to make a trial with battery cars and the decision recently reached by the officers of the Kings County elevated road to make similar tests would seem to indicate that there are still a few railroad men who have no objection to the exploiters of storage battery systems spending money to demonstrate the advantages of modern methods. The cry has been that the litigation between the companies controlling the storage battery patents was one cause of the delayed progress. Doubtless this is so to a great extent. It is to be hoped now, though, that as the railway companies have shown a disposition to give the electrical people an excellent chance to demonstrate the practicability of the application of storage batteries to street car work, any company belligerently inclined which may want to control the battery industry will withhold proceedings until it has been demonstrated that the accumulator has a place that it should be allowed to fill.

ONE of the neatest pieces of detective work that can well be imagined is described elsewhere in this issue. Readers of scientific journals have at one time or another perused with more or less interest articles in which the adaptability of the photographer's camera as an aid to the detective was enlarged upon. There are few, however, who have had an opportunity to see a photograph of thieves secured during the night showing the burglars as they actually appeared while engaged in their nefarious work. Such a photograph, however, was recently obtained from a gentleman whose camera made the negative. This camera is a most ingenious device, and is particularly applicable to this work as it has an electrically operated flash light and the whole arrangement works automatically. The picture from which the cut presented elsewhere in this issue was reproduced, was the means of detecting a couple of juvenile burglars. The little fellows may be clearly distinguished at a cigar case stealing cigars. The work of the electrical camera was particularly praiseworthy in the present instance in that through the flash light picture, an innocent person was relieved of suspicion.

AFTER some unsuccessful trials it seems to have been demonstrated in St. Louis that horse racing by electric light is a practicable amusement. Our correspondent in that city pronounces the recent test to have been "eminently successful," and the *Post-Dispatch* adds this testimony: "A week's trial has demonstrated the fact that horse racing by electric light is no longer a matter of speculation or experiment. The results of the initial attempt at South Side park during the past week show that the scheme is eminently successful from all standpoints." Incandescent lamps were used at the St. Louis track in place of arc lights, which had been previously employed in other cities with but indifferent success, the sharp shadows proving a serious disadvantage. Clusters of four 32 candle power lamps were suspended from brackets at intervals of 23 feet, and 525 of these lights were employed about the course, independent of the lighting of the grand stand. The attendance was very satisfactory, and, in the absence of information to the contrary, it is to be presumed that the horses took kindly to the innovation. The great advantage of the method, of course, is the fact that it enables many persons to attend the races who would otherwise be unable to do so. This and the novelty of the thing will doubtless prove sufficient to induce managers of other race tracks to use electric lights, although it is hardly to be expected that any records will be broken at these evening contests. Already arrangements are in progress for an attraction of this character at the West Virginia state fair at Wheeling, and other associations will not be long in following these examples.

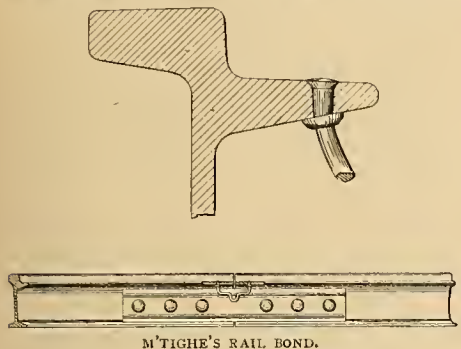
A YOUNG man who "plainly confesses" that he hardly knows what to make of himself, writes to the *State Register* of Des Moines, Ia., stating that he has heard that "there is a large field opening in the line of electric work," and asking the editor to advise him in relation to venturing into electrical work. The editor is rather guarded in his reply, pointing out the importance of starting in life aright, and the difficulty of offering advice on this delicate subject. He adds: "The fact that you 'want to' be an electrician, or that you have a 'bent' in that direction, is not enough. You must remember that peculiar requirements are necessary in this the newest and least understood of any of the trades." In conclusion the *Register* man advises his correspondent to read up on the subject of electricity thoroughly before "making a break" in the direction indicated. It does not appear, however, that the young man has even an inclination toward electrical study, simply having heard of a large field that now offers itself in that line, and casting longing eyes toward it. The editor might have been much more decided in his opinion and told the applicant for information what is undoubtedly the truth—that he will be much better off on the farm than in undertaking the difficult duties of an avocation for which he has neither taste nor talent. A great deal is said nowadays about the great opening in the field of electrical development for young men, and it is true that there is a demand for competent electrical engineers. As in every other profession there is and always will be "room at the top;" but those seeking advice on this subject should be fairly warned that they need not only a decided "bent" in the direction of electrical work, but that they must possess the ability to perform a great deal of hard, unromantic work before reaching a position that will enable them to speak and act with confidence in electrical problems. There is no need to disguise the fact that it requires a high order of intelligence and hard study to obtain a comprehensive knowledge of the phenomena and applications of electricity as they are now known, and the student is also required to keep abreast with the constant advancement. Earnest workers, with an intelligent appreciation of the difficulties to be encountered, are always welcome, both in the workshops and in the schools. There are not too many of these. But irresolute young men, who are vaguely looking for sinecures in the electrical field, had better hold aloof, or else dabble in electricity merely for their own amusement. There are too many "half-baked electricians" already. It must not be forgotten, also, that theoretical knowledge must be supplemented by practical experience in shops, either in the technological schools or in the factories, and no one lacking in aptitude for mechanics need look for success in any application of electricity.

ANOTHER victory has been achieved at Chicago by the telegraph companies. On Monday last, after a controversy extending over a period of nearly two years, the Western Union and Postal Telegraph companies were admitted to the floor of the Board of Trade, and the service of quotations to the outside world was resumed. It will be remembered that the obnoxious order issued by ex-President Baker of the Board of Trade, prohibiting the sending out of quotations, created quite a sensation, and was bitterly opposed by many influential members of the board. This was one of Mr. Baker's hobbies, however, and he was supported by a majority of the governing board, despite the fact that it was pointed out at the time that the quotations would be sent out any way and that the order would ultimately react upon the board. While the companies were enjoying the privileges of the board, they had in return granted a special rate to the members, but as soon as the privileges were withdrawn the regular rates were resumed and instead of paying 25 cents for ten words to New York, for instance, the members were charged the regular toll—40 cents. This naturally aroused opposition to the arrangement, but as a majority of the members under Mr. Baker's leadership expressed a desire to "bring the telegraph companies to time" these corporations took no part in the controversy. Meanwhile the board found it impossible to withhold quotations from the "bucket-shops" and the war on the telegraph companies threatened to affect the life of the board. It was seriously proposed to build a new telegraph line, and several spasmodic attempts were made to establish a company for this purpose. In January, 1891, Mr. Baker revived the discussion of this topic in his annual address, but the matter was again dropped. About this time there was a general revulsion of sentiment, and overtures were made to the old companies to return to the floor. After considerable discussion terms were arranged and it was decided to abandon all attempts to promote a new telegraph line. The directors revoked ex-President Baker's order, and the companies at once set about arranging to resume the service.

At the time the order was issued by Mr. Baker it was pointed out by the WESTERN ELECTRICIAN that it was only a question of time when the board would return to the old arrangement. Mr. Baker and his followers took another view and their efforts to enforce their ideas upon the board have proved exceedingly costly. A Chicago paper, explaining the failure of the plan, says that shortly after the order was issued "members were detected supplying bucket-shops with quotations by means of a code of signals. All efforts of the administration to prevent the quotations from being supplied to the bucket shops proved fruitless, and as a result the telegraph companies were permitted to resume their old work." This is a substantial victory for the telegraph companies.

McTighe's Rail Bond.

Rail bonds are sometimes employed that are made of wire or a flat band of metal having rivets attached to its ends by soldering, brazing or riveting, the bond as a whole thus comprising three separate pieces. A modification consists in taking a plain wire, inserting its ends in enlarged holes in the rails, and driving alongside a channeled pin of conical or wedge shape. Here again are three separate pieces of metal. The rail bond illustrated in the cut is made in one piece, and has shoulders or rivet heads on its curved



M'TIGHE'S RAIL BOND.

ends terminating in pins or rivets for insertion in and attachment to the rail. The bond may have the shoulders formed by simply upsetting the metal at those points, or it may be made from stock, the diameter of the shoulders swaged down to form the rivet ends, and the body or drop-forged rivet ends, including the shoulders, may be welded to the body piece. The act of riveting such a bond in the rails seals the contacting surfaces against moisture.

The inventor of this bond, T. J. McTighe of New York, claims that by drilling through the tram of the rail close to the ends, as indicated, it is possible to use a rail bond as short as nine inches without interfering with a due allowance for expansion and contraction of the rails, thus, he claims, practically eliminating about three-fourths of the possible resistance due to the rail bonds. Another very important advantage follows this application of the rivets upwardly through the tram of a girder rail, in that, as this portion of the rail is always uncovered, the whole rail bond system may be readily inspected frequently without disturbing the paving or rails in any way. Any suspected loose bond may be tested and tightened, and thus the continuous maintenance of the integrity of the rail return circuit easily insured.

Chicago's Aurora Borealis.

The World's Fair city was treated to a wonderful display of aurora borealis on Saturday evening last. A little after 9 o'clock the horizon, for nearly 120 degrees, was lighted up and shafts and beams of prismatic colors flashed and darted toward the zenith, there to meet and mingle in one great display of Nature's fireworks. The bars of light which shot so quickly back and forth took on various tints, from a light pink to a deep crimson, an occasional flash of pale orange adding to the beauty of the exhibition, while the bright red of the sky behind formed an attractive background.

The aurora was appreciated from two different points of view by Chicagoans. The ordinary citizen considered it from an æsthetic standpoint, but to the telegrapher the display was not so attractive. Between the hours of 10 A. M. and 3 P. M., while the sky was cloudless and the sun shining brightly, a tremendous current of electricity, said to be due to the aurora borealis, charged the air to such an extent that it was impossible for the telegraph companies to use the long wires while it lasted. The disturbance was first noticed at the Western Union offices. The current gradually increased in intensity until noon, when it was at its height. The officials state that it was absolutely impossible to get the use of the wires at Pittsburg, New York, Omaha and St. Louis, but the shorter circuits within a radius of 200 miles were apparently unaffected.

Prof. Charles B. Thwing, of the Northwestern University, who is teaching physics and astronomy in the university summer school at Evanston, Ill., made some peculiar observations during Saturday night's display. In a written statement on the result of his observations, Prof. Thwing says:

Another fact to be accounted for is the magnetic disturbance shown by the needle, and known as a "magnetic storm," which is usually found to accompany the aurora. There seems to be not the slighest foundation for the common belief that the aurora is a reflection from northern icebergs. The true explanation would seem to be that the aurora is an electrical discharge in the rarer regions of our atmosphere, very similar, on a large scale, to what is seen on a small scale when an electrical discharge occurs through the rarified air in a Geissler tube. The occasion of the discharge is a variation in the electrical rays which come to us from the sun, produced in some way by sun spot eruptions. Recent experiments have demonstrated that what we know as electricity consists of vibrations, similar in all respects to radiant light and heat and differing from these forms of energy exactly as they differ from each other—viz., in wave length. It is highly probable that a solar ray contains not only the short light waves and the slightly longer heat waves, but the much longer electrical waves as well, and that the phenomena connected with the earth's magnetism, together with many manifestations of atmospheric electricity, are traceable directly to variations in the electrical solar waves.

A Novel Trial.

Gustave A. Tempel, said to be the first man ever tried on the charge of stealing electricity, has been discharged in the court of criminal correction at St. Louis by Judge Claiborne. The judge would not concede that the offense was petit larceny and the grand jury would not allow that it was fraud, so when the case came up Attorney McDonald, for Tempel, entered a plea for acquittal, which was concurred in and the defendant discharged. As stated in the WESTERN ELECTRICIAN some time ago, Tempel, who is a hardware dealer, was accused of having tapped a wire of one of the electric light companies to get his illumination free.

The Ford-Washburn Storage Battery.

The Ford-Washburn Storelectro company of Cleveland, O., through Electrician Washburn has been experimenting for some months on a new storage cell, and the work has just been brought to a point where the details of the cell may be explained to the public.

The accompanying cuts, Fig. 1, and cross section, Fig. 2, will give a clear idea of the construction of the battery. Strictly speaking no plates are used, the cell consisting of

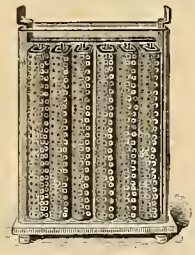


FIG. 1. FORD-WASHBURN STORAGE BATTERY.

six elements, each made up in the form of an oblong cup, Fig. 2. The negative element proper consists of a perforated lead sheet inside of which and next to a porous cell, is the active material. Inside of the porous cup there is a copper plate extending to the bottom of the cell and on the outside of this plate and next to the porous cup is

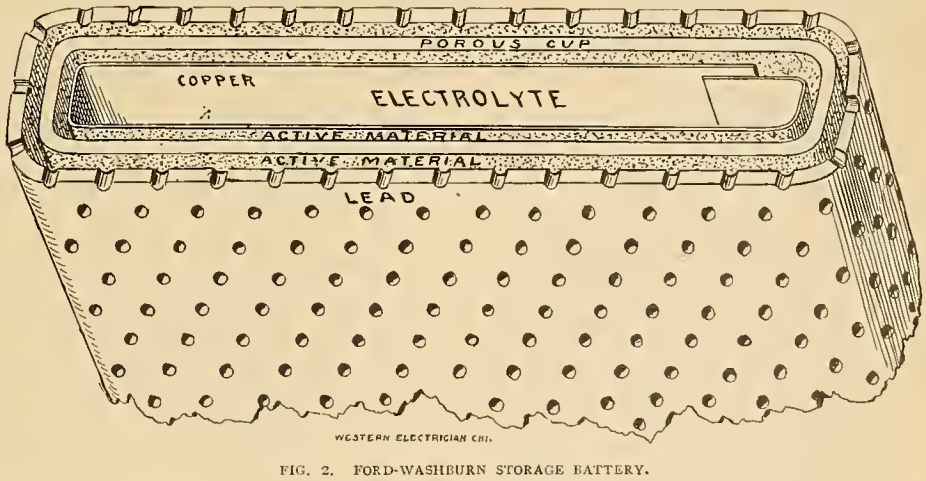


FIG. 2. FORD-WASHBURN STORAGE BATTERY.

the active material. The copper plate and its active material forms the positive plate.

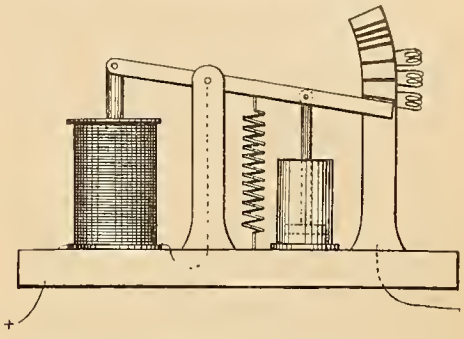
It will be seen that in this cell the active material is held rigidly in place, and it is claimed that repeated charging will have no effect to loosen the active material from the lead or copper.

A representative of the WESTERN ELECTRICIAN was in Cleveland last week and through the courtesy of Mr. Ford was invited to a ride in a street car equipped with this battery. With other guests on board, the car was run over Jennings avenue to South Cleveland, the round trip covering fully six miles. The car was propelled at a high rate of speed, and the exhibition was a decided success.

A Method of Extinguishing the Electric Arc.

Prof. Sidney H. Short of Cleveland, O., writes that he has discovered that the electric arc—such as tends to form on opening a circuit—requires a certain amount of heat for its maintenance or formation, and that by conducting the heat rapidly from the contacts between which the opening in the circuit is made, the arc can be extinguished, for its formation prevented, and the injurious effects of the sparks lessened or avoided.

To accomplish this object the contacts are made com-



METHOD OF EXTINGUISHING THE ELECTRIC ARC.

paratively massive and of a material which is a good conductor of heat. The contacts are also separated into a number of parts insulated from one another, so that the arc is exposed at two or more points to the cooling influence of the material composing the contacts.

The accompanying cut shows an electro-magnetic cut-out provided with Prof. Short's arc extinguisher. This device after it operates restores the current after an interval of time.

In this cut-out the electro-magnet is included in the main circuit, and the switch lever is connected with the movable core of the magnet and also with a retracting spring and a dash-pot adapted to allow the switch lever to move rapidly when sufficiently attracted by the magnet, but to check and delay its return under the influence of the spring. A rheostat may be combined with the cut-out as indicated. Its effect is that the circuit is made to include the resistance coils as it is opened and closed. The arc extinguisher comprises a number of blocks of metal like copper, which is a good conductor of heat as well as a conductor of electricity. These blocks are insulated from each other and so arranged that the sparks which are formed where the switch lever leaves the last contact leap across the space between the blocks. These latter should be adapted to convey away the heat so fast that the spark or arc is cooled or refrigerated out of existence by the conduction. According to Prof. Short blocks of pure copper, each three by one-half by one-half inches, separated from each other by an air space or insulation of one-fourth inch across, will answer.

Rhode Island Clam Bake.

During the last week members of the electrical fraternity have been receiving invitations to the fourteenth annual Rhode Island clam dinner to the electrical fraternity by the American Electrical Works of Providence, R. I., at Haute Rieve Union Club Country House, Saturday, July 23d. Lunch will be served at 11:30; bake opens at 2. The following committees have been announced: Honorary committee—A. C. White, Providence; Lemuel Bannister, Pittsburgh; E. D. Floyd, Boston; H. F. Woods, Boston; A. D. Newton, Windsor; E. B. Baker, New Haven; John

I. Sabin, San Francisco; J. I. Ayer, St. Louis. Reception committee—W. A. Hathaway, W. H. Sawyer, C. R. Remington, Jr., P. C. Ackerman, E. Rowland Phillips, C. H. Wagenseil, A. L. Capper, John Carroll. The experience on former occasions warrants the prediction that the gathering will be a most enjoyable event.

Railway Problem of Chicago.

On June 4, 1890, the Western Society of Engineers appointed a committee, consisting of Col R. B. Mason, Benezette Williams, Gen. Sooy Smith, E. L. Corthell, Richard Price Morgan, Oliver B. Green and Isham Randolph, to consider "the railway problem of Chicago in relation to terminals, rapid transit, marine commerce and related interests." Later H. B. Herr was appointed to fill the place of Col. Mason, deceased. This committee has given the subject much attention, and the result of its labors is presented in a comprehensive report just published by the society. Concerning the subject of rapid transit the report says:

In populous districts rapid transit can never be attained upon the street levels. A multiplication of street railways, whether the modes of propulsion used be horse power, electric motor, cable traction or steam, or whatever other power the future may develop, will not give rapid transit, although every added line of travel increases the ability to handle a large volume of business. Rapid transit can only be attained by resorting to elevated or depressed tracks, and all that has been said about the application of these methods to the uses of standard steam railways applies with almost equal force to railways for passenger travel only. The preference of the traveler will probably be always for the elevated system, because it affords better light, freer circulation of air and a more extended view, besides its undoubted safety as demonstrated by long use. The city has much to gain in the way of unobstructed street travel by the adoption of depressed ways and tunnels for rapid transit routes. And only by resorting to tunnels beneath the river can uninterrupted communication between the different divisions of the city be attained, so long as the river channels are kept open to navigation as at present conducted.

Up to a comparatively recent period water and steam power have been almost universally used for manufacturing and mechanical purposes, but in the use of steam there is a great waste of power without much prospect of remedying it.

Within the last few years, however, electricity, which had been previously comparatively dormant, has been rapidly supplanting steam and gas, and only a cheaper method of generating it (which will no doubt be realized) is required to enable it to substantially take the place of steam and gas in many places where the latter are now used.

The most satisfactory and perfect success in the use of electricity has lately been attained in the underground railroad in London, called the London & Southwark Subway, extending in a southerly direction from the monument in King William street, near the north end of London bridge, under the Thames river to Southwark. It is 3½ miles long. The report states that it was opened for business in October, 1890, at a cost of $3,000,000.

The trains run continuously on two or three minutes' headway. The road lies from 40 to 60 feet below the surface of the streets. The tunnels and the trains are electrically lighted, and the trains are run by electricity; the tunnel is perfectly dry, and as there is no fire or gas in it, it is claimed that the air is as pure as that of the streets.

The shafts at stations are 25 feet in diameter, and in them are placed two water balanced elevators to take people to and from the platform.

The trains are run at as high speed as twenty-three miles per hour, but in general they will not maintain a higher rate than sixteen miles per hour.

No other available power could be used that could give such perfect satisfaction. The use of electricity is still in its infancy, and far greater developments in the near future are confidently anticipated, and in my estimation are sure to be realized.

The lighting of tunnels, underground railroads, streets, offices, dwellings and manufacturing establishments is already done to a considerable extent, and electricity is rapidly taking the place of animal power on our street railroads. It is entirely among the possibilities that it may take the place of steam for locomotives on our railroads, especially on short lines for suburban travel. Indeed, its use may be said to be almost unlimited, and it has the decided advantage of cleanliness over steam power, which is of immense importance, and it may have the further advantage of economy. In running trains, electricity is a growing power, and it is difficult to realize what may be accomplished by it in the near future.

Your committee is met by conditions which are beyond the scope or influence of engineering skill; passing into the domain of broad statesmanship, profound jurisprudence and able financiering. These conditions arise in the shape of corporate, civic and individual rights and economic expediency. There are in the city no less than fifteen (15) distinct rights of way owned by surface railways, and your committee knows of but one law which can group these several lines in the occupancy of any reduced number of railway thoroughfares and terminals; that one law is the decree of self-interest. These organizations can only be brought to abandon present methods and present holdings by a strong conviction that such a procedure would mean increased revenue by reducing expenses and increasing conveniences and facilities for transacting business. It is within the power of the law in the enforcement of the great principle which demands that you should so use your own as not to injure another or infringe upon another's right; to compel these several lines to so conduct their operations as not to endanger the lives or limbs of the people who everywhere in this broad land enjoy the right to life, liberty, and the pursuit of happiness. But it does not seem to be within the province of the law to prescribe specifications covering the details involved in the attainment of this great end. The law may order improvements of such obvious merit that, as an abstract conception, all must approve; but if the execution of these improvements involve an outlay beyond the financial ability of the parties in interest, then the majesty of the law is mocked by the poverty of the subject of legislation. In conclusion, we urge that it be demanded of the proper authorities that a commission of engineers be created to work up this whole subject; and that their work may be more intelligent and practical, that they be given able counsel in all questions involving legal rights and legal methods of procedure. To the end, that the conclusions reached may be authoritative for their broad and comprehensive wisdom. And further, that prompt measures be taken to secure such legislation as will make the plans and conclusions of the commission operative and binding, so that the improvements recommended may be entered upon at once and pushed to completion as fast as is consistent with the welfare and the rights of all of the parties interested.

Large Electric Water Power Plant.

There has recently been installed at Geneva, in Switzerland, a water power plant of unusual size. The turbines, which are situated on a small island in the middle of the Rhone, are principally used for furnishing power to a central station supplying the electric light to the town. It was found necessary to place this station 350 meters above the hydraulic house, resulting in an unavoidable loss of power. The Societe d'Appareillage Electrique of Geneva has just terminated negotiations for the entire lighting of the town by electricity and the present plant will soon be doubled and trebled to meet the requirements of the place. Geneva will then have the largest installation in Switzerland. The present hydraulic station, says the London *Electrician*, was commenced in 1883, under the direction of M. Turettini, the pumps being built by E. Wyss, of Zurich. Weibel and Briquet of Geneva, furnished the overhead trolleys, the total horse power capable of being developed by the turbines being nearly 5,000. The water is distributed at high and low pressure. For supplying the electrical central station, 12 to 15 centimes per horse power hour is charged according to the consumption. Nearly 1,000,000 francs have been spent on the station and service. These hydraulic works, which belong to the town, have entailed an outlay of 6,000,000 francs and more, and 160,000 francs is required annually for maintenance. Still there is a yearly profit of some 200,000 francs. In 1891 the total amount of water supplied was 6,050,000,000 gallons.

A new project for utilizing the power of the Rhone on a vast scale has just been presented to the authorities. The promotors state that they will put down machinery of the biggest type ever made, to realize 12,000 horse power (15 turbines of 800 horse power). The site is 6 kilometers from Geneva, near the junction of the Rhone and Arre.

The present central station on what is known as the Ile at Geneva, contains eight dynamos, giving 600 amperes at 110 volts, and two extra dynamos of 115 electrical horse power. The distribution is carried out on the three-wire system. Each cable incloses three separate conductors of the same size, and the current generated by the central station is delivered by five special feeder cables. The five feeders have a total length of some 3,000 meters. The distributing mains are about 3,500 meters long. Some 2,000 meters of other cable brings the total length up to 25½ kilometers. The whole of the cables are underground.

Up to the present the lighting at Geneva is nearly all private. Some 10,000 incandescent lamps are divided among nearly 350 subscribers. The total value of the central station and plant is put down at about 890,000 francs. Salaries of electricians and other employes amount to 25 000 francs yearly, and an additional 25,000 francs per annum is spent on the water power. The progress of electricity at Geneva is well shown in the annual report, 22½ francs per share being the last dividend declared.

The following are a few particulars of the supply prices: Per 8 candle power lamp hour, 4 centimes; 16 candles, 7 centimes; 32 candles, 12½ centimes; 50 candles, 18 centimes; 100 candles, 35 centimes. The arc lamp hour is rated at 10 centimes per ampere. The consumer has to pay for the installation of his meter, being charged at the rate of 6 francs for one meter, nine francs for two, twelve francs for three, and so on, increasing three francs for every additional meter. The 12 ampere meters cost 25 francs yearly, 25 amperes 30 francs, 50 amperes 40 francs and 100 amperes 50 francs. These prices include maintenance. Subscribers have to pay a minimum annual sum of 150 to 250 francs per year per lamp, according to the nature of the places lighted. Payments are made monthly. Persons who pay promptly are allowed a discount of from 5 to 17 per cent., according to their agreement.

The Western Electric Construction company has begun suit to recover $46,727.59 from the Metropolitan Railway company and the Investors' Security Accounting company of Denver. The plaintiff alleges that the Metropolitan company, as successor to the Suburban Railway company, operating extensively in North Denver and Highlands, was responsible for the fulfillment of a contract made by it for performing labor and furnishing material in the construction of the road. The Construction Company prays that the court will give it judgment for the amount it sues for and a first lien on the property, to the exclusion of the Accounting company. It also prays that if the money is not forthcoming in a proper period, that the road be sold.

The First Atlantic Cable.

Many interesting reminiscences of the laying of the first Atlantic cable have been recalled by the death of the projector of that great enterprise. In describing his feelings during the stirring days preceding the successful accomplishment of this great work, Mr. Field said:

It has been a long, hard struggle, nearly thirteen years of anxious watching and ceaseless toil. Often my heart has been ready to sink. Many times when wandering in the forests of Newfoundland, in the pelting rains or on the decks of ships, on dark nights—alone, far from home—I have almost accused myself of madness and folly to sacrifice the peace of my family and all the hopes of my life for what might prove after all but a dream.

I have seen my companions, one and another, falling by my side, and I feared that I, too, might not live to see the end. And yet one hope has led me on, and I have prayed that I might not taste of death till this work was accomplished. That prayer is answered, and now, beyond all acknowledgments to men is the feeling of gratitude to Almighty God.

The New York chamber of commerce entertained Mr. Field at a grand dinner given in his honor November 15, 1866. On that occasion Mr. Field gave an exceedingly interesting account of the recovery of the cable which had been lost in mid-ocean. A report of this graphic description is herewith reproduced:

After landing the cable safely at Newfoundland, we had another task—to return to mid-ocean and recover that lost in the expedition of last year. This achievement has, perhaps, excited more surprise than the other. It was the triumph of the highest nautical and engineering skill. We had four ships, and on board of them some of the best seamen in England—men who knew the ocean as a hunter knows every trail in the forest. There was Capt. Moriarty, who was in the Agamemnon in 1857-8

He was in the Great Eastern last year, and saw the cable when it broke; and he and Capt. Anderson at once took their observations so exactly that they could go right to the spot. After finding it, they marked the line of the cable by a row of buoys, for fogs would come down, and shut out sun and stars, so that no man could take an observation. These buoys were anchored a few miles apart They were numbered, and each had a flagstaff on it, so that it could be seen by day, and a lantern by night Thus having taken our bearings, we stood off three or four miles so as to come broadside on; and then, casting over the grapnel, drifted slowly down upon it, dragging the bottom of the ocean as we went. At first it was a little awkward to fish in such deep water, but our men got used to it, and soon could cast a grapnel almost as straight as an old whaler throws a harpoon.

Our fishing line was of formidable size. It was made of rope, twisted with wires of steel, so as to bear a strain of thirty tons. It took about two hours for the grapnel to reach bottom, but we could tell when it struck. I often went to the bow and sat on the rope, and could feel by the quiver that the grapnel was dragging on the bottom two miles under us. But it was a very slow business. We had storms and calms and fogs and squalls.

Still we worked on, day after day. Once, on the 17th day of August, we got the cable up, and had it in full sight for five minutes—a long, slimy monster, fresh from the ooze of the ocean's bed; but our men began to cheer so wildly, that it seemed to be frightened, and suddenly broke away and went down into the sea.

This accident kept us at work two weeks longer; but finally, on the last night of August, we caught it. We had cast the grapnel thirty times. It was a little before midnight on Friday night that we hooked the cable, and it was a little after midnight Sunday morning when we got it on board What was the anxiety of those twenty-six hours! The strain on every man's life was like the strain on the cable itself. When finally it appeared, it was midnight; the lights on the ship and in the boats around our bows, as they flashed in the faces of the men, showed them eagerly watching for the cable to appear on the water.

At length it was brought to the surface. All who were allowed to approach crowded forward to see it. Yet not a word was spoken; only the voices of the officers in command were heard giving orders. All felt as if life and death hung on the issue. It was only when it was brought over the bow and on the deck that men dared to breathe. Even then they hardly believed their eyes. Some crept toward it to feel of it, to be sure it was there. Then we carried it along to the electricians' room to see if our long-sought treasure was alive or dead.

A few minutes of suspense, and a flash told of the lightning current again set free. Then did the feeling long pent up burst forth. Some turned away their heads and wept, others broke into cheers, and the cry ran from man to man, and was heard down in the engine rooms, deck below deck, and from the boats on the water, and the other ships, while rockets lighted up the darkness of the sea.

Then with thankful hearts we turned our faces again to the west. But soon the wind rose, and for thirty-six hours we were exposed to all the dangers of a storm on the Atlantic. Yet, in the very height and fury of the gale, as I sat in the electricians' room, a flash of light came up from the deep, which, having crossed to Ireland, came back to me in mid-ocean, telling that those so dear to me, whom I had left on the banks of the Hudson, were well and following us with their wishes and their prayers.

This was like a whisper of God from the sea, bidding me keep heart and hope. The Great Eastern bore herself proudly through the storm as if she knew that the vital cord which was to join the two hemispheres hung at her stern, and so on Saturday, the 7th of September, we brought our second cable safely to the shore.

Cables Under the Pacific.

The project of a telegraphic cable under the Pacific Ocean to connect this continent with Asia and Australia and provide a short, direct, quick and cheap route to the far East in place of the present costly and comparatively long route, which circles backward three-fourths of the way around the globe, seems to have been advanced very materially toward accomplishment by the results attained by the United States cruiser, Thetis, in the second survey of the proposed route. The Thetis left San Francisco on April 18th last to take soundings and make a general survey of the ocean bed over the proposed route from California to the Sandwich Islands, the first section of a proposed cable route to Japan. She returned to San Francisco recently. Six months ago the Albatross made a similar survey, but the results attained at that time were not considered of a nature very favorable to the project. The Albatross surveyed a route running from a point on Monterey Bay, near the town of Monterey, direct to Honolulu. Her soundings, according to the New York *Sun*, showed the bottom of the sea was very irregular over the greater part of the route surveyed. The depths of the water were very great, and a great many lofty and perpendicular coral reefs were discovered along the track, indicating great danger of frequent and serious troubles to the cable through abrasion, and also of total loss, from the great depths and the swing between the reefs.

The Thetis met with far greater success in her survey. The theoretical route was the same from San Francisco to Honolulu, but, as in the case of the cables from New York to Europe, the actual route of the deep sea cable was located to begin at a point some considerable distance from San Francisco. The Atlantic deep-sea cables begin, or end, at Nova Scotia, Newfoundland, or in that immediate vicinity. The Thetis started from Point Conception, 220 miles south of San Francisco, and 38 miles west of the town of Santa Barbara, at the head of the Santa Barbara Channel. The place was considered by the electrical engineers to be favorable for a deep-sea cable landing. The ground at that point is high, and the water shoals off on a mud bottom.

The Thetis took a course nearly due southwest, and by way of the Great Circle. In the beginning of the survey soundings were made every two miles until a depth of 900 fathoms was registered. Five miles out from Point Conception sea bottom was found at eighty-seven fathoms, and at thirteen miles 281 fathoms were registered. From that point on toward the Hawaiian Islands the depth of water increased gradually to 3,000 fathoms, or more than three and a half miles. That great depth was the average for many miles. When the bottom was level soundings were taken every ten miles, and where it was irregular, undulating, or where reefs were discovered, soundings were taken at short intervals down to two in a mile. The greatest depth sounded on the route was 3,228 fathoms, at a point about three hundred miles from Hilo, on the island of Hawaii, where it is proposed to land the cable. The water shoaled to one thousand fathoms thirty five miles from Hilo, and shoaled gradually from that on to the landing place, near which the depth is twenty fathoms. A short cable will have to be laid to connect the island of Hawaii with Honolulu, but it is probable that the direct cable to Japan would be laid from Hilo to avoid transmissions and for reasons of favorable landing.

For the route surveyed by the Thetis the cable to the Sandwich Islands would be 2,060 miles in length. The route surveyed by the Albatross is about fifty miles longer. The Albatross had heavy weather during a great part of her trip, but the Thetis experienced favorable weather during most of the time. The Thetis survey is considered to be the most accurate and the best determined of any yet made for a Pacific cable.

The importance and necessity of a Pacific cable and the immense value it would be to the commercial interests of this country are obvious. Our exports to China and Japan last year amounted to more than $246,000,000. The British government is also deeply interested in the laying of such a cable, to connect Canada with China and Australia, but the interests considered are necessarily somewhat different, and are in a measure competitive and conflicting. They are partly commercial and partly political. Direct and quick communication with British ports and colonies and the far East generally is wanted for the sake of Canada's commercial interests in that direction; but, and perhaps mainly, an alternative telegraphic route to the East is wanted for government purposes—a route that shall be entirely through British possessions and not subject to interference or stoppage by any foreign power. It is considered to be an essential move of prudential strategy in line with recent experiments of shipping British troops from England to India and the East over the Canadian Pacific Railway.

These considerations have led to the mapping out of three competitive routes. At present all telegrams from New York for China, Japan, or Australia must go under the Atlantic to London. Thence are three routes to India, two through to China and Japan, and one continuation from either one of the three on to Australia and New Zealand. The northern route is from London to Denmark, through Russia, and across the Siberian steppes, by the Great Northern Telegraph company to Vladivostock, the eastern seaboard, where connections with China and Japan are made. The Indo-European route is a land line across Germany, Russia, and Persia to the Persian Gulf, and thence to Bombay. The eastern route, direct to China and Australia, is by way of France, the Mediterranean, Egypt, the Red Sea, Arabia, India, Penang, and Singapore, and thence by way of Java and Sumatra to Port Darwin, on the northern coast. The routes are long.

Of the three projected Pacific routes two start from British Columbia, one for Japan and Australia, the other for Australia direct, by way of the Fiji Islands. The northern route is projected from a point near Victoria, B. C., to Unimak, in the Aleutian islands, thence to Attu Island, and from there to Japan. A supplementary cable would be run from Japan via Manilla and New Guinea to the northern Australian coast. It is known as the Canadian route. The central or United States route, which has been surveyed to the Sandwich Islands by the Thetis, would run over the route surveyed to Hawaii, thence to Johnston Island, about seven hundred miles west, thence to Wake Island, 1,300 miles west, and midway between Hawaii and Japan, from there to Marcus Island, and from Marcus Island to a landing in Japan.

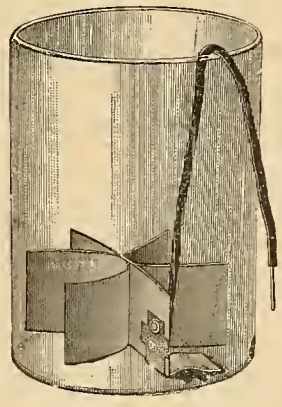
Japan and Australia are in communication now. Either of the Pacific cables would complete the telegraphic circuit of the globe. The third proposed route is from a point near Victoria, B. C., to Oahu, Sandwich Islands, thence due south 1000 miles to Fanning Island, thence to one of the Fiji Islands, 1600 miles, and from there another loop of about equal distance to Brisbane, Australia. That, however, would not afford good facilities for reaching China and Japan.

The approximate distances of each route are: Northern, British Columbia to Japan, 3,600 miles; central, San Francisco to Japan, 5,900 miles; southern, British Columbia to Australia, 6,750 miles. The extension of the first cable route from Japan to Australia, projected mainly for government purposes, probably, by the route indicated, would be an added distance of 3,000 miles. The estimates of the probable cost of a cable by each of the three routes vary, one estimate placing it at about four, six, and seven million dollars respectively for each main route, and an added three million for the additional cable from Japan to Australia; but that is only approximate. The Canadians, Australians and the British government are naturally chiefly interested in the northern and southern routes, and statistics are quoted to show that either of these routes is better than the central. Electricians concede an advantage for the northern route in the shorter distances between intermediate points, which would of course, increase the speed of transmission. That would have an appreciable effect on the tariff for telegrams. Over the short stretches on the northern route the highest rate of speed could be attained probably, but is not improbable that under possible and favoring circumstances the same results could be obtained over the longer cables by the central route from San Francisco. It is said, also, that the sea bottom on the northern route is very much more favorable, and that there would be less risk of interruptions. A British gunboat completed recently a series of surveys along the proposed northern route.

It is probable that at present two cables, by different routes, to China and Australia, would not pay, and that rivalry would cause loss to both. It has been suggested that the United States should join with the British Government in favor of the Northern route making its terminus at a place in the State of Washington instead of in British Columbia. How far the successful survey of the central route by the Thetis may affect the question remains to be seen. That a trans-Pacific cable is needed is conceded, and that it will be constructed very soon by some route, is accepted by electricians as a settled fact.

The Gravity Copper Anchor.

The illustration shows an improvement which has been lately made in the gravity battery copper element, consisting of an anchor attachment for securely and permanently fastening the copper to the bottom of the glass jar. The liability to displacement of the copper electrode has always been a serious obstacle in the way of getting the best results



GRAVITY COPPER ANCHOR.

from the gravity cell, and the new device, it is claimed, effectually prevents the copper from rising above the blue stone. The anchor is made of a piece of sheet copper with a coat of adhesive cement on one side, the upper end being riveted to the electrode, together with the copper connecting wire. When packed for shipping the anchor is rolled up in the shape of a cartridge, with the cement on the inside.

To apply the anchor it is only necessary to unroll the cartridge, bend it back at right angles parallel with the bottom of the jar, slightly heat the cement over the flame of a match or lamp, and the strip is then ready to be pressed down into position against the bottom of the jar. Thus fastened the cohesion of the cement is sufficient to stand a strain on the wire equal to many times the weight of the jar without dislodging the anchor.

This new copper is now being placed on the market by the E. S Greeley & Company of New York.

CORRESPONDENCE.

New York Notes.

NEW YORK, July 16.—Now that Cyrus W. Field has been laid to rest some interesting reminiscences are being recalled by those who knew best of Mr. Field's life and great work. According to David Dudley Field, the whole world has misunderstood his brother's connection with the Major Andre monument, which he erected at Tarrytown. It seems that a few years ago Dean Stanley was visiting Mr. Cyrus Field at Ardsley Park. Mr. Field took him for a drive, and showed him the spot where Major Andre was captured. The spot was only marked with a peg, and was found with difficulty.

"Why, this is one of the most historical spots in this country," exclaimed Mr. Stanley, "and should be marked with a monument!"

"That is a good idea," said Mr. Field; "I will build a monument, if you will write the inscription."

The monument was built, David Dudley Field explains, not as a monument to the British officer, but as a mark of the place where he was captured. The world thought otherwise, but as Mr. Field did not care to enter into a controversy, he never attempted to set himself right in the public mind.

An interesting reminiscence of Mrs. Field is also given:

One day during Mr. Field's greatest perplexity over the cable problem Mrs. Field said: "O dear, Cyrus, I wish your old cable was at the bottom of the sea."

In spite of his great absorption, Mr. Field laughed and said: "So do I."

The storage battery street car is to be given another trial in New York. The application of the Second Avenue Railroad company for permission to change its motive power from horses to electricity has been granted by the State Board of Railroad commissioners, and the railroad company proposes to give the battery cars a fair and thorough test. The cell which will be used, is the outcome of a number of inventions made by Montgomery Waddell, Justus B. Entz and William A. Phillips, all electrical engineers for the Waddell-Entz company, New York. This company operates a factory in Bridgeport, Conn. A very low voltage and a slow speed motor form two important features of this system, and it is said that a car can be run from 60 to 70 miles with one charge. It is estimated that it will take about two months to equip ten cars with this storage battery and start them running on the Second avenue line. The Waddell-Entz company will make the experiment at its own expense. If the storage battery is a success the Second Avenue line will adopt it generally and pay all the bills. Some of the men interested in the Waddell-Entz company are Edwin H. Abbott, formerly president of the Wisconsin Central road; the Hon. Thomas L. James, Percival Knauth, Charles L. Brace, Prof. John Trowbridge and John Straiton.

The Kings County Elevated Railroad company from all accounts will soon substitute electricity for steam as its motive power. The president of this road also favors the storage battery system.

Objectors to the tunnel rapid transit scheme have thirty days from Monday last during which they may take action. The order confirming the report of the Rapid-Transit Railroad commissioners was entered Monday in conformity with the decision of the General Term of the Supreme Court. Objectors can appeal from the order, thus having the Court of Appeals pass on the General Term's decision, or they can allow the decision to stand without appeal, subsequently attacking by injunction proceeding, the right of any company to build the road as planned by the commissioners. The work remaining for the commissioners to do before the construction of the road may begin is now much simplified, and, should no further fight be made by property holders, will probably be speedily accomplished. The first thing to do is to complete the plans and drawings of the road in all details, and this work is now being pushed along. It is thought that it might be completed by the first of August. When that is accomplished, the board, as required by the law, will give due notice of the fact, and will advertise the sale of the franchise at public auction. Six weeks' notice is required, during which time the advertisements must appear in the designated newspapers. Then the sale will be held, and the purchasers will, supposedly, proceed with the construction. Thus it must be the middle of September before the first bit of construction is accomplished. This does not allow for the delays that are likely to occur in the completion of the

plans; so it is likely to be later than that before the work begins.

Word comes from Summit that plans are now in progress for the introduction of a general telephone system in Summit. The men who are now endeavoring to introduce the telephone system, claim that a system could be conducted on a paying basis at a cost to the subscribers of four dollars a month each.

After the recent annual meeting of the New York Electrical society for the election of officers, reception of reports, etc., held at the electric club rooms, the members of the society attended the performance of "Sinbad" at the Garden theater, special arrangements having been made with the management of the Garden through the courtesy of David Henderson. The opera included a large number of spectacular effects, utilizing the projection arc lamp in a way and to an extent never before attempted. After the performance most of the members visited the roof garden where they found a concert in progress, and where they also had a fine opportunity to see some very beautiful electrical decorative effects. The members of the society are much indebted to Secretary G. H. Guy, who completed the arrangements, for the admirable manner in which they were carried out.

Some believe that another attempt will be made to extend the electric railroad from the Newark City line at East Orange, along Central avenue, through East Orange and Orange to the Valley road in West Orange. It is thought, too, that the Newark Passenger Railroad and Traction company will not be content until it has encircled the Oranges in that way, and connected them with Newark by two lines. W. F. O.

Northwestern News.

MINNEAPOLIS, July 16.—Minneapolis is in the midst of an upheaval over the question of street lighting. The five-year contracts with the electric and gas companies have just expired. Perhaps the most interesting phase of the matter is the fact brought out officially in the discussion of bids that a combination of the electric light companies of the city is being consummated. Only one bid was put in for the city's electric lights, that of the Minnesota Brush Electric Light company, which has had the contract. The bid was considerably below the old figure, but the aldermen wanted to know where were the bids from the other companies. They were informed that while this had nothing particularly to do with the figures in the Brush bid, the fact was the electric light companies were negotiating a consolidation of interests. It is asserted positively that it is not an obnoxious "trust" with a view to raising prices. The Brush company offers the city lights all night and every night in the year at about the same figure it made before for running them on the "moonlight schedule"—$150 per lamp. The gas company offers to run lights at $15.63 per year on the moonlight schedule, or $26 79 for every night. The matter of the city doing its own lighting is being vigorously agitated.

Consolidation seems to be the order of the day with electric light companies in the northwest. The companies at Duluth have "got together," and the joint organization is to be known as the Hartman General Electric company. There were three corporations—the Hartman Electric company, the Duluth Electric Light & Power company and the Northern Electric Subway company. The new company will build at once a fine new plant with a capacity of 1,500 arc lights and 30,000 incandescent, besides power circuits and other electric appliances. The wires are all to be put underground as soon as practicable, one mile to go down this season. The telephone wires are also going down. An interesting pointer for Minneapolitans is the announcement that the new company will reduce rates. A. W. Hartman is president; C. R. Haines, vice-president; R. A. Costello, treasurer; C. E. Vanbergen, secretary.

The Street Railway company is not doing much in Minneapolis this season beyond giving the city the finest service by far that it has ever enjoyed. It stood the tests of convention week and holidays splendidly, and the praises of the Minneapolis electric street car system are being sounded far and wide. The company is resting on its oars after two or three years of phenomenal activity and enormous expenditure. Some extensions are being built, notably that of the line to Bryn Mawr. It is many months since a horse or mule has been attached to a Minneapolis street car, but there were other details of transformation. The last is the new deal on station houses. The company had twelve barns when depending on animal power. By combinations and perfecting its switching facilities the number has been reduced to six. The barns utilized have been entirely remodeled, and the others are for sale. The change will reduce running expenses without impairing the service.

In St. Paul the street railway company has not been having so pleasant a time. The company had several lines there to complete or extend and has been delayed. The delay in the completion of a line to Como Park has been the source of especial grief. The park is a fine one, and has no street car connection with the city. Mr. Lowry's plan is to build the line as soon as details can be arranged, and to make it part of his second interurban line to Minneapolis. The city fathers announced that he must have the line to Como running by July 15th, but of course, that was impossible. There is little doubt that another year will see the completion of the second interurban, via Como and St. Anthony Park. A new power house will probably have to be built for this line. Material is on the ground for a line from Hamline connecting with the University avenue interurban.

Quite an important achievement is the completion and operation of the electric line from St. Paul to White Bear Lake, a very popular summer resort. An independent company, the St. Paul & White Bear Railroad company, operates it. The company has given a $300,000 mortgage running thirty years at six per cent.

The two mammoths "whaleback" steamers which Minneapolis capitalists are having built for lake traffic in connection with the "Soo" railroad are to be equipped with complete electrical plants. They are the first of these famous boats to be thus equipped. The Water, Light & Power company of West Superior has the contract. Each vessel will have a 150 light marine dynamo made by the Thomson-Houston company. The work will be done in accordance with the requirements of the United States navy.

The Northwestern Telephone Exchange company of Minneapolis has a $3,500 verdict on hand as the result of a fuss over the payment of telephone rent. The telephone was taken out and the irate customer chopped away several guy wires that had been fastened to his building. The pole which had been supported by these guy wires toppled over and injured a teamster who sued for $15,000 damages. The Supreme court on appeal held that the man had a right to cut the guy wires.

The Columbia Electric company proposes to move its plant from St. Paul to Stillwater, and the Chamber of Commerce of the latter city is trying to place $50,000 of the company's stock.

The tangled status of the affairs of the Stillwater Street Railway company still continues. W. M. Hewitt, the receiver, has, however, been granted permission to purchase electrical supplies and machinery. The creditors have appealed from the court's refusal to appoint an additional receiver.

St. Cloud is rejoicing over the completion of its electric car system. The line was started up last week with an excursion of officials and citizens tendered by the Thomson-Houston company. Everything worked nicely. Work has been begun on an interurban line across the river to Sauk Rapids.

St. Peter now shines nightly. An extensive electric light plant has just been put in by the Thomson-Houston company. There are forty-five arc lights in the streets and in stores and residences 1,000 incandescent lamps have been placed.

Timothy Driscoll has retired from the position of master mechanic of the Minneapolis street railway system.

The new electric light plant at Granite Falls has been started up successfully.

The city of Crookston is paying $3,100 a year for 16 arc lights. The Crookston Light company wants to put in 30 for $4,500.

Marshall & Johnson propose to furnish Red Lake Falls ten electric lights for $950 a year with a twenty year franchise. The council is inclined to accept.

The Minneapolis Electrical Construction company got the contract for wiring the new South Minneapolis high school building.

The council of Faribault is considering an extension of the electric lighting system.

There is little question that the Northern car works will be rebuilt in Northeast Minneapolis.

The value of electricity in decoration for a social event had a most elaborate exemplification in the "floral fete" given last week on the grounds of Dorilus Morrison in honor of Mrs. John A. Logan. The grounds were completely networked with festoons of electric lights.

S. B. Wallace, president of the Pierre, S. D., Street Railway & Electric Light company, recently in company with a party of friends including the son of the governor of the state, Charles Mellette, crossed the Sioux Indian reservation for a vacation outing. When about 150 miles from Pierre they were overhauled by the Indians, bound, taken to Cheyenne agency and put in the guardhouse. They had a telegraphic permit from Secretary Noble, but this was not recognized by their captors. Finally, after a general pow wow they were released in consideration of their connections, after being compelled to go through the trying ordeal of a dog feast. Under the agreement with the Indians no white men can go across the reservation.

The Minneapolis council has contracted with the Bell Telephone company for 62 instruments at $930 a year, $15 each.

Duluth's electric street car system was given a severe test on July 4th. There were 40,000 passengers carried, 15,000 of them on the "incline" road. The company is about to spend $80,000 on a car barn and machine shop.

In street car circles there has been more than the usual amount of "nagging" the past week. In St. Paul the aldermen are still demanding the Como line in spite of the legal point raised that the company can't be compelled to build a line until the sewers have been put in on the streets. In Minneapolis the company and the park commission are squabbling over who shall pay for attractions at Lake Harriet. The St. Paul papers are attacking President Lowry for organizing the Twin City Rapid Transit company and transferring the general offices to Minneapolis. Mr. Lowry says he will continue to give St. Paul the best service possible, and that the shift is simply for convenience and economy. The scheme for building an electric line to Lake Minnetonka, fifteen miles distant, is being agitated.

The new telephone system at Redwood Falls, Minn., will soon be in operation. The company has $4,000 capital, and will use the Bell system.

A new commercial telegraph wire has been strung along the Omaha railroad between Mitchell, S. D., and Worthington.

The State of Minnesota has spent $10,600 on an electric plant for the insane asylum at Fergus Falls.

The Street Railway company of West Superior proposes to lay ten miles of track this season. The electric system prevails.

A franchise has been granted for the construction of an electric car line at Brainerd, Minn.

Isaac C. Walker has begun injunction proceedings against the cities of Minneapolis and St. Paul to prevent alleged infringement of his patent—the electromagnetic tipping and recording mechanism for throwing open the doors of fire engine houses. He also wants damages. The devices were introduced in St. Paul in 1884, and Walker claims he secured the patent in 1885. C.

Detroit, Mich.

Detroit, July 16.—Rapid transit has gained another point in this city. When the matter of the erection of poles for the trolley system on Jefferson avenue came up before the common council committee on streets and ordinances in the request from the board of public works for advice as to whether the Detroit Citizens Railway company should be proceeded against for violating a city ordinance, the committee was informed by the assistant city attorney, that in his opinion the company was violating no ordinance. One alderman took occasion to say that he could not understand where the Mayor had acquired the idea that the company was going to erect unsightly cedar poles. "The company is not erecting such posts and never intended to do so." The members of the committee were almost unanimous in deciding that the company should be allowed to proceed in accordance with the ordinances. The protest of the Jefferson avenue property owners against the trolley system was read, but without effect.

The board of public works has issued an order requiring the police and fire commissioners, the telephone company and the various electric light companies to take down their poles on Grand River avenue, as the new pavement to be laid on that street will be one foot wider on each side than the old pavement. Nothing is said in the order about moving the poles a foot each way, or replacing them inside the new curb line, and the presumption is that the board will order all wires underground within the limit prescribed by the council.

The Fort Wayne & Belle Isle Street Railroad company has closed a contract for six boilers for the new rapid transit boiler house. Two of them will be ready Aug. 1st, and will be sufficient to operate the lines first constructed on Fort and River streets west of Clark avenue. The other four will be ready by Sept. 15th. The General Electric company of Chicago, has formerly accepted the contract. The equipment of the entire system, it is calculated, will cost in the neighborhood of $300,000.

Frank E. Rae, formerly employed as an electrical engineer by the Detroit Electrical Works, has begun two suits against that company in the Wayne Circuit court, placing damages in one $20,000 and in the other at $25,000. Rae is the inventor of the Rae motor and claims that

the electrical works has entered into a contract with the Citizens Railway company, to supply these motors on the new Jefferson avenue electric line. The suits are brought for alleged breach of contract, and also for royalties.

The common council has been asked to recognize a protest against the methods of house movers. The matter will come up in the shape of a petition from the Edison Illuminating company; the Detroit Electric Light & Power company, and the Telephone & Telegraph Construction company. The communication sets forth that in carrying on their work, house movers cut the wires of the petitioners, and the fire and police service is often interrupted for hours, the sending in of the alarms being impossible. Telephones are cut off and public lighting disturbed. "Every week" says the petition, "the fire department is obliged to look after the house mover. On May 11th and 12th last the Telegraph & Telephone Construction company, had one man doing nothing else but working on wires thus cut. Six were at work on June 13th and 14th. The Detroit Electric Light & Power company is compelled to keep two and sometimes three men employed to look after its lines, which are cut to accommodate house movers. The Peninsular company has found it frequently necessary to have several men out for the same purpose, and the Edison company's experience is similar."

The petitioners say they believe the house movers ought to pay the expense of such work, and that if the work was dooe in a systematic manner one or two men could do it all. They ask the council to pass an ordinance compelling house movers to deposit with the city electrician a sum sufficient to pay the expenses of employing such men.

The ordinance recently passed regarding the laying of grooved rails by the Detroit Citizens Railway company specifies that they shall weigh 70 pounds per yard, heavy enough to carry a locomotive. The company has submitted the Johnson rail, weighing 62 pounds, to the city, and the city engineer instructs the board of public works that it is more than heavy enough for all street car traffic.

The Washington Trust company of the city of New York, by John C. Donnelly, its attorney, has filed an important bill in the United States court in this city. The Washington Trust company holds the mortgage on the plant of the Citizens Street Railway company, and is trustee for the holders of $3,000,000 worth of bonds. It starts an original suit against the city of Detroit with a voluminous bill which recites the whole history of the attack on the street railway franchise in this city, the repealing ordinance, etc., and contends that these constitute an attack on the constitutional property rights of the plaintiff. The bill which has been filed is a printed one, covering, with its accompanying exhibits, 83 pages, and it is the rejoinder of the trust company and the owner of the mortgage interest in the property, to the legal battle instituted by the city.

The bill filed by the Washington Trust company alleges that the original franchise of the Detroit City Railway and subsequent amendments and extension were passed by the common council and accepted by the company; that the company operated under them; that the company operated under an ordinance granted the Detroit & Grand Trunk Junction Street Railway company, as also under the franchise for the Central Market, Cass avenue, and Third street railway, and that of the Grand River street railway, and that the Citizens' Street Railway company is the assignee and successor of all the companies operating under the franchises specified. The details of the extension of the franchise in 1879 are set forth in full, together with the common council reports in the premises, and the franchise relations of the compaoy to the city are given in detail. These premises are presented to show that the city is estopped from now claiming that the ordinances are invalid.

The company asks the court to decree; first that the railway company has all the right sought to be conferred by the ordiances of 1879; second, that the franchises are not subject to impairment; third that the recent action of the council is a cloud on the title which should be removed by the court; fourth, that the court declare the repealing ordinance a violation of Sec. 10, Art. 1, of the federal constitution, as impairing the obligation of contracts; fifth, that the court declare the repealing ordinances violations of Sec. 1, Art. 14, of the constitution, as depriving the complainant of valuable property without due process of law; sixth, that the city be enjoined from interfering with the company's rights, or enforcing the ordinances of repeal.

The Fort street officials still believe that October 1 will see their electric equipment in working order. Two carloads of wire are on the ground, and 500 poles are expected within a few days. As soon as the plans for the power house are completed, ground will be broken on the recently purchased Clarke avenue site. The work of setting poles will be begun simultaneously at both ends of the line, the gangs working toward each other. The first 300 horse power engine, which will operate the Springwells loop, will probably not be here until the middle of August, and about two weeks will be required to set it up, so that rapid transit on this section during the Exposition is hardly to be expected.

F. W. G.

New England News.

BOSTON, July 16.—Some large electrical industries are to be located at Milford, Mass. The large factory hitherto occupied by Johnson & Rust has just been leased by the Milford & Hopedale Street Railway company for the purpose of manufacturing storage batteries and other electrical appliances. It will start with a small force of about a dozen men, but expects to increase this at a very early date, and the company now has surveyors at work preparing for a large plant for the manufacture of electric cars. Work on the building will commence in a few weeks.

An enterprising and daring band of thieves on the night of July 11th made a raid on the wires of the Providence Electric Light company. They cut out about a mile of large sized wire, which is strung along the Riverside shore of Narragansett Bay and used to carry the electric current to Crescent Park. Although the wire is said to have been carrying current at 2,000 volts, they climbed fearlessly up, and succeeded in getting away with wire to the value of about $250.

The Holyoke Machine company has made a new departure in the placing of an electric motor in its new building, which is used as a roll department. This is the first Holyoke concern that has adopted electricity for power. The company also lights its building from its own plant.

The Bradbury-Stone storage battery was given a trial on the electric cars at Dover, N. H., July 12th. Garrison hill, which is quite steep, was the scene of the trial. The cars were taken up the hill at a good rate of speed. A large party of Lowell business men, who contemplate introducing the system in their city, were present, and expressed complete satisfaction with the results of the test.

The Hull, Mass., Electric Light & Power company has commenced the erection of a power station at White Head, Nantasket.

The Electric Gas Machine company has been organized at Saco, Me., by citizens of Arlington, Mass., with a capital stock of $500,000. The purpose of this company is to manufacture the Harrington fire proof gas machine. The officers are: Charles B. Fessenden, Arlington, president; Herbert W. Potter, Arlington, treasurer.

The Hanover, Mass., selectmen have granted a charter to the Rockland & Arlington Electric Railway company, allowing them to lay tracks in the town, the only restriction being that the work must be done within two years.

The fine weather in New England on July 4th put thousands of dollars into the pockets of stockholders in electric street railroads. Reports come from all over this section that the business done on electric roads on that day beats all holiday records.

New Haven capitalists are negotiating for the purchase of the Northampton, Mass., street railroad. If they succeed in purchasing it they will introduce electricity, lay a new track to Easthampton, and reduce the fare to five cents.

Rev. H. A. Kidder is this season cruising about the waters of Provincetown in a boat which is a decided novelty to the people of that region. He fitted up a 14-foot row-boat to run by electricity. He has placed a copper-flanged propellor at the stern and connected it by a rod running through the stern with an electric motor, which is driven by a battery placed above it. The shaft and machinery are inclosed by a wooden covering, hinged at the ends, so as to be easy of access.

The Haverhill & Groveland, Mass., Street Railway company, contrary to expectation, has accepted the charter granted by the aldermen of Haverhill for the use of electricity, and a double track system. Work will be commenced at once.

The citizens of Billenca, Mass., dissatisfied with the Lowell service of the Boston & Maine railway, held a meeting on July 15th and appointed a committee to investigate the possibility of building an electric road to Lowell.

Tufts College has had fitted up in the basement of the main recitation building an electric light station. The dynamo room contains a B. F. Sturtevant high speed automatic engine of 25 horse power, belted to a line of shafting. From this shafting are belted an American and a Ball arc light dynamo, a small alternator, a special 4,000 watt machine for experimental purposes, and a pair of 110 volt, 1,500 watt machines, for a three-wire installation in the library, and for charging the electric battery plant. Three other machines are in process of construction, one of 12 kilowatts and 110 volts. Steam power is furnished by two Whittier tubular boilers. Belonging to the dynamo rooms are over twenty arc lamps and a supply of electrical testing instruments. The battery room is adjacent, the main battery consisting of sixty of the large cells of the American Accumulator company. These cells are in constant use for experimental and motor work, and for lighting. Most of the rough and some of the fine apparatus used in the dynamo room was manufactured in an adjoining workshop.

An important decision against the Walworth Light & Power company was handed down by the Supreme Court on Friday. The attorney-general brought action against the company for violating the statute which prohibits companies from laying or erecting wires over or under the streets without the consent of the mayor and aldermen. The Walworth company was operating wires in Hawley street which they had not laid, but had purchased from another company. They claimed that, as they had not put the wires in place, there was nothing in the statute to prevent them from maintaining them and using them for supplying electricity to their customers. The court ruled that, notwithstanding that the statute was worded to prevent the laying of wires, the reason this prohibition was made was to prevent the maintaining of them in the street. Another point made by the company was that the company did not sell electric light, for it did not own the device at the end of the line by which the electricity was converted into light. The claim was that the company only sold electricity. The court said that it was clear that the legislature contemplated making no such nice distinction, and that the wire which is prohibited when used to furnish electric light is equally prohibited when used to furnish electricity which is to be converted into light. An injunction was granted.

The New England Electric Heating company has been formed at Portland, Me., with a capital stock of $205,000. Its purpose is to manufacture electrical heating apparatus. E. Jewell of Boston and L. L. Parsons and A. B. Smith of Saugus, Mass., are the incorporators.

The Beverly & Danvers street railway is expected to be started again soon. It was built to be operated by the storage battery system, but this failed to work satisfactorily, and for six months the road has not been operated. Now the Naumkeag Street Railway company has made the stockholders an offer, and they have voted to accept.

The first car over the new Fitchburg electric road to Leominster was run on June 20th. The company has not yet built a power station, but will do so soon. At present power is furnished by the Leominster Electric Light company. Westinghouse generators are used.

The Wakefield & Stoneham Street Railway company has commenced laying track, and it is expected that electric cars will be running by September 1st. This line will give the people of Wakefield, Stoneham and Reading a direct line to Lynn and Revere Beach, and open up a good deal of land for building purposes.

The Amesbury Electric Light company has ordered an 85 horse power Thomson-Houston generator.

A party of United States military officers, consisting of Gen Cutchen, formerly chairman of the committee on military affairs of the house; Gen. Abbott of the engineers, Col. Clossen of the artillery, Capt. Morrison, the recorder, and Maj. Comley, visited Lynn Friday to inspect the factory of the American Projectile company. They wished to ascertain the capacity of the factory for the manufacture of electrically welded shells and other projectiles, and also to obtain knowledge of the process of shell-making by electric welding, with a view to its extension and development over other methods of production.

A. L. Rohrer, the general superintendent of the Thomson-Houston works at Lynn, Mass., will soon take up his permanent location at Schenectady, N. Y., where he will assume his new duties as assistant manager of the General Electric company.

The Thomson-Houston people employ over 4,000 persons at their Lynn works, and their weekly pay roll amounts to $50,000.

The contract for the electric equipment of the elevated road on North street, Baltimore, Md., has been awarded to the General Electric company.

The new mammoth buildings of this company now being constructed on the Lynn marshes will be ready for occupancy by the middle of September. There are 300 men at work on them, and the outer walls are already assuming gigantic proportions. Work on the wharf is being rapidly pushed. The Boston & Maine railroad has completed a spur track around the building, and the material

for construction is arriving every day. The electric company expects to just double its force and turn out double the amount of work before the snow flies.

The new power station of the Lynn & Boston railway was started up July 4th for the first time, and has been running ever since. Only one engine and generator, however, are in use.

Claflin & Kimball were incorporated July 2d to manufacture and sell electric dynamos, motors, batteries, arc and incandescent lights and all kinds of electrical appliances, and to act as manufacturers' agents for the purchase of such goods. Adams D. Claflin is president, and M. M. Kimball treasurer. The other stockholders are George Walker and Joseph H. Walker. This firm is Boston agent for the Mather Electric company and the Perkins Electric Lamp company. The offices are at 116 Bedford street. The firm is not a new one in electrical lines, but the demands of a rapidly increasing business made an incorporation necessary.

The Storage Battery Street Railway company has been organized in Cambridge, Mass. President Whitney of the West End Street Railway company says the object of this company is to endeavor to coerce the West End into its absorption, but that the West End will have nothing to do with it. "If we could charge 25 cent fares," says President Whitney, "the storage battery might be adopted, but our policy is to cheapen transportation, and with low fares the storage battery is impossible."

A committee of citizens of Weymouth, Mass., has been appointed to raise money for the building of an electric road, the route to cover the three villages of North, East and Weymouth Landing. This road would be six miles in length, and would cost $60,000. The Quincy & Boston road has applied for the right to extend the tracks to cover this territory, but the Weymouth & Hinghan Street Railway company oppose the granting of a franchise to outsiders, and it is probable that local capital will build the road.

The New Bedford Gas & Electric Light company will double the size of its present building and increase its capacity in proportion. A building 75x75 feet, two stories, is to be erected. Two new engines will be put in, one a Green engine of 600 horse power built by the Providence Steam Engine company. To provide for the heavy machinery required there will be 162 feet of 6-inch shafting.

The lighting system of the Boston Grand Opera House is to be changed next season. Incandescent electric lights will be substituted for the gas now in use.

The Worcester & Millbury Electric Railway company is to be supplied with a new power plant of 500 horse power capacity.

The aldermen of Newton, Mass., have granted the Electric Street Railway company permission to lay tracks and erect poles from Beaver Brook to the Watertown line.

The K. & W. Electric company has been incorporated at Bridgeport, Conn., to manufacture electrical appliances.

The Worcester Electric Light company has just put in a 600 horse power Corliss engine to be kept for use in an emergency. A new 2,000 incandescent light machine is being put in place besides two new arc machines.

A relic of the useless fight the late Manager Furber of the Boston & Maine attempted to wage against electricity is now to be seen on the Lowell division of this road. It consists of a train of small sized passenger cars with a light double headed engine attached. When the electric road was built from Dover to Great Falls, N. H., Manager Furber attempted to kill the project. He accordingly purchased these light cars, constructed on the plan of the New York "L" cars, and ran the train at short intervals between the two places. But the electrics were deemed more desirable by the patrons and the B. & M. train was run at a loss. Mr. Furber kept it going, however, till his death, and then the officials of the road stopped it and the cars are now doing suburban service out of Boston.

J. C. E.

St. Louis, Mo.

St. Louis, July 16.—As indicating what may be expected in the near future, in the direction of electric railway work in St. Louis and vicinity, the following synopsis is given of bills now pending before the city legislature. The Fourth Street and Arsenal Railway company asks the privilege of extending its tracks, and changing its motive power from horses to electricity on overhead wires. The extension proposed is from its present terminus north on Fourth and Third streets to the intersection of Third street with Broadway, between Bates and O'Fallon streets. This point is very near the location of the proposed new Union depot to be built by the Merchants Terminal Railway association. From its present terminus southward to Fourth and Chateau avenue, it will operate over the tracks of the People's cable railway—both cable and electric cars running over this length of 1¼ miles.

The Compton Heights Union Depot & Merchants' Terminal Railroad company desires to construct and operate a road from Third and Carr streets; south on Third to Washington avenue; thence west over the tracks of the Lindell Electric railway to Eighteenth; thence south past the new Union depot and over the Eighteenth street bridge to Papin and Choteau avenues; west on Choteau to Mississippi avenue, south to Park avenue; west to Lawrence street; south to Tower Grove Park. Also from Lawrence street and Park avenue north to Choteau avenue, to connect with the Vandeventer Avenue Electric line. The company also desires to lay a single track from Compton and Park avenues, south to Shenandoah; also from Nebraska and Park avenues south to Shenandoah, thence west to Compton; thence west with a double track to Lawrence. This project is said to be in the interest of the owners of the Lindell Railway. The speed east of Grand avenue is limited to ten miles an hour, and west of Grand to fifteen.

The Union Depot Railway company, now operating about forty miles of single track electric railway, desires to extend its tracks and change the location of some of them. The extensions are with a double track from Meramec street and Virginia avenue south on Virginia to Compton avenue; south to Wilmington road; east to Michigan avenue; south to Stein; thence with a single track on Michigan to Primm, and with double track in Primm to Ivory single track on Ivory to a junction with the double tracks in Michigan avenue. Also from Twelfth and Clark avenue west with double tracks to Eighteenth (near the new Union depot); south on Eighteenth across the bridge to Dolman; south on Dolman to Lafayette. Also from Lafayette and Second Carondelet avenues south, with double track to Crittenden; west to Lemp; south to Cherokee; west to Gravois; southwest on Gravois to a point 300 feet west of Grand avenue. Also to change certain of its present single tracks to conform with the above double track system. The speeds are limited to ten miles per hour, north, and fifteen miles south, of Lafayette avenue.

The Taylor Avenue Railway company desires to construct and operate a double track electric railway beginning at the tracks of the Missouri Pacific railway northward along Taylor and Clagett avenues to Bellefontaine and Calvary cemeteries. The application also is said to be in the interest of the owners of the Lindell railway, over whose tracks it operates for some distance. Its speed is limited to fifteen miles per hour, and the privileges are to extend for fifty years.

The Grand Avenue Railway company, already briefly referred to in a recent letter, desires to operate a double track electric railway from the intersection of Grand and Blair avenues; south on Grand over the tracks of the Benton-Bellefontaine electric; Citizens' cable, Lindell electric, and People's cable, which roads occupy Grand avenue for short distances, to Meramec street; thence east to Virginia avenue; south to Courtois; thence south on Virginia with a single track to Primm; west to Ivory; northeast to the double track on Virginia. Grand avenue is one of the finest streets in the city, and will probably be made a boulevard soon. The new line passes the water tower, fair grounds, base ball park, the Missouri Pacific railway, Tower Grove park and many other points of interest. Cars may be run at a speed not exceeding fifteen miles per hour. The franchise is to run forty-five years.

The Manchester Road Electric Railway company is a very ambitious project proposing to extend out into St. Louis county to Meramec Highlands, some eighteen miles west of St. Louis, entering a suburban territory which has heretofore been served exclusively by the short trains of the Missouri Pacific and St. Louis & San Francisco railways. The movement is receiving enthusiastic support in the county, and is backed by men of means. It will pass through the towns of Benton, Greenwood, Old Orchard, Tuxedo Park, Webster Grove, Glendale and Kirkwood. The company was organized with a capital stock of $20,000, W. C. Orton, of Chicago holding 90 shares; Thomas Howard of St. Louis, 90 shares, James Danils, St. Louis, 20 shares. It is understood that the company desires to make a down-town connection with the Lindell or Laclede avenue electric lines. The cost of the road from King's Highway, St. Louis, to Kirkwood is estimated at $500,000.

Work on all these lines is to be done under the supervision of the St. Louis Board of Public Improvements. The poles are to extend not less than twenty feet above the streets.

The Central Street railway also has a bill before the council. It is making good progress.

In addition to these projects, work is now in progress changing the Cass avenue, Northern Central, and Union lines, to electricity; the Jefferson avenue line has permission to change; the Forest Park and Clayton line has authority to proceed with its lines out into St. Louis county; it is proposed to change the Citizens' Grand avenue line to electricity, from cable; the Citizens' Easton avenue extension, and the Baden lines from horse to electricity; and an extension of the Southern electric railway to Jefferson Barracks is proposed.

Prof. Francis E. Nipher, who has charge of the department of electrical engineering at Washington University and who is prominently connected with the Adams Electric Railway company, has returned from a short vacation at Iowa City, Ia.

The Webb City Electric, Light & Power company, Webb City, Mo., has been incorporated with a capital stock of $150,000. The following named St. Louis capitalists are among the incorporators: Thos. H. West, John T. Davis, A. C. Stewart, J. D. Filley, and J. P. Helferstein.

Extensive improvements are being talked of for Madison, Ill., which is located at the eastern end of the new Merchan's' bridge, opposite North St. Louis. It is expected that franchises for electric lighting and a street railway will be asked for soon

Norman W. Eayrs, formerly of St. Louis, but later of Pittsburg, has been appointed superintendent of the St. Louis bridge. His duties include the operation of the St. Louis and East St. Louis electric railway running over the upper roadway of the bridge.

The annual assembly of the Southern Illinois Chautauqua Literary societies is now being held on the grounds in the suburbs of Chester, Ill. The grounds are illuminated by arc lights operated from the plant owned by the State penitentiary.

George R. Olshansen, lately engineer of construction for the Benton-Bellefontaine street railway, during its change to electricity, has been appointed to a permanent position with the Union Depot electric line.

The contract for wiring the new fourteen story building of the Union Trust company, on Seventh and Olive streets for electric lights and telephones, has been awarded to the Western Electric company, Chicago.

The People's Gas, Electric Light & Power company has made application to the city legislature of St. Louis for a fifty years' franchise. The persons interested are John Maguire, Perry Barthlow, John B. Taylor and others. Illuminating gas is to be furnished for 90 cents per thousand, and fuel gas for 45 cents. City gas lamps are offered for $20 each per year. No statement is made as yet regarding the company's plans in electric lighting.

The racing by electric light at the South Side Park is eminently successful. Large crowds are present, the attendance averaging 2,500 each night. The lights burn from about 7:30 to 10:30, and the current is furnished by the Missouri Electric Light & Power company, whose central station is about two miles distant. Every twenty-three feet around the inside of the half mile track a pole is located, with an arm and shade. Each arm carries a cluster of four 32 candle-power lamps, there being about 525 32 candle power lamps in all, used around the track. In addition there are around the grand stand 36 32 candle-power and 29 16 candle-power lamps.

Mrs. Jennie T. Forster who owns the electric light plant at Farmington, Mo., has filed a bill for an injunction restaining W. L. Hockaday, late manager of the plant, from drawing or handling any portion of the company's funds which have been deposited to his credit in a St. Louis bank. She claims that Hockaday is insolvent, and that he threatens to draw the money and appropriate it to his own use. W. A. Jackson has been appointed manager to succeed Hockaday. Thirty additional city lights have been put into service, making fifty in all, and it is claimed that Farmington is now one of the best lighted towns in the state. A large demand for incandescent lights for domestic service, is also reported.

Negotiations are now in progress looking toward the establishment of a street railway over the Merchants' Bridge, connecting North St. Louis with Madison and Venice, Ill. The cost of the road is estimated at $250,000. It would be necessary to widen the bridge and build separate approaches. Prominent capitalists have signified their readiness to interest themselves in the enterprise. It is probable that arrangements will be made with some line on the St. Louis side to enable the bridge cars to go down town. It is probable that matters will assume tangible shape next week.

A. W. Remnitz of the Pond Engineering company, has left for an extended trip to the southwest, and will spend some time in Texas.

W. H. B.

Spokane, Wash.

Spokane, Wash., July 14.—The Edison Electric Illuminating company of this city has ordered from the Northwest Thomson-Houston Electric company a 1,000 light

alternating current incandescent dyamo, with separate exciter and all the necessary equipment complete. Though the company is now dispensing current nightly for about 9,000 incandescent lights and 600 arcs, this will be the first alternating current dynamo introduced into the system. It is to be used principally for residence lighting outside of town, where it is not economical to carry the continuous current.

The Spokane Cable Railway company on the 6th instant filed an injunction in the Superior court against the city of Spokane and V. M. Massey, enjoining them from tearing up the tracks of the company to lay a sewer on Post street. The contractor, V. M. Massey, began excavating between the tracks on the afternoon of July 5th. Work was, however, suspended by a restraining order early on the following day. There is a double track on Post street, and under the franchise the company is operating an electric line on the street. The section track in question is the most important piece on the company's system, as it is the only route by which the company can obtain access to the system on the north side of the river, and also to the car barn on the north side. The company claims that the city has no right to tear up the tracks, to lay a sewer in the center of the street, as there is abundant room on either side of the tracks for the sewer, and that it would seriously injure and damage the company's business, and property and seriously interfere with public travel. J. M.

PERSONAL.

J. P. Ord, general accountant of the General Electric company, was in Chicago on Monday.

Elmer E. Sperry of Chicago paid a visit to the Thomson-Houston works at Lynn on Thursday of last week.

W. W. Griffin, of the New England Electrical company of Bridgeport, Conn., was in New York last week.

John Lee Bunce, of the Perkins Electric Switch Manufacturing company, Hartford, Conn., was in Chicago several days during last week.

Captain John McKinlock, treasurer of the Western Electrical Supply company, the Omaha branch of the Central Electrical company of Chicago, was in the city for a few days last week.

President S. A. Barton, Boston, of the Brush Electric company, Cleveland, was in Chicago last week. Mr. Barton was as usual warmly welcomed by his many old friends of the Chicago Electric club.

Charles E. Brown's friends are congratulating him upon his twenty-seventh birthday, and the Central Electric company is celebrating the event. Mr. Brown has been with the company for three years. He has proven himself a valuable and efficient officer, and has hosts of friends in the trade who wish him continued prosperity.

Harry H. Turner, of the Lynn factory of the Thomson-Houston company, is in Berlin, where he was sent to instruct local workmen in the art of winding Thomson-Houston armatures, as the Thomson-Houston International Electric company, in order to protect its patents in European nations, has to manufacture in those countries.

NEW INCORPORATIONS.

Cedartown company, Roanoke, Va.; capital stock, $750,000; electric lighting, etc.

Stanford Electric Light company, Stanford, N. Y.; capital stock, $20,000; to manufacture and use electricity for light, heat, or power, etc.

Bath Electric Illuminating & Power company, Bath, N. Y.; capital stock, $35,000; to manufacture, generate, use, rent, lease and sell electricity.

Union Electric company, Benton Harbor, Mich.; capital stock, $150,000; electric light and power and street-railway; Jas. L. Clark, Chicago, Ill.

Manchester Road Electric Railway company, St. Louis, Mo.; capital stock, $20,000; to own and operate an electric railway; T. A. Post, Commercial building, St. Louis, Mo.

Payette Real Estate Investment company, Boise City, Idaho; capital stock, $25,000; dealing in real estate, operating electric plants; R. D. Wolterbeck, Boise City, Idaho.

Knapp-Sellner Chandelier company, St. Louis, Mo.; capital stock, $30,000; to manufacture and sell gas and electric light fixtures, etc.; Vernon W. Knapp, 102 North Third street, St. Louis, Mo.

Webb City Light & Power company, Webb City, Mo.; capital stock, $150,000; to manufacture and supply electric light and power; Edw. Cunningham, Jr., St. Louis Trust company, St Louis, Mo.

Sharon Hill Electric company, Sharon Hill, Pa.; capital stock, $1,000; supplying light, heat and power by electricity at the borough of Sharon Hill, Pa.; Edward Bliss, 727 Walnut street, Philadelphia, Pa.

Everett & Lake Stevens Water & Electric company, Everett, Wash.; capital stock, $250,000; to operate and maintain waterworks, electric light and power plants, electric railways, etc.; F. H. Brownell, Everett, Wash.

Bradley General Electric company, Chicago, Ill.; capital stock, $1,000,000; to manufacture and sell electric devices and machinery, construct electric street railroads, etc.; Furber & Douglas, 121 La Salle street, Chicago, Ill.

Columbia Cronophone company, Camden, N. J.; capital stock, $500,000; to manufacture, utilize, sell and dispose of the machine or device known as "the electrical time call and set back," etc.; R. T. Smith, 106 Market street, Camden, N. J.

Durango Railway & Realty company, Durango, Colo.; capital stock, $250,000; to construct a system of street railways in the city of Durango by horse, electricity, cable or other power and deal in real estate in LaPlata county, Colo.

Home Electric concern, Brooklyn, N. Y., incorporated in West Virginia; capital stock, $100,000; manufacturing, selling or leasing all kinds of electrical or mechanical devices; Jos. Sachs, 107 Arbuckle building, Brooklyn, N. Y.

Country Club, Seattle, Wash.; capital stock, $24 000; to construct, operate, own and lease street railways, both steam and electric, cable roads, steamboats, telegraph and telephone lines, electric light, gas and waterworks; Strudwick, Peters & Van Wyck, Seattle, Wash.

Elwood Electric Railway company, Elwood, Ind.; capital stock, $150,000; constructing, owning, maintaining and operating by means of electricity or other motive power, lines of street railway through the streets of Elwood, and to extend such lines in Madison county and adjacent counties and connect Elwood with other towns.

ELECTRIC LIGHTING.

Montello, Wis, is to be lighted by electricity.

The village of Spring Valley, Ill., has contracted for 30 Ball arc lights for street illumination.

The Maroa, Ill., city council, has passed an ordinance authorizing the mayor and city clerk to contract for an electric light plant.

The capacity of the isolated plant at the state hospital for the insane at Kankakee, Ill., has been doubled, and now there is a generating capacity for 3,200 incandescent lamps and 25 arcs. Western Electric dynamos are used. The mains leading to the various buildings are laid entirely in underground conduits.

The public lighting committee of the Hillsdale, Mich., council has reported in favor of the city owning its own electric light plant. It recommends that the mayor be requested to call a special election so that the voters may decide whether they wish to bond the city for $15,000 that it may own and operate its own light plant.

At a recent meeting of the council of an Ohio city some very uncomplimentary things were said about the electric light service. The city marshal said that the lights were so poor that the policemen could not see to make out the tickets showing how long each lamp had burned. The clerk was instructed to investigate the matter.

The New Bedford, Mass., Gas & Electric Light company is to nearly double the size of its present building and increase its capacity in proportion. A building 75 by 75 feet in area, two stories in height, is to be built to adjoin the present building on the front or west end. The old building is 75 by 112 feet. Two new engines will be put in, one of 600 horse power.

The ordinance entitling the Archer Electric Light company of Chicago to operate a plant in the section bounded by Wentworth avenue, Thirty-ninth street, Western avenue, Thirty-first street and the South branch canal has been referred to the electric light committee of the common council. It gives the city 3 per cent. of the gross earnings, and the company must maintain a 1,200 candle power light in each police district.

The Thomson-Houston company and the Buckeye Engine company have each brought suit against the Citizens' Electric Light company of Louisville. The former company seeks to recover $1,667.39, said to be due it for machinery sold, and the engine people have a similar claim for $1,512.45. The Louisville company asserts that the suits result from an unjustifiable attempt to discredit its business, and that it is in no way embarrassed.

Mayor Rogers of Denver and representatives of the Consolidated Electric Light company held a conference recently. The subject under discussion was the differences between the mayor and the company. For several months the former has refused to sign warrants for incandescent and arc lights used by the city, claiming that many of the lights were unnecessary. Another conference will be held soon, when all differences are expected to be settled.

The dispute between the city authorities of Grand Rapids, Mich., and the Grand Rapids Electric Light & Power company in relation to the candle power of the lights furnished the city, will be settled in the courts. The manager of the company has refused to make the desired deduction in the May lighting bill, in which action he is sustained by the city attorney, and he also presents a bill for $15 interest. The committee has engaged outside legal talent, and has decided to report to the council in favor of letting the whole matter be settled in the courts.

The Thomson-Houston company is erecting a large plant on Front street, near the lower wharf, in Nashville, Tenn. The brick building used by the Capital Electric company will be used for a boiler room, and a new $20,000 building is being erected for the engines and dynamos. The improvement will be finished within sixty days, when the station on Grundy street will be discontinued. When the new plant is completed the Thomson-Houston company will have an investment in Nashville in buildings, machinery, wiring, etc., of $150,000 or more.

The Citizens' Electric Light company, of Windsor, Ont., bought its transformers from the Reliance Electric company of Watertown. The latter, though, retained a lien on the goods. O. E. Fleming, solicitor for the Reliance company, said that his client's money, nearly $1,000, was due in a year's time. When the year was up the bailiff took possession of the property by order of the Reliance company, and held it for thirty days in order to give the Citizens' company a chance to raise the amount of the debt. When the time had expired, no money was forthcoming, so the bailiff at once began taking away the transformers.

A press dispatch from Fostoria, O., dated July 7th, says: About 10 o'clock a dynamo in the Fostoria light and power works exploded with terrific force. The fly wheel on the engine was dismantled a second later and smashed to atoms. The flying pieces crashed through the wooden ceiling in several places, tearing great holes in the roof. The engineer, Paul Hyder, was instantly killed, his skull being crushed, both legs broken and one arm nearly torn from the body. The works, which are run in connection with the artificial gas works, had three dynamos. The steam connections from the engine were broken and the escaping steam added to the confusion.

ELECTRIC RAILWAYS.

It is said that a new electric railway line is to be built in Cairo, Ill., by the Delta Electric company.

An electric road is building to connect Shickshinny, Pa., with several small villages in the Huntington valley. This railway is to carry freight as well as passengers, is eight miles long, and has a tributary population of about 6,000. It is expected that it will carry about 125 carloads of lumber, bark and ties per month, besides miscellaneous freight.

The conference concerning the proposed reorganization of the North Lincoln, Neb., City Electric Street Railway company's affairs is reported to have reached a satisfactory conclusion. It is said that the property will pay 6 per cent. interest on an investment of $65,000 as it stands, and with certain extensions would pay a fair rate of interest on a much larger sum.

On June 4th Judge Simonton, Harrisburg, Pa., handed down an opinion in the two injunctions applied for by the City Passenger Electric Railway company and the city of Harrisburg. He refused the former application, but granted the latter. He says that the City Passenger company cannot build a track on Walnut street under its charter, which says the motive power is to be furnished by horses, and operate the line by electricity. Much dissatisfaction prevails, and the officials of the City Passenger Railway company have demanded another argument on the injunctions.

The stockholders of the street railway company at Lancaster, Pa., have decided to substitute electric power for horses; to increase the capital stock to $50,000, and change the name of the corporation to the Lancaster Electric Street Railroad company. In recommending the change Manager Bauman said: "I hand you a report of thirty roads having from 1½ miles to 7 miles of track and from 2 to 8 cars each. Fourteen of these roads were built for horse railroads, and not a single road paid operating expenses, while now, as electric roads, each one pays. The traffic not only increased 100 but from 200 to 300 per cent. Sixteen of these 30 roads were built lately and every one of them pays."

The city attorney of Grand Rapids, Mich., has recommended that the council declare void the franchise of the Reed's Lake Electric Railway company to operate lines on various streets and highways in the township of Grand Rapids, now included within the corporate limits of the city of Grand Rapids, on the ground that the company has failed to comply with the ordinances under which it was permitted to operate its lines; and further, that the company has failed to comply with the provisions by which it was to run cars at stated intervals the year round, and, in fact, it has not run cars for a period of eleven months, and has allowed its line to get out of repairs and impede traffic.

An accounting is demanded in a Circuit Court bill filed in Chicago by William Forbush, assignee of the Continental Electric Construction company, against D. B. Dewey, W. T. Rickords, Geo. John L. Beveridge, Frederick J. Wilson, and the Battle Creek Electric Railway company. The Continental Electric Construction company had a contract to construct a line of electric railway in Battle Creek, Mich., for the Battle Creek Electric Railway company. Being unable to carry out the contract it was assigned to Wilson, who was to give up one-half of his profits in the deal. Wilson, associated with the other defendants, completed the contract, and it is charged that they cleared $20,000, beside securing the entire stock of the Battle Creek Electric Railway company, worth $75,000. The assignee now claims that he is entitled to one-eighth of the entire sum under the contract with Wilson.

TELEGRAPH.

The building occupied by the Western Union Telegraph company in New Orleans was partially destroyed by fire on July 10th.

City Engineer Hunter of Denver has declined to issue any more permits to the Western Union company to place poles and string wires in the streets until the company can show that it has a right in the streets. It is claimed that the company has no franchise. Manager Brooks of the Western Union called upon the mayor recently and stated his willingness to comply with the city's requirements, but he did not desire to have his company discriminated against.

A press dispatch states that the city of Philadelphia has been suing the Bankers & Merchants' Telegraph company and the Postal Telegraph company to recover license fees for poles and wires erected in that city by the respective companies. On July 15th the referee, Robert Sturgis, filed a report in favor of the Quaker City. In 1885 the common council of Philadelphia passed a resolution requiring the poles to be yearly licensed at $1 each and each mile of wire at $2.50. The Bankers & Merchants' company, which has been absorbed by the Postal, maintained 551 poles in Philadephia and an average of 370 miles of wire. The companies denied the right to impose the license fees. The referee says that the fees were used to have the poles regularly inspected for the safety of pedestrians. He decided that the companies should pay the city of Philadelphia fees amounting to $11,850 for the years from 1885 to 1892.

TELEPHONE.

A telephone line is to be built from Wellford to Spartanburg, S. C.

Important changes will be made in the Toledo, O., telephone system. It is proposed to expend $50,000 in these improvements. Complete metallic circuits will be introduced and connection made with the long distance telephone lines.

The committee on railways and telegraphs of the city council of Toledo, O., has voted in favor of an ordinance empowering the Ohio Telephone & Telegraph company of Cincinnati to construct, operate and maintain a telephone service in the city of Toledo, and primarily to allow the company to erect poles in certain streets, to be stipulated by future legislation. This is in the line of long distance service in Toledo.

MISCELLANEOUS.

The directors of the State Fair association of West Virginia intend to have races by electric light on the opening day of the next fair, September 5th.

West Bay City was deluged with a swarm of June bugs one evening last week, says the Dowagiac, Mich., *Times* of recent date, and the electric lights had to be turned out to head off the invasion.

Mayor Rogers of Denver, has recommended the establishing of subways for wires, to be used by the telegraph, telephone and electric light companies, but the council has taken no action on the matter.

The *Daily Financial News* of New York, in its issue of July 11th, said: "The General Electric company, which took over the Edison General and Thomson-Houston companies on the first of June, shows so far an increase of over 100 per cent. over the corresponding period last year."

Mayor Rogers of Denver, has refused to approve the bill of $3,500 which the council has voted to pay the Consolidated Electric company for substituting incandescent lights for arcs.

The sparrow killing business is quite profitable to some people says the Kalamazoo, Mich., *Gazette*. Mr. Hays who attends to the electric lights brought in 141 yesterday. They nest in the lamps and be lets them get just large enough so they cannot fly and then pinches their heads for three cents each. He made $70 last year at it.

The electrical steering gear on the monitor Miantonomah is now said to be in good working order. The device was designed by the Edison General Electric company, and as this is the first time such apparatus has been applied to a monitor, which is the hardest of all vessels to steer, it required a little time to get it working properly. The electrical equipment of the Miantonomah is probably the most complete of any of our warships.

Some interesting experiments in flash light telegraphy have lately been made on the Eiffel tower. From this conspicuous eminence rapid communication can be made to all the forts around Paris, and recent experiences seem to indicate the possibility of the tower being very useful in case of war. For some weeks past a body of army engineers has nightly been engaged in signaling from the summit, and the results are said to be most satisfactory. In only one case, that of Vincennes, was there any difficulty in communicating with the outer defenses of Paris.

The project for erecting an electric installation for the transmission of power from the large Trollhättan waterfall to Gothenburg, Sweden, has so far advanced that about 100 firms in the latter town are willing to use electric power from Trollhättan if conveniently installed and if the prices are suitable. The amount of motive power and electric lighting required by these applicants amounts to 5,262 horse power and 8,395 incandescent and 178 arc lamps. The plan, if realized, is likely to become the forerunner of many similar installations in Scandinavia.

TRADE NEWS.

Julius Andrae of Milwaukee has made arrangements to represent the Central Electric company in Milwaukee.

The Central Electric company, Chicago, is meeting with success with the Acme lead cable manufactured by the Okonite company. This cable is substantially made, and especially adapted for underground service.

T. J. Murphy, the well-known New York manufacturer of slate for electrical purposes, returned to New York last week after an absence of ten days during which time he visited his quarry in Vermont. Mr. Murphy reports some very large sales during the last month of his Italian and American marble for switches and switch boards.

The consolidation of the Edison and Thomson-Houston companies' business in Seattle consequent on the consolidation of the two parent companies, took place on July 1st. The new offices are at 807 Front street, where the Edison company had been located. W. J. Grames, formerly manager for the Edison company, will be the local manager.

The fourth semi-annual dividend of 4 per cent. has just been paid on the preferred stock of the Great Western Electric Supply company. Several new street railway contracts have recently been taken by the Great Western company, one of them being at Bozeman, Mont. Several isolated lighting plants complete have recently been installed, and business in all departments is reported active and the outlook for the future very bright.

The Gould & Watson company of Boston, dealers in mica, has disposed of its entire mica stock and the goodwill of its business to the American Mica company. This last named concern will in the future conduct the business in all its branches with headquarters at 620 Atlantic avenue, Boston. G. B. Watson, who has been treasurer for the Gould & Watson company, will be general manager of the American Mica company.

The American Engine company of Bound Brook, N. J., whose high speed engine has attracted so much attention, has just added a large amount of new machinery and built in addition 40x60 feet to its factory in order to meet the rapid increase in business. An electric crane to be built by the Bay City Iron company of Bay City, Mich., has also been ordered. Recent contracts secured by the American Engine company, include a number of installations for steam yachts. No little credit must be given to General Manager Elmer Stillman Smith for the rapid growth of this company.

BUSINESS.

The Engineering Equipment company of New York, has secured United States rights of manufacture and sale of the Goodell boiler and pipe covering. This is an important addition to the company's business, which is now divided into three special departments, viz.: Belting, boiler and pipe covering and overhead electric railway materials. In each of those specialties the company purposes to enlarge its facilities and strengthen its position in the trade.

Norman Hubbard of 93 Pearl street, Brooklyn, N. Y., manufacturer of the Packard vacuum pump, used in the manufacture of incandescent lamps, has recently supplied one No. 3 pump to the Edison Lamp company, Harrison, N. J, and one No. 3 and one No. 4 to the Dominion Electric company, recently organized in Montreal. Mr. Hubbard states that there are now 150 of these pumps in use in this country and abroad, and that recent improvements of great value have been made in them.

The ideal shape, the small weight for the output, the novelty of the design together with the simplicity and noiselessness of the Lundell fan motor; these are the advantages an appreciation of which by the trade is keeping the Interior Conduit & Installation company of New York working to its utmost capacity. In addition to the work of filling the demands for this fan motor, the Interior company is selling quite a number of its new combined pull-switch and ceiling pendant cut-outs.

The Hercules Iron Works of Chicago, Ill., have added to their already extensive line of specialties the manufacture of a new line of forging and bending machines for iron and steel work. One special feature of the machine is the rapid manufacture of turn buckles of all sizes. They have also begun the manufacture and already placed on the market a new design of a light spring hammer, with a blow ranging from fifteen to thirty pounds. The hammer is so arranged that one or more can be operated with a single belt. They may be attached to posts or the side of the shop.

Queen & Co., Philadelphia, are experiencing quite a demand for their standard portable testing sets. In every central station, no matter how small, it is real economy to have accurate apparatus for measuring resistance of lines, dynamos, lamps, etc., and the Queen set, "1891" type, with its wide range, accurate adjustment, and dead beat galvanometer, proves wonderfully efficient. A few years ago a commercial resistance, set correct within one or two per cent. was considered good enough, but Queen & Co. now guarantee sets to 1-5 of one per cent.

Among the recent sales made by the Sioux City Engine Works, Sioux City, are the following: One 12x18 Giddings' automatic boiler and complete plant for the Chadron, Neb., Electric Light company; five 5½x9x14, five 6½x11x16, and one 12x20x36 Giddings' automatic Corliss to G. Y. Bemis for milling plants; one 12x30 Corliss boiler and complete steam plant, Diamond Iron Works, Minneapolis; one 12x30 Corliss to Stratton & White, Fort Worth, Tex.; one 12x30 Corliss to Brookman & Barrett, Vermillion, S. D.; one 16x36 Corliss, Joliet Enterprise company, Joliet, Ill.; one 20x48 Corliss, Salem Electric Light & Power company, Salem, Ore.; one 12x36 Corliss, Cavalier Roller Mill company, Cavalier, N. Dak; one 11x18 Giddings' automatic to Corvallis, Or., Roller Mill company, and one 12x36 Corliss to Crouch Bros., St. Edwards, Neb. The Sioux City Engine works also report a decided increase in the demand for engines since the 20th June 20th, and there is every prospect for a very large demand for their engines during the balance of the season. In anticipation of this call they have completed a number of standard selling sizes, ready for prompt delivery, and are now engaging additional force for a night gang to take care of rush orders. They have also in preparation a new list of users of the Sioux City engine, which will soon be ready for the trade, and also a descriptive catalogue of the Corliss engines, which they hope to issue a little later.

ELECTRICAL PATENTS.

Issued July 12, 1892.

478,551. Magnetic Separator. Clinton M. Ball, Troy, N. Y., and Sheldon Norton, Hokendauqua, Pa.

Ore is fed to the surface of one of several adjacent revolving cylinders and passes successively to the surfaces of the others, being held to the surfaces by magnetic poles provided thereon, unlike poles of the adjacent cylinders being presented at the points of exchange to magnetically assist the exchange, the cylinders revolving at different speeds to grade the ore.

478,565. Desk Attachment for Telephones. Lewis C. Butler, West Bay City, Mich.

478,591. Electric Locomotive. Joshua Gray, Medford, Mass.

478,629. Electric Rail Bond. Thomas J. McTighe, New York, N. Y.

478,643. Method of Welding Metal Wheels. Emmet H. Scott, La Porte, Ind.

478,644. Method of Making Metal Wheels. Emmet H. Scott, La Porte, Ind.

The method provides for inserting the spokes in proper holes in the hub and tire, and passing an electric current through the spokes and portions of hub and tire.

478,661. Electrode for Storage Batteries. Henri Tudor, Rosport, Luxemburg.

478,664. Electrode. Armand Vanden-Kerckhove, Brussels, Belgium.

478,683. Apparatus for Lighting Locomotive Engines. Alexander R. Cavner, Chicago, Ill.

478,689. Cut Out Switch. William B. Cleveland, Geneva, O.

478,692. Telephone. Paul H. D'Unger, Chicago, Ill.

An adjustable damper is adapted to act upon the diaphragm and regulate its vibration to prevent difficulty caused by the inertia of the diaphragm.

478,701. Thermal Alarm. Hosea F. Maxim and Jesse M. Price, Norfolk, Va.

478,718. Arc Extinguisher for Electric Switches. Sidney H. Short, Cleveland, O.

The arc extinguisher consists of a series of supplemental contacts, each being a good conductor of heat and electricity, and arranged in the path of a switch lever, actuated by an electromagnet.

478,722. Distribution of Electric Currents. Elihu Thomson, Swampscot, Mass.

The invention embodies a main circuit, a local circuit and induction apparatus between the two, and a fusible plug in the connection from the main to the induction apparatus.

478,743. Telephone Repeater. Thomas A. Edison, Menlo Park, N. J.

Two or more reciprocal telephone repeaters, each comprising a receiving and a transmitting telephone, are connected with a telephone line to enable conversation to be carried on over lines of any length.

478,788. Electrical Thermostat. William L. Denio, Rochester, N. Y.

The thermostat is designed to open and then to close the circuit automatically by the fusing of the solder that holds the parts together.

478,789. Electric Signaling Apparatus. William L. Denio, Rochester, N. Y.

478,792. Mould for Glass Battery Jars. John Gayner, Salem, N. J.

478,816. Electro Mechanical Apparatus for Starting or Reversing Machinery. Albert Piat, Paris, France.

478,821. Electric Elevator. Alonzo B. See and Walter L. Tyler, Brooklyn, N. Y.

The invention embodies a switch arm operated from the car, a pole-changer and circuit controller operated in succession thereby, and an electromagnetic apparatus controlling the motor circuit and itself controlled by the said circuit controller.

478,865. Electric Time Alarm. John Jacobi, Brooklyn, N. Y.

478,956. Conduit System for Electric Railways. William H. Ford, St. Louis, Mo.

A main insulated conductor is connected with a sectional bare conductor, composed of one long and two short sections alternately, and switches between the conductors under the control of the moving vehicle.

478,968. Electric Motor. Harlon F. Ong, Newberg, Ore.

The invention embodies a motor whose power may be regulated, and which may be easily reversed.

Claim two reads:

In an electric motor the combination of an armature formed of a number of sections and provided with a commutator, a field magnet formed of a number of sections corresponding with those of the armature, and a multiple switch for sending the current through one or more of the field magnet sections in either direction.

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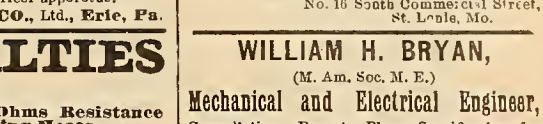

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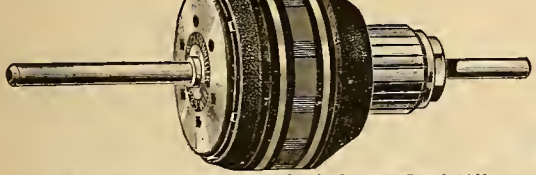

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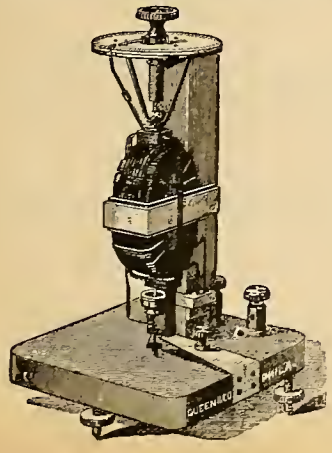

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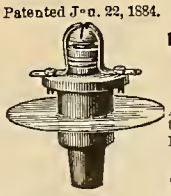

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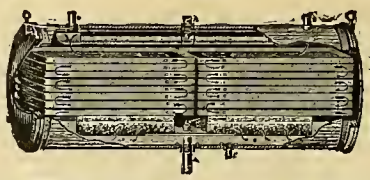

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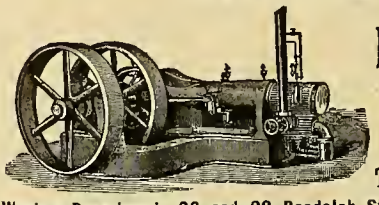

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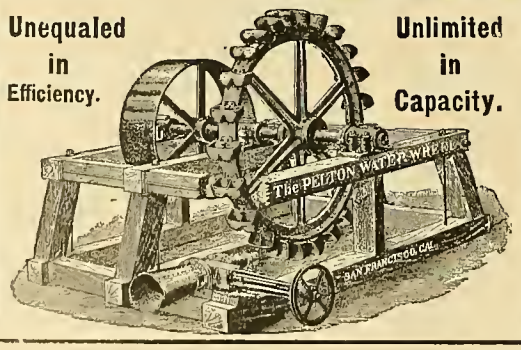

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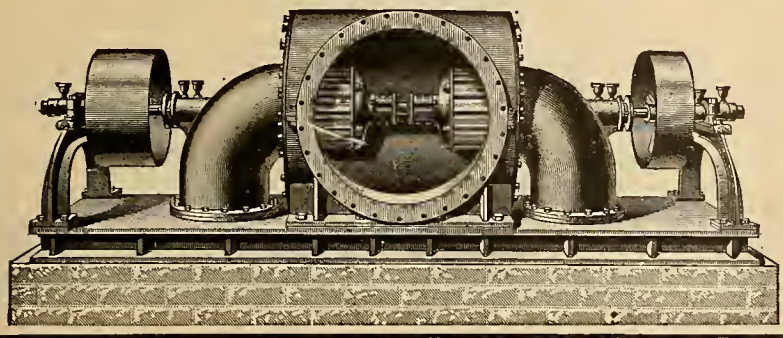

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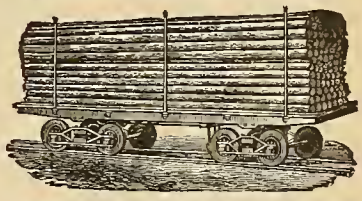

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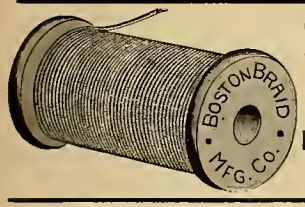

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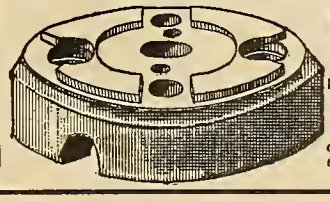

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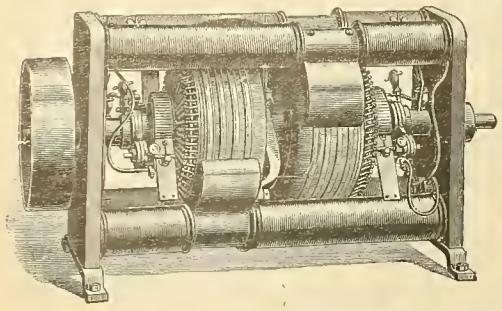

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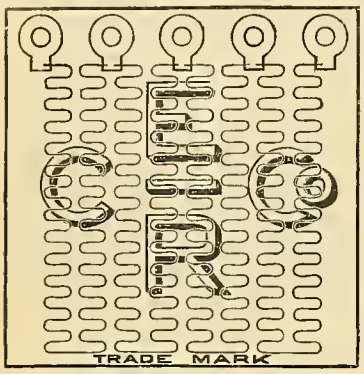

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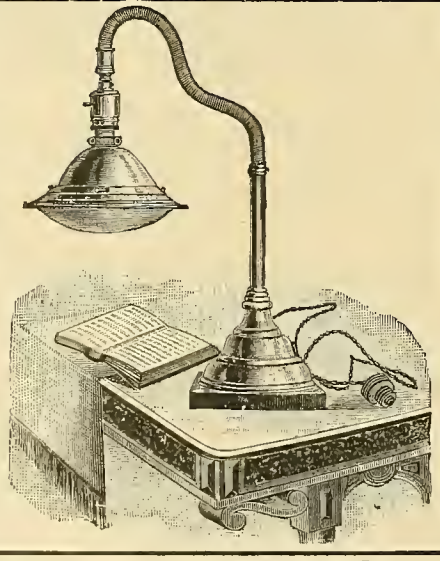

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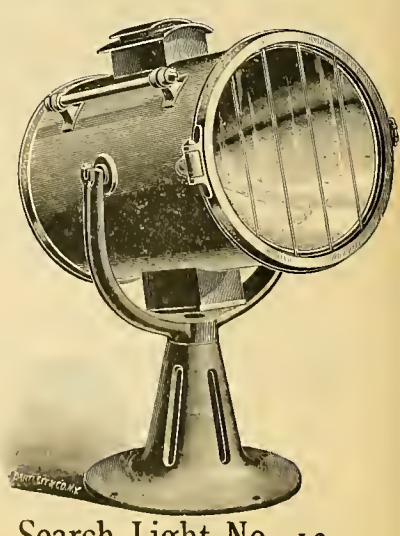

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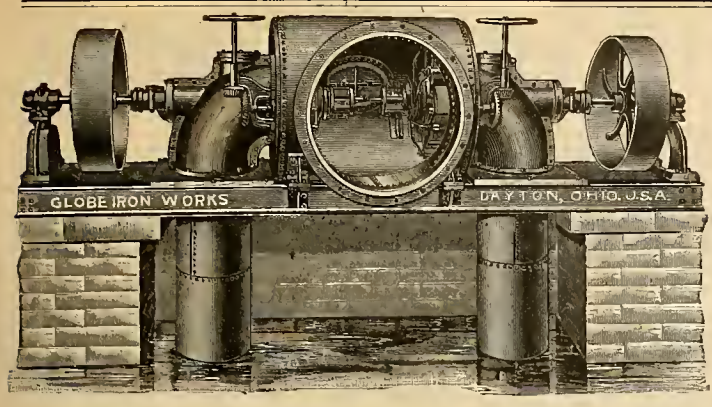

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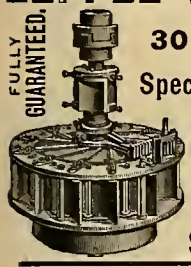

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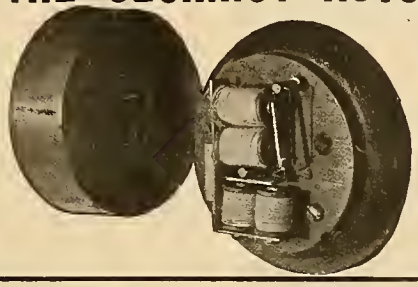

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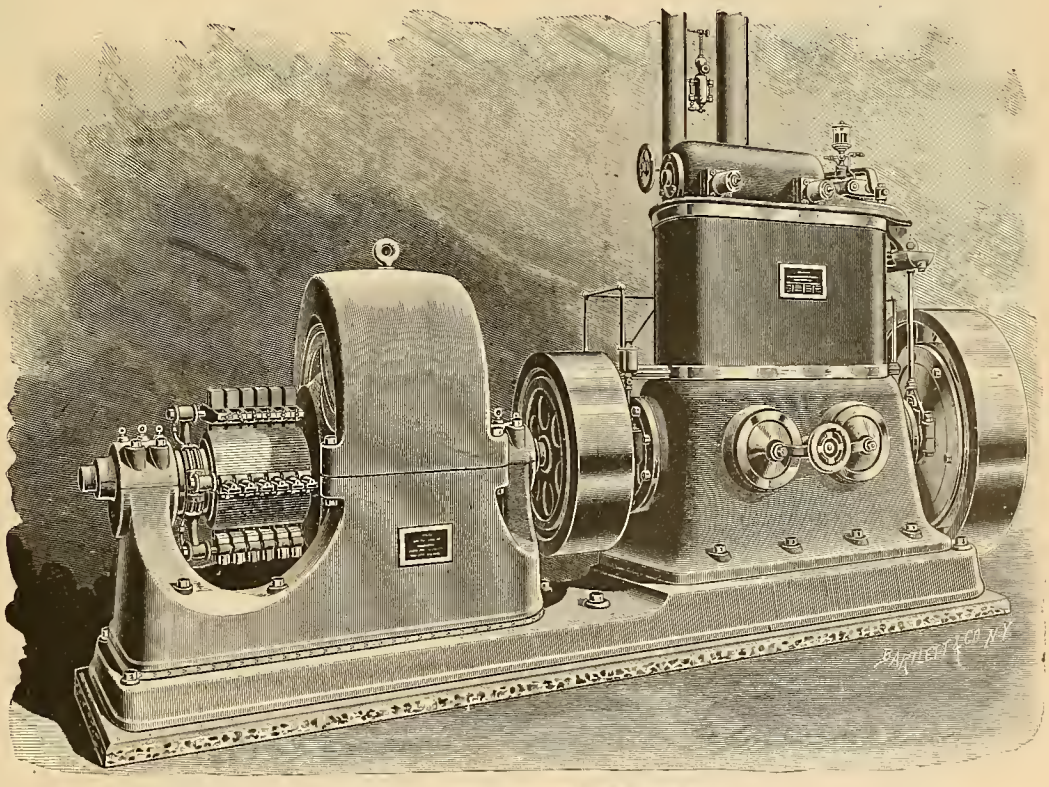

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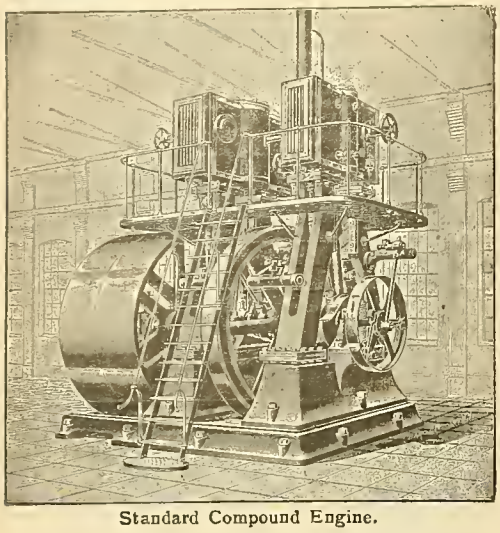

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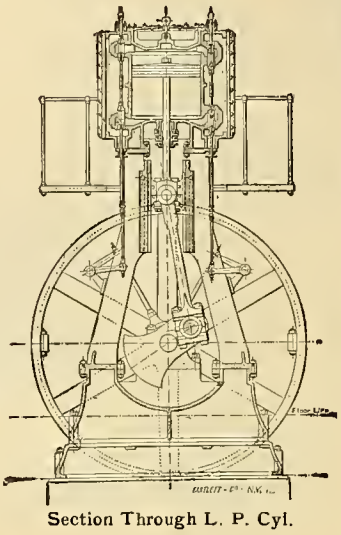

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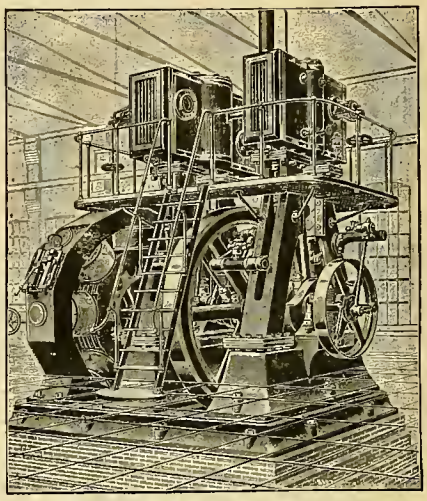

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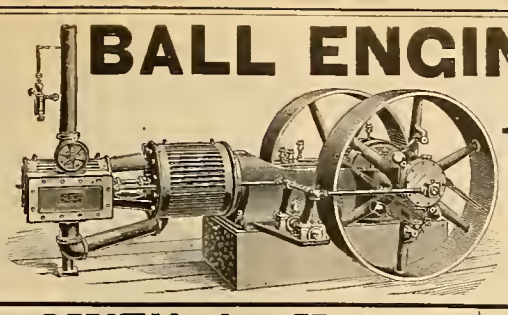

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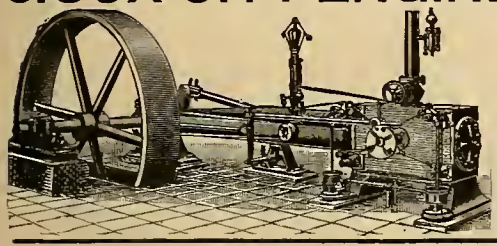

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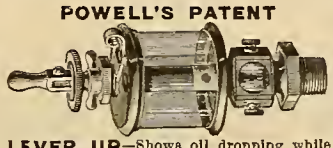

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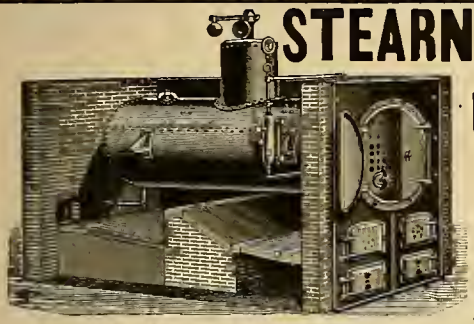

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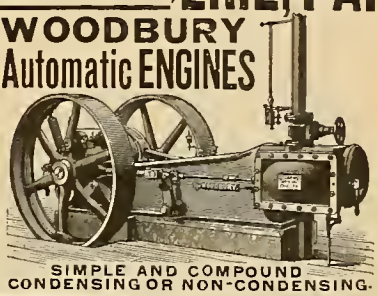

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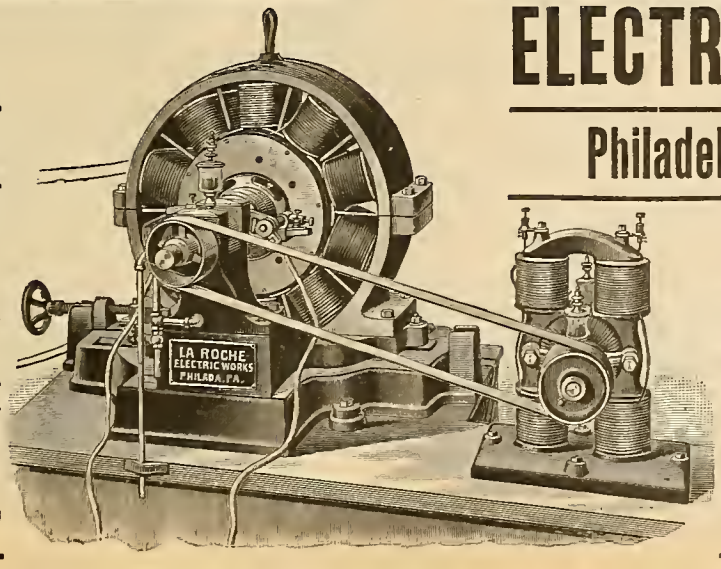

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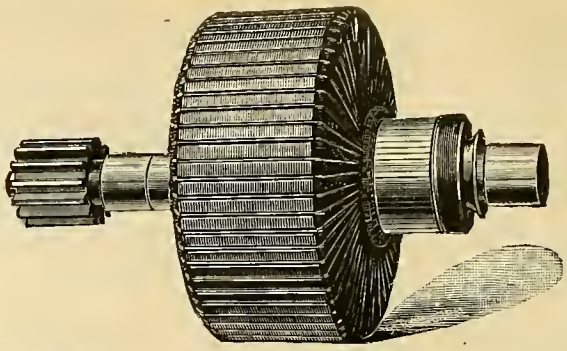

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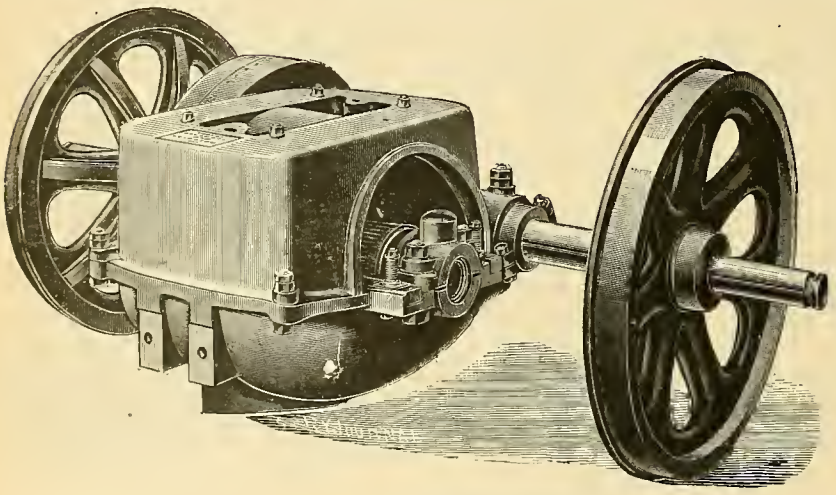

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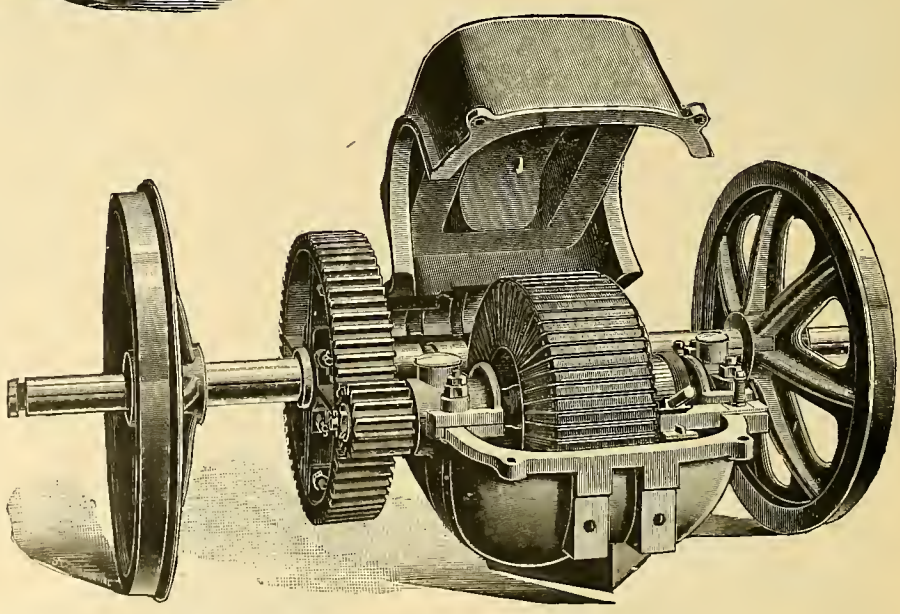

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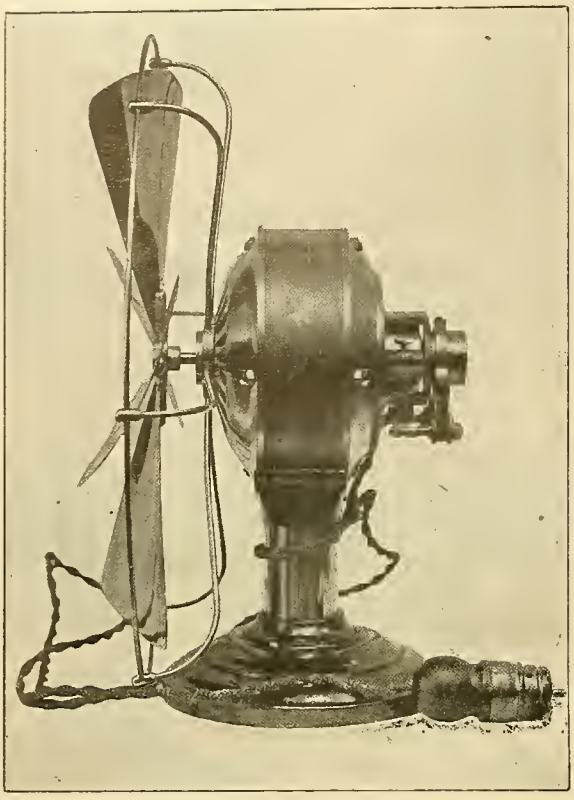

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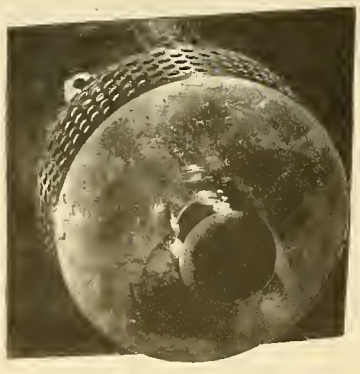

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Takes the place of ordinary one-light switch and enables the lamp to be set at any candle power desired, or turned full off or on.

JUST THE THING

For lodge rooms, nurseries and sleeping apartments.

MANUFACTURED BY

The Electrical Supply Co.,

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FACTORY, ANSONIA, CONN. CHICAGO.

THE WAY IT FOOLED HIM.

He was reading a TRIBUNE but suddenly gave it a crumpling grasp between his hands and sent it flying at his partner's desk.

"Demmit!" he said between his teeth.

"What's the matter, Cleverly?" asked his partner.

"Matter? got fooled again on one of them dad-binged advertisements. You know how they go—mighty interesting readiog until they dump you into a box of pills or somebody's cod liver oil."

"Yes—y-e-s," he replied slowly, "they have it pretty slick, don't they? No capital letters or anything, and you are reading right through sol coleman's ko-ko-tu-lu chewing gum or diokleberry's soap before you know it."

"That's it—that's it, or you think you are just chocking your head full of some scientific fact that'll do to remember;—only the other day I was reading an article about Para rubber, and—"

"And the Amazon River?"

"Yes—did you see it? Well, you know that young explorer Morris was a friend of mine and I'm always interested, and I was just getting into it when it wound up with something about Habirshaw's wire being made out of genuine gutta percha, and so forth—"

"Same here. I was reading about cyclones and the tall buildings in Chicago, and wind pressure, and structural resistances, foundations and the like, just to find a fan motor ad stuck at the end—"

"I know—one of these electrical supply company's things—they are the boss fan, though." And he reached up and turned the key on his motor.

"Nice, aint it?"

"Fine! I've got to have one," said the partner, getting into his coat and reaching for his hat.

SHIELD BRAND

Weather Report for June:

"Twenty-five rainy days, three clear, two doubtful."

And yet Shield Brand Moisture Proof Wire kept going—miles on miles of it—it was a fine month for Shield Brand.

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30 miles per day for 30 days.

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INCANDESCENT LAMPS OF SUPERIOR QUALITY.

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Long Life Lamps or High Efficiency Lamps.

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So Are Our Line Supplies and

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Western Electrician.

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Vol. XI. CHICAGO, JULY 30, 1892. No. 5

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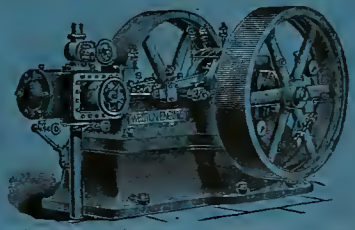

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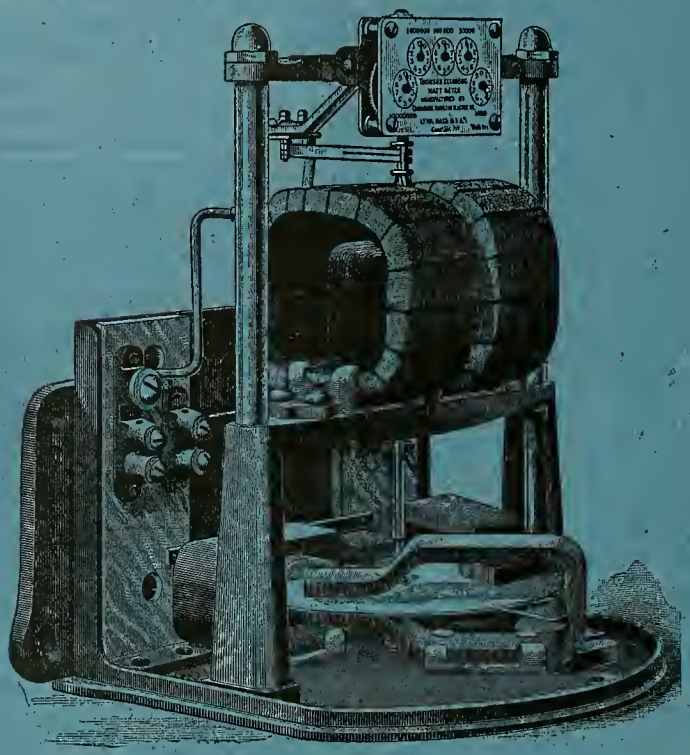
Thomson Recording Watt Meter.

For Lighting and Power Circuits.



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GERMANTOWN, PA., April 29, 1892.

Thomson-Houston Electric Co.

GENTLEMEN:—Replying to your inquiry of the 21st I am pleased to say the THOMSON RECORDING WATT METERS in use by us are giving us no trouble in any way. Repairs are so insignificant as not to need mentioning. We are using a great many, both on Direct and Alternating Currents to our great satisfaction. Yours truly,

GERMANTOWN ELECTRIC LIGHT CO.,
(Signed) Chas. M. Allen, Supt.

LANSING, MICH., April 6, 1892.

Thomson-Houston Electric Co.,
BOSTON, MASS.

GENTLEMEN:—Answering yours of the 31st regarding the THOMSON-HOUSTON RECORDING WATT METERS, would say that we are well pleased with them so far, and consider them better than anything else we have tried.

Yours truly,
LANSING ELECTRIC LIGHT & POWER CO.,
(Signed) E. F. Cooley, Supt.

Thomson-Houston Electric Co.,

PRINCIPAL OFFICE,
[illegible] Atlantic Ave., Boston, Mass.

WESTERN OFFICE,
148 Michigan Ave., Chicago, Ill.

INDEX AND CLASSIFICATION OF ADVERTISEMENTS.

ALPHABETICAL LIST.

American Battery Co..... xvii
American Desk & Seating Co.. xv
American Engine Co..... xii
Andrae, Julius..... —
Andrews & Co., A. H..... —
Babcock & Wilcox Co., The.... i
Baggot, E xiv
Ball Electric Light Co..... xvi
Ball Engine Co..... xix
Ball & Wood Co., The I
Beacon Vacuum Pump & Elec. Co. i
Becker Mfg. Co., John..... xiii
Beggs, J. E., Mch. & Supply Co. x
Bernstein Electric Co..... xii
Boston Braid Mfg. Co..... xv
Bowers Bros..... xvi
Bristols' Mfg. Co..... —
Brookfield, Wm..... xii
Brush Electric Co viii
Bryan, W. H..... xiii
Bryant Electric Co..... xii
Buckeye Electric Co., The..... ix
Butler Hard Rubber Co..... —
Carpenter Enamel Rheostat Co. xvi
Central Electric Co..... v
Chicago Electric Motor Co..... xii
Chicago Rawhide Mfg. Co..... —
Crescent Ins. Wire & Cable Co. xiii
Crocker-Wheeler Electric Co.. xiii
Cushing, F. W..... vii
Cutter, Geo..... i
Cutter Electrical & Mfg. Co... —
Dayton Globe Iron Works Co..xvii
Densmore Typewriter Co..... xii
Detroit Electrical Works..... xxiv
Diamond Electric Mfg. Co.... xii
Diehl & Company..... ix
Dixon Crucible Co., Jos..... xiii
Dudley & Co., W. W..... xiii
Duplex Electric Co., Ltd..... —
Eastern Electric Cable Co..... xiii
Easton Electric Co..... xv
Edison General Electric Co.....viii
Electric Cons. & Supply Co... xvi
Electric Engr'g & Supply Co.. ix
Electric Secret Service Co..... ix
Electrician Pub. Co..... xvi
Electrical Construction Co.,The. xii
Elec. Eng.& Sup. Co., The.... —
"Electrical Progress"..... —
Electrical Supply Co., The... xxii
Elektron Mfg. Co..... xix
Empire China Works..... x
Enterprise Electric Co..... xv
Falls Rivet & Machine Co..... ix
Ferracute Machine Co..... i
For Sale Advertisements.x, xii, xiii
Fort Wayne Electric Co..... xxiv
General Electric Co..... ix
Gravity Purifier Co..... —
Greeley & Co., The E. S..... I
Gregory, Chas. E..... xii
Hart & Hegeman Mfg. Co..... x
Heisler Electric Co..... —
Hill Clutch Works..... xix
Hine Eliminator Co..... —
Holmes, Booth & Haydens.... xiv
Illinois Electric Lamp Co..... xv
India Rubber & G. P. Ins. Co. xxiii
Institute of Technology..... xiii
Interior Conduit & Insulation Co. x
Internstional Okonite Co..... i
Jewell Belting C o..... i
Johns Mfg. Co., H. W..... xvi
Kartavert Mfg. Co..... xvi
Kelly Brothers ..... —
Knapp Electrical Works..... xxi
Lake, J H. & D., Co ..... —
Lake Erie Engineering Works.xviii
Lane & Bodley Co..... —
La Roche Electric Works..... —
Law Telephone Co..... xiii
Leclanche Battery Co., The .. xiv
Lefmann, Julius xiv
Leffel, & Co., Jas xvii
Leonard & Co., H. W..... xiv
Link Belt Machinery Co..... xiv
Loud, H. M. & Sons Lumber Co. xiv
Lovell Mfg. Co., Ltd..... xiii
Mather Electric Co..... vi
Morse & Co., A. M..... .. xv
Munsell & Co., Eugene..... xiii
National Carbon Co..... xiv
National Electric Mfg. Co .... —
New York Insulated Wire Co. xvii
N. Y. Safety Steam Power Co.. x
New York & Ohio Co..... I
Ostrander & Co., W. R..... xix
Page Belting Co..... —
Partrick & Carter Co..... vi
Pearson & Co., W. B..... xviii
Pelton Water Wheel Co..... xiv
Perkins Elec. Switch Mfg. Co. ix
Phoenix Glass Co..... xix
Pierce, Jr., Josiah. xvi
Pioneer Armature Co..... xiii
Porter-Leavitt Elec. Motor Co. xiii
Premier Electric Co., The..... x
Queen & Co..... xiii
Racine Hardware Mfg. Co..... —
Rae, Frank B..... xiii
Railway Equipment Co..... x
Ries Electric Specialty Co..... x
Roebling's Sons Co., J. A xii
Rose Elec. Light Supply Co.. xiii
Royal Electric Co..... —
Samson Cordage Works..... xii
Sawyer-Man Electric Co..... iv
Schindel & Schindel..... —
Schuyler Electric Co..... xvii
Sechrist, Albert..... xvii
Short Electric Railway Co Iv
Shultz Belting Co..... xvii
Siebert, G..... xiii
Sioux City Elec. Supply Co., —
Sioux City Engine Works.... xix
Smith, A. T..... —
Smith, Thos. G. Jr..... —
Somoff, J. L..... —
Sperry Elec. Mining Mach. Co. xvi
Standard Electric Co..... vi
Standard Paint Co xv
Stanley Electric Mfg. Co..... v
Star Electrix Co..... xv
Stearns Mfg. Co..... xix
Sterling, W. C..... xv
Stilwell & Bierce Mfg. Co. xlv, xv
Sunbeam Incand. Lamp Co...xxiii
Taylor Engine Co..... —
Thomson-Houston Elec. Co.. ii, xx
Union Hardware Co..... xii
U. S. Electric Lighting Co.. —
Utica Elec. Mfg. & Supply Co. x
Van Nuis C. S..... i
Vulcanized Fibre Co..... xv
Waddell-Entz Company..... xii
Wannopee Pottery Co..... xix
Want Advertisements.....xii, xiii
Western Electric Co.....xiv
Westinghouse, Church, Kerr & Co.....xviii
Westinghouse Elec. and Mfg Co..xi
Weston Engine Co..... i
Woodhouse & Rawson, Ltd.... —
Worthington, Henry R..... xii

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Annunciators.
Central Electric Co.
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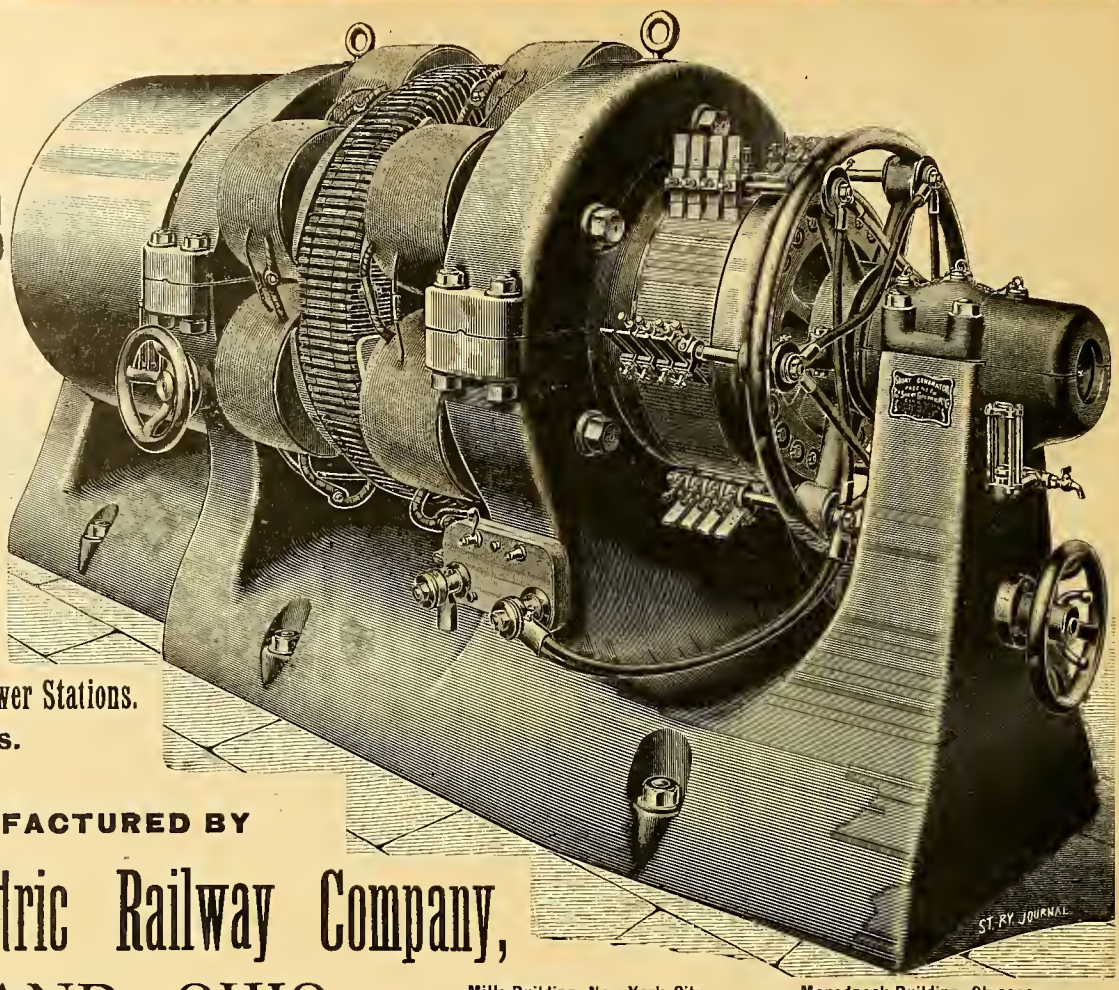

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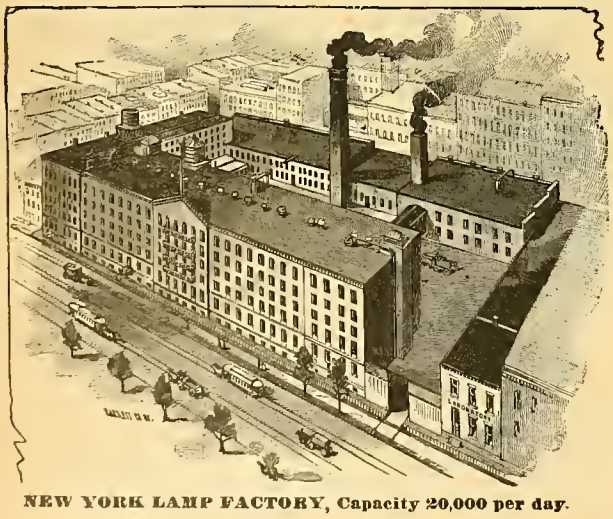

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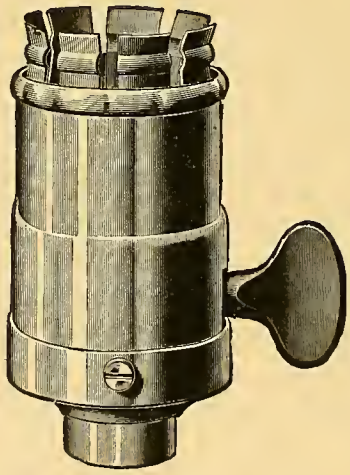

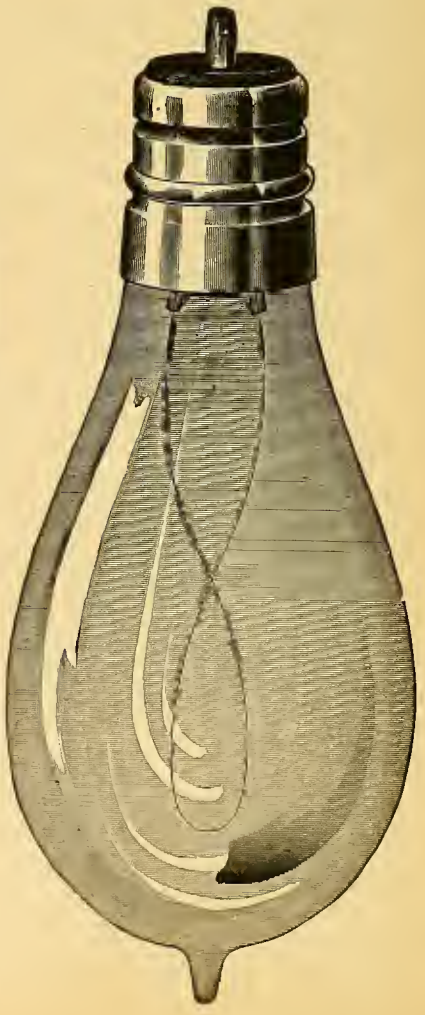

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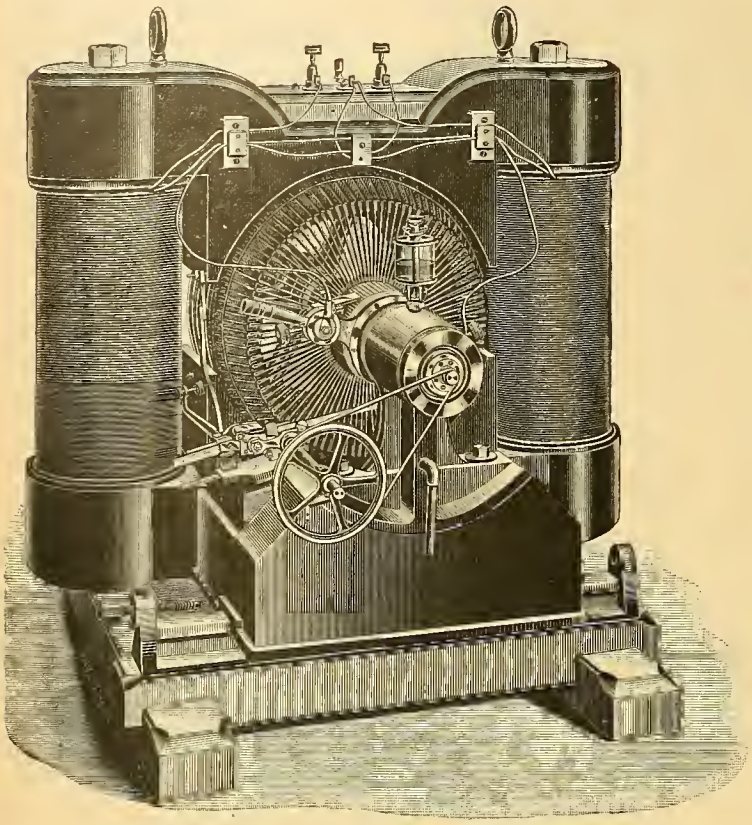

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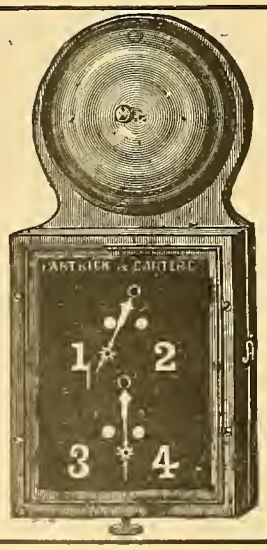

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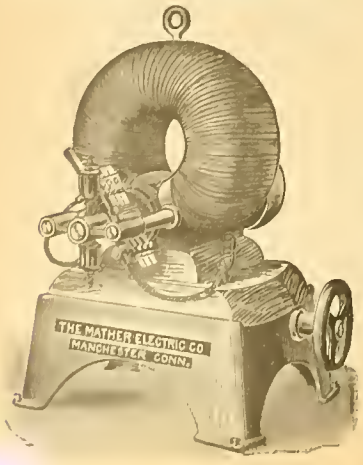

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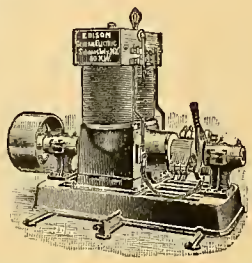

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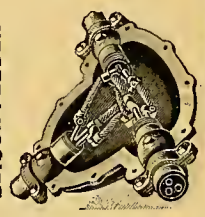

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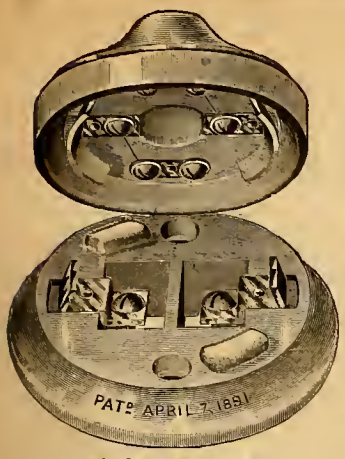

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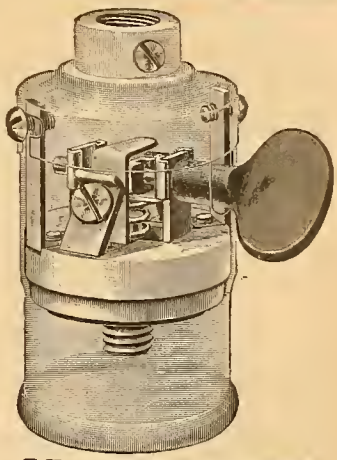
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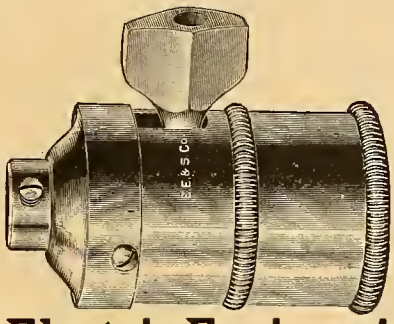

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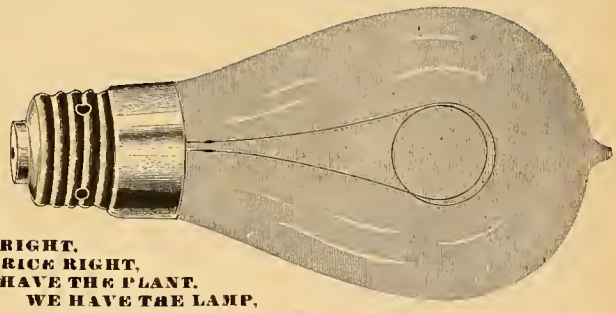

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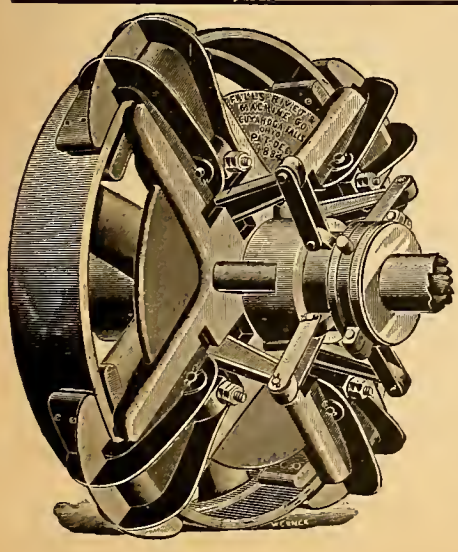

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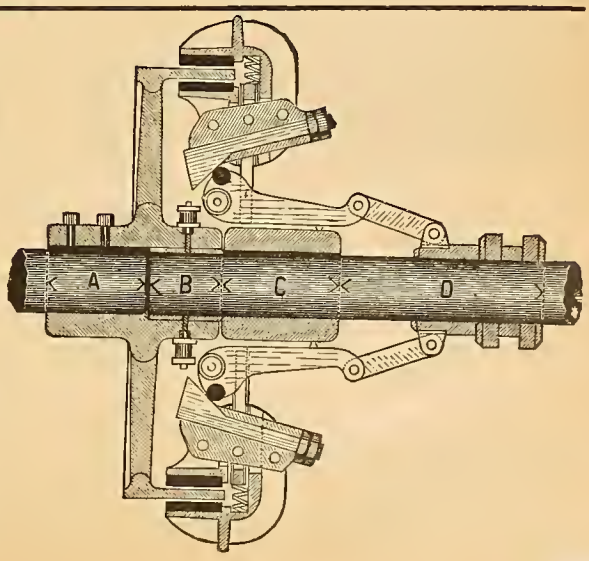

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We have sued H. T. Paiste, of Philadelphia, Penn., for infringement of our patent on Eccentric Snap Switches. The trade will please note that we have no intention to annoy them, but have sued the manufacturer of the infringing switch. The case will be pushed to an early hearing and it is not too much to ask that the trade will in the meantime respect our patent rights and await the decision of the Court in the case.

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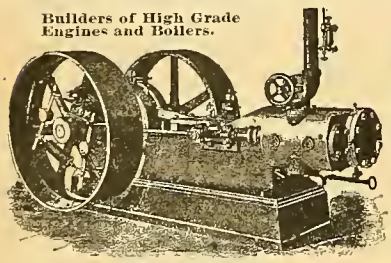

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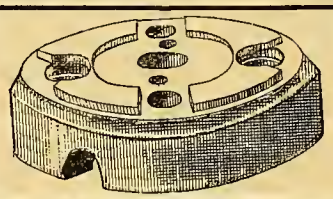

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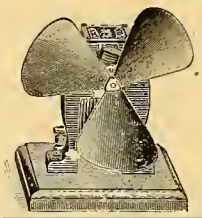

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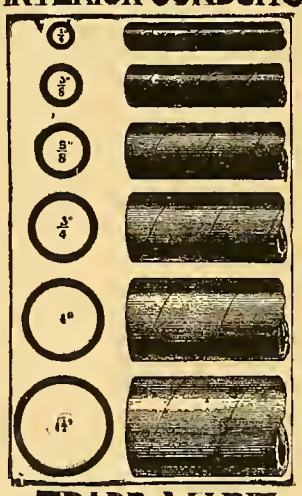

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NOTICE!!!

The Westinghouse Electric & Manufacturing Company will, at its own cost and expense, defend any and all suit or suits that may be instituted by any party against purchasers for the alleged infringement of patents, when such alleged infringement shall consist in the use of apparatus manufactured and sold by it.

We call the attention of users of electric railway and lighting apparatus to the attempts being made by the Edison-Thomson-Houston electric combination, or Trust, to secure, by threat and otherwise, a monopoly of the electric lighting and power business, which they are not entitled to, and cannot secure by means of their patents. If they could succeed in frightening users into entering into contracts binding them to take only the apparatus supplied by the Trust, then such users would be subject to a contract which they might have some difficulty in setting aside.

A proposed contract submitted by the Trust to one of our customers indicates that they intended to bind such customer to use exclusively apparatus manufactured by the Trust, and on such terms and for such prices as the Trust might name from time to time; and it is a fair presumption that the Trust would exact a margin of profit greatly above what is generally considered a fair manufacturing profit, in order to pay dividends on their immense capitalization (fifty million dollars capital stock, ten millions of which is preferred) and the interest on the proposed issue of ten millions of bonds.

The users of electric lighting and power apparatus, however, by refusing to purchase, except upon the terms and conditions on which they ordinarily purchase machinery, i. e., with the right to go into the open market unhampered to purchase their future supplies, or repairs, or alterations (as they should do), will always be free to select the best apparatus and details.

The Westinghouse Electric & Manufacturing Company sells all of its apparatus and makes all of its contracts on the above basis, and has never done otherwise, relying for future sales upon the merit of its apparatus.

We suggest the following as worthy of your careful consideration:

1. Enter into no contract with any electric light or power company except with respect to each purchase, and see that there are no hidden limitations or unreasonable provisions.

2. See that every contract contains a clause substantially as follows, for your protection as to patent matters, which clause is inserted in all of our contracts:

"The company shall at its own cost and expense defend any and all suit or suits that may be instituted by any party against the purchaser for the alleged infringement of a patent or patents, when such alleged infringement shall consist in the use of any apparatus, machinery or device, or parts thereof, manufactured or sold by the company, for which the purchaser shall have made all payments then due, provided that immediate notice of the institution of such suit or suits be given in writing by the purchaser to the company, and that the purchaser shall permit the company, through its counsel, to defend the same, and shall give all needed information, assistance and authority to enable the company to do so, and thereupon, in case of an award of damages in such suit or suits, the company shall pay such award, but the company shall not be bound to defend any such suit or suits, nor to pay any damages therein when the same shall arise by reason of the use of parts not furnished by the company."

3. Bear in mind that the agents of the Trust and its stockholders are numerous, and that specious arguments may be advanced, and threats used, to induce you to bind yourself to purchase apparatus only of the Trust.

4. If users of electric apparatus will act judiciously, then no Trust or Combination can expect to receive a higher price for apparatus than is warranted by fair competition.

When the Westinghouse Electric and Manufacturing Company entered upon the manufacture of railway apparatus, the price charged by the present members of the Trust was about $3,500.00 per car equipment. One-half of the above figure is the asking price to-day, and this reduction has been brought about by competition.

WHAT THE TRUST WOULD CHARGE IF THERE WERE NO COMPETITION.

The members of the Electric Trust (Thomson-Houston, Edison General, Fort Wayne and Bruah Companies) made bids for the incandescent lighting of the World's Fair, in each instance amounting to about $1,800,000.00, and they have since offered to do the same work for $550,000.00, the result of our competition.

We invite the co-operation and support of all users of electrical apparatus, who desire to have the benefits of competition.

Pittsburg, Pa., April 29, 1892.

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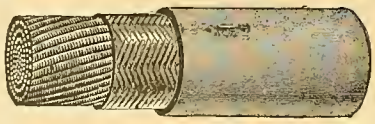
FOR ELECTRICAL PURPOSES.



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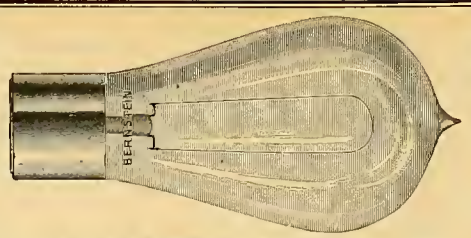

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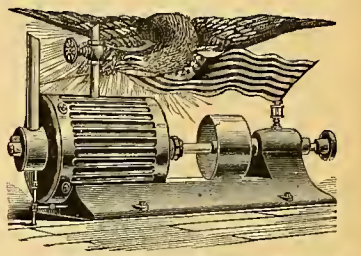

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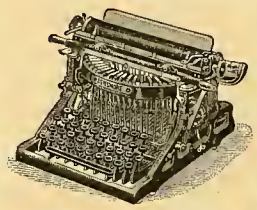

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We will appoint a reliable dealer in unoccupied territory as soon as possible, and in the meantime will ship machines on approval to parties having a good commercial rating.

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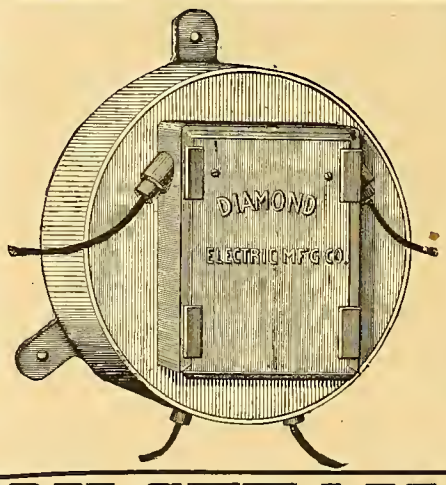

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A FULL LINE IN CHINA.

Because the Public Will have the

CHINA SWITCH.

WE HAVE

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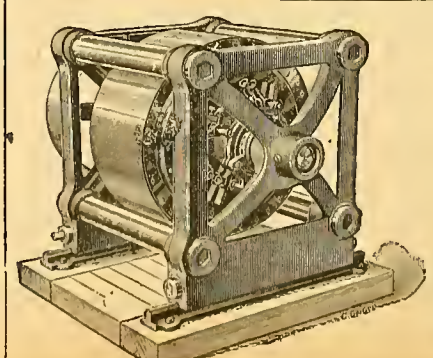

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WORKS AT BRIDGEPORT, CONN.

Western Electrician.

EVERY SATURDAY.

Vol. XI. CHICAGO, JULY 30, 1892. No. 5.

Electricity at the World's Fair.

On the recommendation of Chief Burnham of the bureau of construction, the committee on grounds and buildings of the World's Fair has decided in favor of the Columbian Launch company for the contract for supplying and operating the launches on the lagoons at the World's Fair. As a question of revenue is involved, the matter must still be passed upon by the committee on ways and means, but it seems to be likely that the recommendation of the grounds and buildings committee will be accepted. The latter committee hinged its decision on the conditions that the company make satisfactory terms with the ways and means committee regarding the division of receipts and that it show that it could not be enjoined from using storage batteries. The contract involves the furnishing of about fifty boats for regular service, carrying twenty-six or twenty-eight passengers each, and a dozen or more "cab boats," each having a capacity of six passengers, and subject to call, as the name implies. If the Columbian company can make satisfactory arrangements with the committee on ways and means, as is thought to be probable, the result will be a decided triumph for electricity and will give a great impetus to the building of electric launches in this country.

Naturally enough the three unsuccessful competitors—the Electric Launch & Navigation company and Meeker & Co. of New York, and Willard & Co. of Chicago—are dissatisfied with the result, and they are not slow in expressing through the newspapers an unfavorable opinion of the successful contestant. Of the Electra, the electrical boat of the first named company, it is only fair to say that it is a handsome and handy craft and that, on the tests, it satisfied all the requirements of the exposition. Unfortunate business difficulties had much to do with this company's lack of success. Meeker & Co. and Willard & Co. had each a fine steam launch, but it was found impossible to wholly eradicate the smoke nuisance, although this was done in a considerable degree. This was a serious draw-back, as it would have proved very disagreeable to the constant throngs passing over the bridges spanning the lagoons. Mr. Willard's launch, the America, is a boat capable of carrying fifty passengers and is equipped with a ten horse power engine. It is not unlikely that a vessel of this character will be recommended for service in the outer harbor.

The competitors of the successful company claim that on account of the comparatively slow speed of the Volta boats of its class will be unable to carry as many passengers as the larger and speedier steamboats, and the Exposition company, which is to get a percentage of the receipts, will lose money in consequence. There are also threats of infringement suits to prevent the use of the American Battery company's cells, with which the boat is equipped. In meeting these charges Mr. Nixon, of the Columbian company, says:

> The day before the test began we received a letter instructing us to run at whatever speed we thought proper. After consultation with those in charge of the planting of the islands and shores of the lagoons, and showing various speeds before them, we settled on a speed perhaps as great as is possible without injuring the plants by the wash. As we have said, we can run as fast as anything there. As to our capacity for running at a greater rate of speed, after a test of ten hours we obtained other experts from the construction department and made an additional run of over fourteen and one-half hours, showing that we had stored energy for about two and one-half times the service laid down.

The threat that the World's Fair company or the Columbia Launch company will be sued for infringement is simply idle. The Julien company does own the Brush patent, but in no way does the American Battery company infringe it. The Brush patent, we grant, gives the exclusive right to the mechanical application of active material. The American Battery company does not apply its active material mechanically. The principal argument that has been made against our electric launch by competitors has been on its lack of earning capacity. Earning capacity is dependent, first, upon the number of passengers that a boat will carry; second, upon speed. The number that a boat will carry is dependent upon its size. The size has been limited, in suggestion and hint at least, from the very beginning by the department of construction and by the landscape gardeners, the projectors of the entire boat scheme. Our boat is two feet longer than we were given to understand would be acceptable when we built it; therefore we have built as large a boat as any one had a right to believe would prove pleasing to those who had the idea of landscape, scale, and so on, in mind.

ELECTRICITY AT THE WORLD'S FAIR.

In addition it is claimed, on behalf of the American Battery company, that the batteries were hurriedly made, in order to comply with the requirement fixing June 1st as the date of the beginning of the test, with which no other company complied, and that the formation was not uniform in all the cells. Neither were the batteries sealed with rubber covers, but simply with paraffine. These defects are to be avoided in the cells furnished for the boats required for actual service. It is also claimed that the tests of the rival batteries show that when discharging at the rate of 96 amperes the American Battery company's cell lasted for over an hour, while the Julien battery was exhausted in twenty minutes. On the other hand, disinterested persons who are in a position to know assert that the two batteries did not vary 5 per cent. when judged by the output in watts. The official report of the World's Fair tests, however, has not been made public, as it was intended merely for the information of the Exposition company, and not for commercial use.

The competition has excited much interest and has received considerable attention from the Chicago newspapers. The *Chicago Evening Post* says editorially:

> It was expressly understood at the outset of the test that the concession should go to the bidder whose launches made the least noise and gave out the least heat and smoke. The Columbian company's launches fulfil these conditions, while those of some of the protesting concerns gave faithful imitations of river tugs in belching out dense volumes of black smoke, puffing like grampuses and throwing off a high degree of heat. What the directors seek to secure is comfort for the visitors. The matter of revenue is, as it should be, a secondary consideration.

The manner of charging the launches has not been definitely settled. It is proposed to locate one large station under the pier at the peristyle, where the boats could be under cover.

The illustration on this page shows the four contesting boats as they appeared on the basin on the occasion of the review of July 14th. The Volta, the successful launch, is the one heading the line and containing the members of the ways and means committee. Next in order, to the right, is the Electric Launch & Navigation company's Electra, while farther along is Willard & Co.'s America, the Isabella of Meeker & Co. being the last. In the immediate foreground, at the pier, is the little cab boat.

Carriages intended for road use and propelled by electricity will be exhibited in the transportation building, and the exhibit will be made under the supervision of Chief Willard A. Smith. In speaking of this feature of his department Chief Smith said: "A special place will be provided in the rear of the transportation exhibits building for showing electric carriages in operation. These vehicles will not be heavy, lumbering affairs, but will be built for use on common roads. They are now in use in Europe, and are a success. American inventors are in the field, and will have some fine carriages on exhibition. The road between the transportation annex and Stony Island avenue is well adapted for the exhibit. There will be a line of trees, vines and shrubbery along the fence, making the road very pleasant in every respect. The railroad tracks will be removed and a fine pavement laid. Up and down this road the carriages will run, and people will be surprised to learn that for centuries money has been uselessly tied up in horse flesh."

The arc light department of the central station service plant in machinery hall is now practically all laid out, the capacity being 5,000 lamps. The exhibit is laid off in sections of about 50 by 100 feet, surrounded by aisles. That of the Standard Electric company will be in the southwestern corner of the building. Next will come the Fort Wayne company's machines, and then a third section devoted to Brush and Excelsior dynamos. The Thomson-Houston company will have the adjoining compartment, and the fifth section will be largely given over to the Western Electric company. Space is left for additions to the plant in the several sections. The Westinghouse incandescent plant will adjoin the Western Electric section on the east. The foundations for the boilers for the arc light plant are nearly all in now. About all the engines that are needed for arc lights have been secured. Exhibitors who contemplate showing condensers in the service plant should make application to Mr. Sargent at once.

The electrical and mechanical department of the bureau of construction has been removed from the ground floor to the second story of the service building, overlooking the interior court. Engineer Sargent will soon ask for bids

for lighting the wooded island on the series incandescent system.

Superintendent Keller, of the Westinghouse installation, has appointed W. J. Reilly as assistant manager. Mr. Reilly has had several years' experience with Westinghouse apparatus and was lately manager of the station at Evanston, Ill.

W. H. Wachter of Brinkley, Arkansas, has an application before the committee on ways and means for constructing a monster observation wheel at the World's Fair. He proposes to revolve people to a height of 220 feet in swinging baskets. The wheel will revolve between two steel-trussed towers 110 feet high. Twenty-eight upholstered baskets, swinging on two pivots, will accommodate eight persons each, and a round trip will be made every fifteen minutes. The motive power is to be electricity.

The Star Iron Tower company, of Fort Wayne, Ind., has made a proposition for space for towers by which to show tower lighting by arc lamps. The structures proposed will be about one hundred feet high and will contain six or eight lights each. It is proposed to place two of these towers at the Cottage Grove avenue entrance to the Midway Plaisance and one at the stock exhibit.

Protecting Dynamos.

By Foree Bain.

A lightning arrester that does not arrest is like an inefficient police officer; and there are a great number of lightning arresters of this type. An old style device which has always been successful with a few exceptions, in telegraphing, is the saw tooth plates; one connected to ground and an opposite one separated only a fraction of an inch and connected to line. Lightning will crack through this simple device a dozen times a day and do no harm. Combs would work just as well on an electric light circuit if it were not for the fact that the powerful currrent of a dynamo will follow the lightning arc across the combs and thus short circuit the dynamo. A fuse between the ground comb and the ground will prevent any dangerous results. But it frequently happens that several flashes come in rapid succession, and in such a case the second flash would not go to ground over this path because of the long gap where the fuse melted away. Efforts have been made to produce an arrester that would substitute fuses but in most

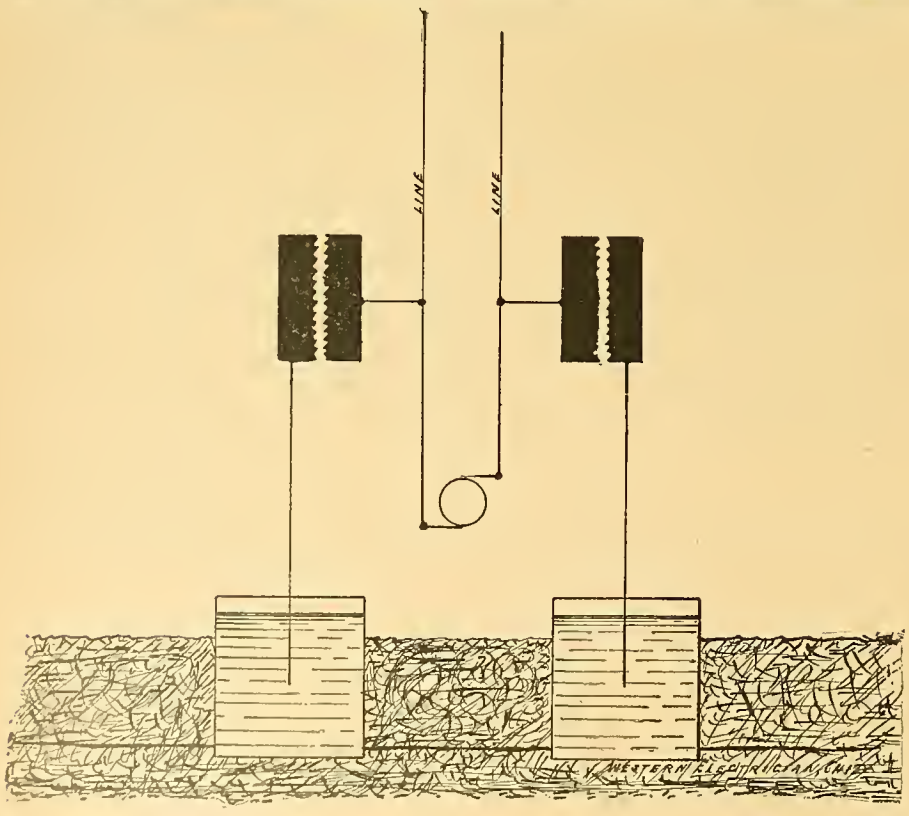


FIG. 1. PROTECTING DYNAMOS.

of these devices a single flash seldom fails to blow all the fuses. It is unnecessary to designate the various devices that have been called lightning arresters, and are still being sold under that false name. I will say, though, that I have records where most of them have failed.

Fig. 1 illustrates a device, however, which will be found more reliable than most of the fancy finished machines that do not arrest. Leave your old saw tooth plates as they were and take out your fuses. Substitute instead a tin or iron bucket, a couple of powder kegs each with one head out. Sink these kegs in a bed of charcoal or coke under the eaves of your engine or dynamo room. Connect these vessels together and to a good ground, gas or water pipe, by wire. Take the ground wire for the circuit to the bucket and let it dip down about half the way to the bottom. Now fill the kegs with water, and keep them filled. A bucket for each side of the circuit will be required. I have known this device to be in use for several years without any disastrous results from lightning. The only objection to it is that the buckets or vessels must be kept filled with water.

Static electricity, produced by rapidly traveling belts, especially on cold, crisp days in winter, is very annoying and dangerous. I have seen a well insulated dynamo standing idle become charged as a condenser, to such an extent that it would knock a man down when he touched it. Had this machine been thrown suddenly into circuit the discharge would have caused an arc to ground and produced, no doubt, a burn out, just as lightning would have done.

I have found a very efficient device to completely and thoroughly protect dynamos and underground cables

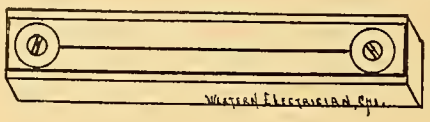


FIG. 2. PROTECTING DYNAMOS.

against damage resulting from static electricity. As the device costs little or nothing it can be easily applied and is worth trying.

Fig. 2 represents the static preventer. It consists of a piece of vulcanite with a screw and two copper washers at each end. The piece of vulcanite should be 7 inches long by 1 inch wide and ¼ inch thick. Paste a piece of semi-calcodared writing paper under the screws and one side of the vulcanite, draw with a soft lead pencil a line as indicated from one washer to the other. The line should be carefully drawn so that electric continuity between the washers is secured. This lead pencil mark will measure several megohms, but but it will prevent an accumulation of static charge. Connect the frame of each dynamo to the ground through one of these divices, also connect each side of the circuit to ground in the same way. If there is any lead cable in circuit, locate one of these devices in a dry place and connect the copper conductor of the lead cable through the pencil mark to the ground. This simple little wrinkle will prevent many burn-outs from so called "mysterious causes."

Central Station Lighting in Small Cities.

By Wm. H. Bryan.

The larger cities of the country are very far from having a monopoly of electric light. There is hardly a town of 30,000 inhabitants which has not its central station—and sometimes more than one; while a great many smaller places are similarly equipped. There are in fact a number of villages of less than 1000 where fully equipped plants are regularly operated.

There are abundant reasons why this should be so. The first cost of a plant of suitable capacity is small, and it may readily be extended over comparatively wide areas. Land, buildings, labor, and frequently fuel, are cheap; and there is sometimes the seductive influence of an unused water power in the vicinity. There is abundant space, and plenty of light and air—ideal conditions which permit of an arrangement of plant admirably fitted for good work. To these tangible advantages may be added the often imaginary one of a present or prospective "boom," and the desire to equal or out-do some neighboring or rival town.

And yet it must be admitted that the results of these installations are not all that could be desired. Some important elements, bearing directly upon the question of success or failure, have evidently been under-estimated, or wholly overlooked. True, a few such plants have prospered, and many others maintain satisfactory service, and are able to keep going. Others, however, find themselves playing a losing game—fixed and growing expenses, and limited incomes; no money for interest, repairs, or renewals.

This unsatisfactory state of affairs has caused foreign capital to be very slow—if not entirely unwilling—to seek investment in such plants, and has even hurt the cause of electric lighting in general, even under conditions entirely favorable to success.

Wherein does the trouble lie? And is there a remedy? To consider these questions intelligently it is desirable, first to get a clear idea of what constitutes success.

There must, of course, be satisfactory service—the lights must be of proper candle power and uniform intensity. There must be no interruptions and no delays in starting. All reasonable demands as to character and sub-division of the light and extensions of circuits must be met. Prompt and courteous attention to the wants of patrons is indispensable. In short, the light must be so superior in quality, and so reasonable in price, as to insure a large and growing demand. Such a plant would certainly be considered a success from the standpoint of the customer.

Whether a plant so operated is successful from the standpoint of the investor is, however, quite another question. Do the established rates yield a proper net income? And it must not be forgotten that financial success means far more than a mere surplus of income over running expenses. The permanently successful station must have a gross income sufficient not only to pay all ordinary operating expenses, but a net income which will pay:

First—A fair interest on the capital invested, say from five to ten per cent., depending on the ruling rates in the vicinity, and

Second—A certain regular sum for a sinking fund This may be expended wholly in keeping the apparatus and plant in as good condition as new; it may be used partly for ordinary repairs, and the remainder set aside for the purchase of new machinery when the present shall have worn out. The proper amount to charge to sinking fund varies widely, depending on the character of the service, the design and construction of the apparatus, and the intelligence and care exercised in its operation. It should rarely be estimated at less than eight per cent. per annum on the first cost of the plant, and sometimes should be as high as twenty per cent. In the earlier days of electric light installations, when designs were had, methods of construction crude, and the handling and care poor, even the latter figure was frequently too low. These objections, however, have been largely overcome in late years, with the result that better service and greater durability are now readily obtainable.

It is held by some that the earnings should also be sufficient to provide for such increase of capacity as is necessary to enable the plant to keep pace with the growth and advancement of the community it serves. Quite a number of the plants in the larger cities have done this, and they are now pointed out as shining examples of success. Such results are cause for congratulation, and would be highly desirable to obtain; but they cannot legitimately be charged against the earnings. Increased demands and increased opportunities for revenue justify

the investment of additional capital—on which in turn the same net revenue must be earned.

Failure to earn a net income sufficiently large to meet the requirements of interest and sinking fund will in time inevitably lead to disaster. The effect will first be felt in inability to properly operate and maintain the plant, resulting in an impairment of the service, and dissatisfaction among the patrons, which can but add to the trouble, and hasten the end.

A brief study of the situation as it usually exists in small cities and towns may not be out of place. Mention has already been made of the favorable conditions, real and imaginary. What are the unfavorable influences which in so many cases have caused financial disappointment, if not ultimate failure?

First of all, the demand is so varied in character as to be beyond the capacity of the average station to meet. People want arc lights of different candle powers; long and short hours; incandescent lights of all candle powers, and at any distance; current for power at varying pressures. But few subscribers need light after midnight, but there will be quite an unfavorable sentiment raised if the lights are shut down at twelve, although there is rarely sufficient income to justify operating after midnight.

The area to be covered is frequently large, and the users scattered, so that an unusually large investment in mains is necessary in proportion to revenue. So much so in fact that no other form of public illumination would be thought of at all.

The hours of lighting are short. Stores and business houses close early. There is little or no activity on the streets after dark, and there are usually no theaters or halls or other regular places of amusement to keep people up late.

Neither is there usually a demand for as high a grade of illumination, nor as large quantity of it, as exists in large cities. The people have been accustomed to coal oil or candle light for indoors, and a few feeble oil or gasoline jets for the streets; and they do not readily see the advantages of more and better light. There is not the rivalry between adjoining districts or streets, nor between neighboring or competing business houses, which has so frequently resulted in increased demands for light in the cities.

Furthermore, there are but few large stores and residences, where any large and concentrated demand can be expected. The outfit must therefore be distributed among a larger proportionate number of small consumers, with a resulting increase in the cost of operation and maintenance per unit. But few places will be found where arc lights can be economically employed. The vast majority cannot afford to pay a living price for such a light.

And it is at first difficult to convince them that the new form of light is really worth what it costs. It is not claimed that electric light can be furnished as cheaply as coal oil, except in remote districts, under conditions particularly unfavorable to oil. It takes time to prove the superior merit of electric light, its greater illuminating properties, its safety, cleanliness, ease of handling, and its adaptability to varying conditions. Make the price as low as you will, and there are still many who think it too expensive. They and their fathers and grandfathers have gotten along in the past with oil and candles, and they are slow to see wherein an improved light is worth more to them in dollars and cents.

Right here is where the careful and conservative station manager meets his greatest difficulty. The maximum rates are usually fixed by charter or ordinance, and are seldom excessive. Shall they be rigidly adhered to, at the possible cost of restricting the output far below the station's capacity, or shall a general reduction be made, trusting to increased consumption to bring up the revenue? What schedule of rates will bring in the maximum net returns?

Many failures may be traced to unwise competition. A town may already have a small gas or electric light plant which is serving the people fairly well. There are always some malcontents ready to raise the cry "monopoly" who imagine that unheard-of profits exist in the lighting business. The result is the installation of a second plant. As there is not sufficient business for both, rates are cut to secure or hold what business there is, and losses result. Usually it is simply a question of the longest pocketbook. The struggle is finally ended in consolidation or the extinction of one of the plants, and another failure of electric lighting as an investment is chronicled.

Not far removed from these are the cases where illuminating companies add electric lighting plants in order to forestall the installation of a plant by others, thus keeping the entire lighting business in their own hands. There are, of course, certain economies of operation which should result, due to combined management, reduced or no cost for space, buildings, etc. But it is not uncommon for the electric lighting department to be run as a side issue, without special expert attention. No enthusiastic and persistent effort is made to enlighten the public regarding the meritorious features of the new light. Small wonder, then, that such plants fail to earn a proper income, particularly where the demand for light is limited in quantity and revenue.

These are some of the conditions existing in the town itself, and which not infrequently determine in advance the probabilities of success. Failure may, however, result even when a fair review of the situation amply justifies an installation, and from causes inherent in the plant itself.

The manner in which the average plant of this kind is purchased is usually such that the chances of success are against it from the start. A number of public-spirited citizens, each successful in his own line, agree upon the necessity for such an improvement. They get together, organize, secure a franchise and a city lighting contract if possible. They are waited on by representatives of all the companies manufacturing and selling apparatus, and are invited to go on tours of inspection. Visits are made to other towns, where the operation of plants is inspected. There is rarely a man among them qualified by education or experience to pass upon a problem of this kind, fairly or intelligently. Neither are the men in charge of the plants visited usually capable of judging any apparatus or system outside of the particular type they are themselves operating. As a result the plant last visited, the one with the greatest income, the lowest priced apparatus, or the most glib salesmen, determine the choice, without respect to whether the apparatus selected is suited to the requirements, which may be—and usually are—different from those elsewhere. Men who would not think of acting as their own lawyers or physicians, who would not build a bridge without having an engineer, nor a house without an architect, unhesitatingly take in their own hands decisions involving the most complicated of technical and expert considerations. Usually the salesmen securing the contracts do the engineering, and it is greatly to their credit that they so often secure successful results in the face of many unfavorable conditions.

Not infrequently, however, the salesman is not asked to supervise all the work. And sometimes, when asked, he is prevented by previous engagements and lack of time from following the matter up as he would like. Often, however, the proper solution of the problem involved calls for a wider experience and more thorough training than is possessed by the average salesman. The companies whose systems are used, and who build the apparatus, should, and frequently do, take a decided interest in the plant, but ast heir business is manufacturing and selling, and not operating, and as their best men ar e usually very busily employed on other and more profitable work, it is seldom that they can follow up each separate installation.

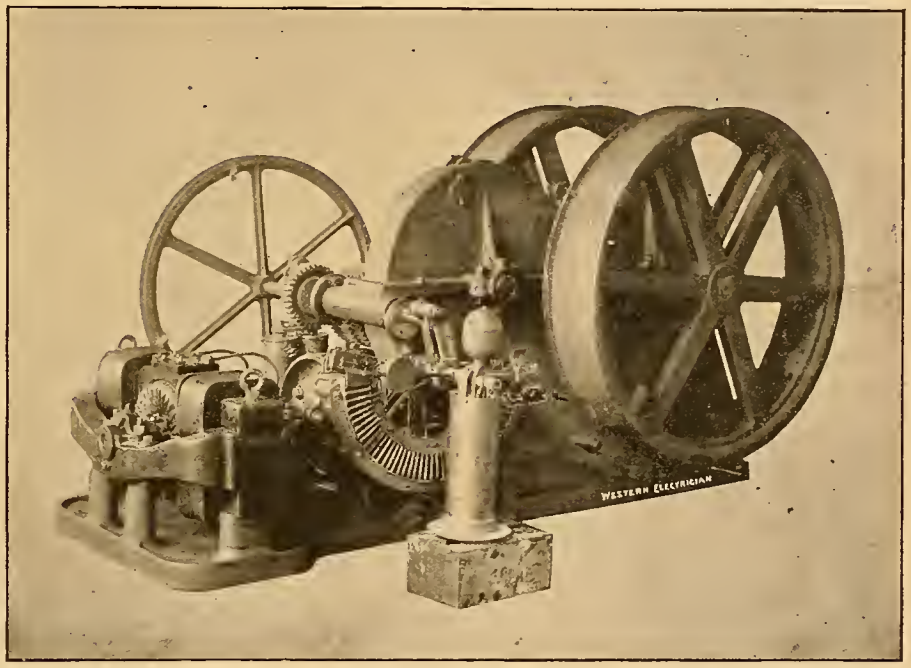
Frequently, therefore, the system selected is by no means the best for the existing conditions; the owners adhere to a single system, where a combination of several systems would often be better; the plant is poorly designed and arranged, and accidents and interruptions are frequent; the character of the attendance is inferior; the parent company appears to take little interest in it; and no expert supervision whatever is being exercised.

It is evident that this unfortunate state of affairs can only be remedied by a more careful, thorough and unbiased consideration of each special case. Where the conditions are clearly unfavorable it is better for every one in the end to discourage the enterprise. If the outlook is not reasonably promising, do not put in the plant at all. Much of the trouble in the past has been due to the misdirected energy of the salesmen in working up and selling plants in locations where they could not thrive by any possible means.

If the preliminary expert study of the situation is favorable, then let careful plans and specifications be prepared by a disinterested specialist, covering the general system or combination of systems best fitting the conditions. Give the contract to a company of standing and experience, under the supervision of its own expert—or better still, of the local company's expert or consulting electrical engineer. Give special attention to the training of the man or men who are to operate the plant; and let there be regular and continued expert inspection and supervision after starting.

For already existing stations the remedy is not so clear. A preliminary study of the local situation in all its bearings is necessary to any improvement. Sometimes the case is desperate, but not infrequently it is possible to remodel the plant, locate and remedy troubles, revise the rates, re-arrange the general plan of operating, so as to materially improve the plant's prospects—all without excessive cost.

Altogether, the subject is well worthy of more study than has thus far been given it.



NEW ELECTRIC ELEVATOR PLANT.

New Electric Elevator Plant.

There are in Chicago perhaps a half dozen direct connected electric elevator plants, all working successfully; and there is no doubt that in this department the application of electric power is destined to have a rapid and substantial development. This result will be greatly aided by the World's Fair, in which several buildings will be supplied with electrically operated elevators.

One of the latest forms of electric elevators is that represented in the illustration. The mechanism is that of the elevator now in daily use at the restaurant of Lansing & McGarigle, on Clark street, but the photograph was made before the equipment was removed from the factory of the Crane Elevator company, by which it was manufactured. In the picture, however, the mechanism is represented exactly as installed, with the exception of the necessary connections with the cage of the elevator.

The motor used is of the Thomson-Houston type and is rated at 18 horse power. It is operated by a 110 volt current from the Adams street station of the Chicago Edison company. The mechanism of the elevator differs from any of the kind now in use. By the employment of a double drum, with a double worm and gear, much fric-

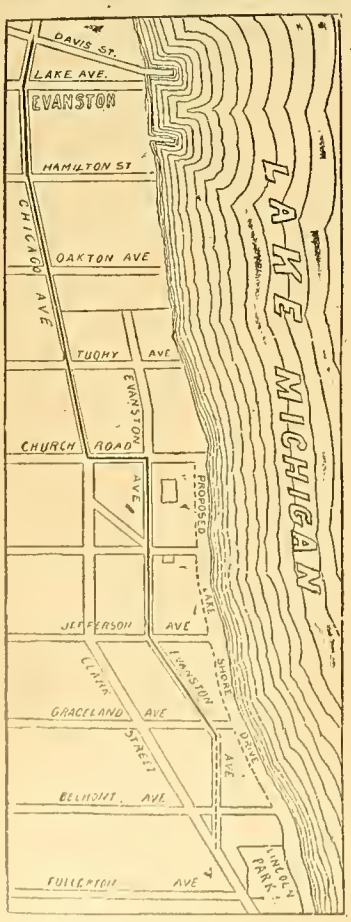
tion is overcome, and at the same time the efficiency of the machine is materially increased. The brake is electrical, being controlled by electro-magnets, and is instantaneous in its operation. The current for starting is controlled by a large rheostat, and the speed with which the resistance is cut out is regulated by a dash-pot, shown in the illustration. This is an important feature, as it prevents the operator cutting out the resistance too quickly. On the downward trip the motor acts as a dynamo, thus

A PECULIARLY MARKED INCANDECSENT LAMP.

effecting a considerable saving in current. The machine is durably constructed to withstand rough usage. The elevator at Lansing & McGarigle's has been in constant operation for four weeks, eighteen hours a day, and has thus far responded to every demand made upon it, working smoothly and well. Both that firm and the elevator company are well satisfied with its operation.

Chicago and North Shore Railway.

The Chicago and North Shore Street Railway company has secured the right of way for an electric railway



CHICAGO NORTH SHORE RAILWAY.

to extend from the northern terminus of the North Side cable line, Chicago, to the town of Evanston. The promoters of the enterprise are Chicago capitalists. The proposed route is shown in the accompanying cut. It was found by the new company that the cable company held the right of way for several streets and it was the negotiations on this account that delayed action to this late day.

At a meeting of the Chicago city council last week the amendatory ordinance was called up permitting the use of Evanston avenue from Graceland avenue to Dewey street, where the Yerkes company now has its horse car tracks. The ordinance gives the electric road the right to run on Evanston avenue from Graceland avenue to the intersection of Clark street and Evanston avenue and thence on Clark street to Dewey court. It provides that the Yerkes line shall run one trailer on each train and passengers in that trailer as far north as Graceland avenue shall pay only one fare. This is all in ratification of an agreement between the cable and electric companies.

A Peculiarly Marked Incandescent Lamp.

The lamp illustrated in the cut presented herewith was forwarded to the office of the WESTERN ELECTRICIAN by Force Bain, Chicago.

"This lamp," writes Mr. Bain, "was taken from a series of five on a railway circuit. It was in the office of the electrician of the Minneapolis street railway, with the four other lamps, which were suspended from the ceiling at different points of the room. At the time this lamp burned out there appeared on the inside of the globe the five irregular loops, which are not unlike a reflection of a zigzag filament. The lamp illustrated was the only one in the series that burned out, and it was also the only one marked in this peculiar manner. The loops, it will be seen, are evenly arranged around the inside of the globe. There was no noticeable vibration of the building, and there did not appear to be any extraneous cause for this strange phenomenon. I send the lamp to the WESTERN ELECTRICIAN, hoping that some one may be led to explain the strange marking."

The Delta Electric company of Cairo, Ill., has given notice that on August 2d it will apply to the city council for permission to change its motive power from mules to electricity.

New Paris Telephone Fire Alarm Service.

After two years of investigation the committee on the improvement of the fire department has decided to adopt the Digeon fire alarm system for use in the city of Paris. The apparatus which has been heretofore in use was found to be faulty for these reasons: First the location of the fire was indicated only approximately; second, the person who sent in the alarm was unable to communicate any information concerning the nature of the fire, so that it was necessary to send the ladder and cumbrous fire-fighting apparatus to the scene of every small blaze; third, the receiving apparatus only gave a momentary signal, and the operator at the central office might, if grossly incompetent, forget the number of the box from which the alarm was sent in; fourth, if several alarms were turned in for a single conflagration the firemen were obliged to visit each one of the calling boxes to make sure that their services were not needed at more than one point.

In the Digeon system, which is described in *Le Genie Civil*, all these faults are eliminated. In the first place the receiving apparatus at the central office is a Morse recorder, which prints on the tape three times the number of

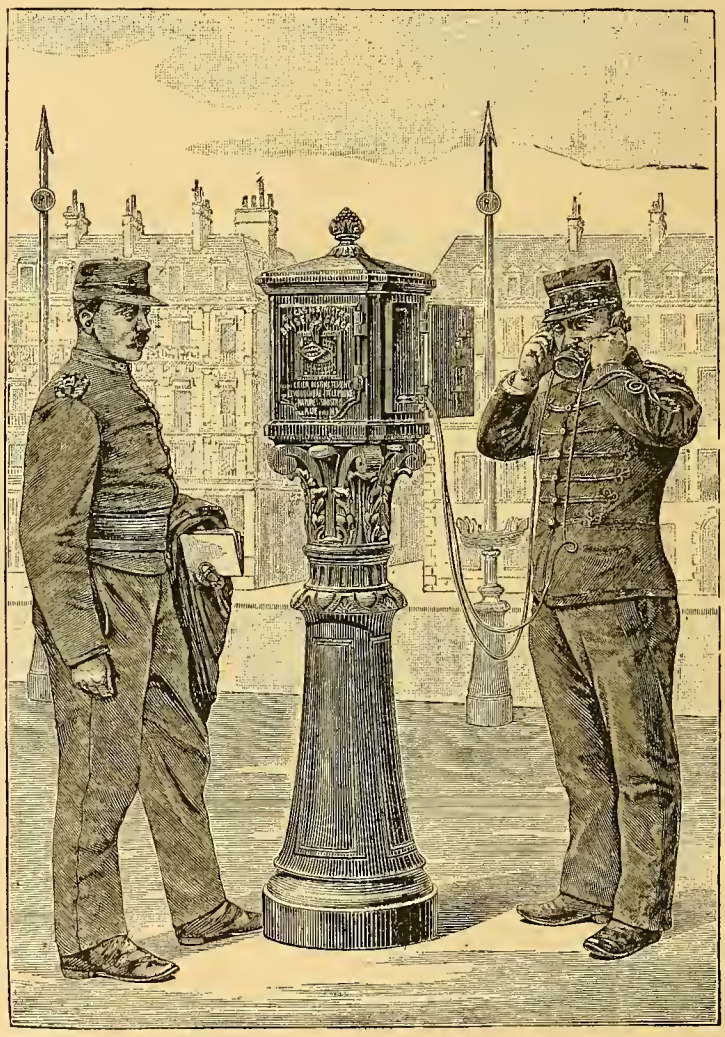
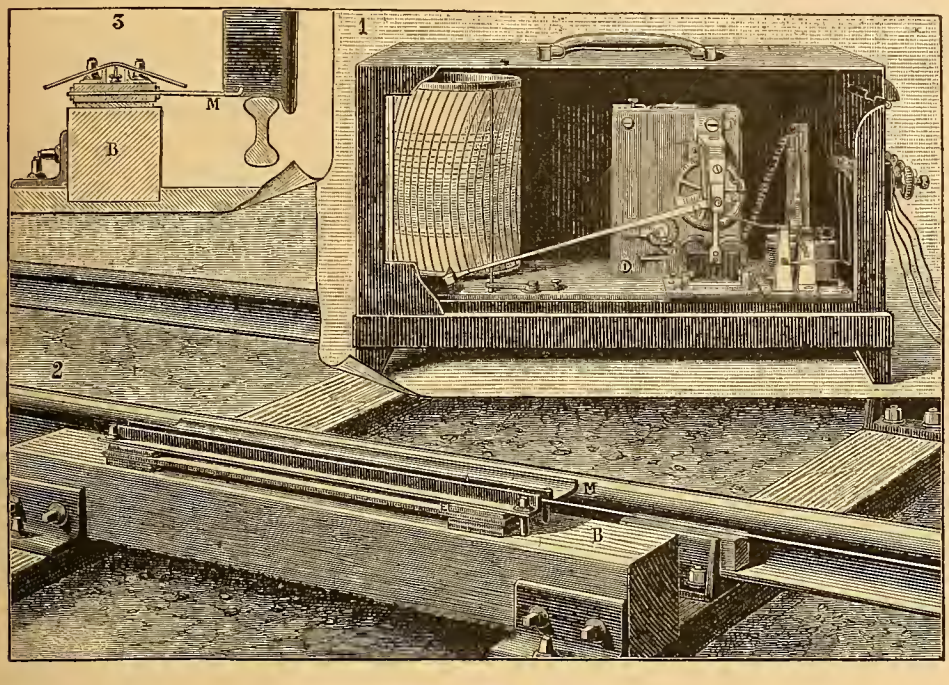


FIG. 3. NEW PARIS TELEPHONE FIRE ALARM SERVICE.

the station from which the alarm is sent in. Several alarms can be signalled simultaneously or in quick succession without affecting in any way the operation of the system. If several alarms are sent in for the same fire no confusion is created and its exact location can be readily ascertained. Communication by telephone can be carried on between one or several of the stations and the central office. The circuit can be used for telephonic communication between two central offices without affecting the integrity of the service. Digeon has not been able to prevent the possibility of false alarms, but he has made such provision that the number of calls of this kind will be small in any event.

The illustrations give a general idea of the apparatus which is used. It should be stated that Digeon has as far as possible made use of the Petil apparatus formerly employed in the fire alarm service. Fig 1 represents one of the telephone fire alarm boxes with the door open. The exterior of the door is shown below at the right; in its center is a glass cover. If this is shattered by a quick

blow the door automatically opens disclosing the telephone tranmitter. Upon this a gong sounds for ten or fifteen seconds sufficiently loudly to attract the attention of passers-by—a provision which is relied upon to prevent malicious persons from sending in false alarms. When the door opens a clock movement is set in operation which causes an alarm to be sent in electrically; it is registered on the Morse recorder three times as already stated. The ringing of the gong serves a double purpose; beside attracting the attention of those in the vicinity, the noise naturally prevents the person sending in the alarm from using the telephone at once. Several seconds elapse and by this time the operator at the central office has the receiver at his ear. Instructions for the guidance of the novice are printed on the box, as Fig. 1 indicates. He is informed that as soon as the gong stops ringing he is to talk into the telephone distinctly stating the nature of the trouble. Fig. 2 shows the arrangement at the central office.



ASCERTAINING THE SPEED OF TRAINS.

Ascertaining the Speed of Trains.

Ascertaining the speed of trains is a matter of no small interest to railway companies, says *La Nature*. It is important to determine whether at certain points—as switches, crossings, grades, for example—the engineer slackens speed in accordance with the regulations. Special devices have been designed to register automatically the speed at these points, and the first indicator of the kind was located on the locomotive, but a device which, while located at some distance from the train, can make the proper registered record is found to be far more satisfactory.

The apparatus illustrated in the engraving was constructed for this purpose by Pickard Freres of Paris, in accordance with the plans of the Compagnie d'Orleans. It is provided with registering apparatus so sensitive and accurate that the engineers of the company have been able to ascertain from the record a number of interesting facts.

The principle of the speed register is simple. Two contacts are arranged on the rail at a certain distance apart; in practice this distance is 100 millimeters. The contacts are connected electrically with the registering apparatus shown at 1 in the illustration. This device is located at a convenient point at some little distance from the track.

The general operation of the device is as follows: When the first wheel of the locomotive strikes the first contact the circuit is closed, and the stylus is lifted and begins to trace a line on the paper on the cylinder. The upward motion of the pen stops when the first wheel reaches the second contact, as the circuit is broken. The length of the traced line is then inversely proportional to the speed of the train at this point, and it furnishes the measure of it. The cylinder, it should be stated, is connected with a clock movement which causes it to revolve once in twenty-four hours; the register, therefore, may be left twenty-four hours at a time to record speed, and the lines traced on the paper will not interfere with each other. Trains can easily be identified on the record by referring to the time at which they passed the contacts The paper on which the record is traced is ruled into squares, as shown in the cut, the vertical lines representing the hours, and the horizontal lines indicating the heights corresponding to given speeds.

The toothed wheel seen at the right is connected with the clockwork, and is in continual motion, making a complete revolution in 2½ minutes. When a contact is made and the electromagnet becomes operative it attracts its armature. This movement causes the toothed wheel to clutch a cross piece on the end of the needle. The stylus on the other end of the latter is raised, and the tracing continues till the current is broken.

No one has yet discovered a good contact which will take a given position on the passage of the first wheel and while being unaffected by the following wheels will still resume its original position after the passage of the train.

The two electro-magnets at the right are designed to facilitate the operation of the device with any kind of a contact. One of them is connected with the contact against which the wheel is supposed first to strike. As soon as the contact is made the electro-magnet attracts its armature and the latter moves a switch which opens a circuit connected with another electro-magnet controlling the needle. When the second contact is reached the first circuit is broken, and the needle is stopped, and falls back to its normal position.

In case the stylus reaches the top of the cylinder, which might happen if the train moved very slowly or if the second contact failed to work, a stop is provided which causes a break in the circuit, and the stylus falls.

The registering device is mounted in a metal case and weighs a little less than 19 pounds. Two portable contacts complete the outfit. The Orleans company, however, prefers a fixed contact, and as the one which it has used has given satisfactory results, a view of it is given in the illustration at 2 and 3. This contact consists of an insulated steel plate *M* fastened on a a wooden stringer *B* which is placed on the ties parallel to and outside of the track.

The edge of the plate is turned up slightly, and is some millimeters from the rail, so that when the wheel rests on it it bends and meets the rail. It is thoroughly insulated and is made sufficiently elastic by two sheets of rubber placed above and below it. A galvanized iron cover protects it from the rain and the sun.

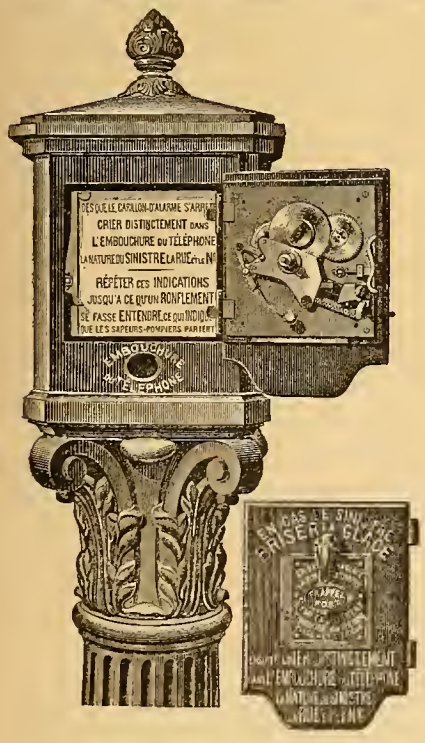


FIG. 1 NEW PARIS TELEPHONE FIRE ALARM SERVICE.

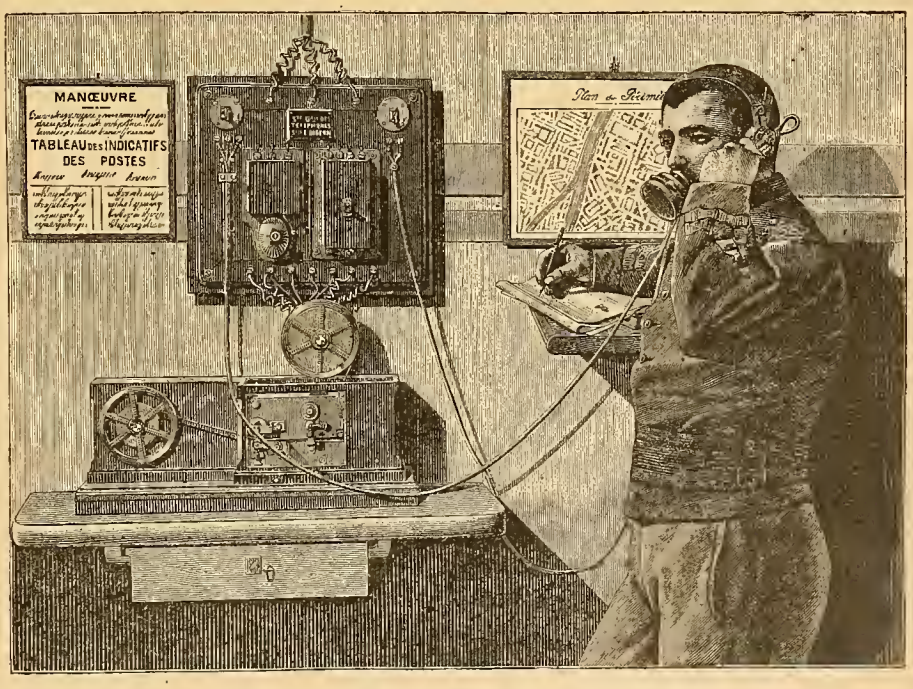


FIG. 2. NEW PARIS TELEPHONE FIRE ALARM SERVICE.

As it is often desirable for the firemen to communicate with the central office, provision is made for this purpose in the fire alarm box, As Fig. 3 shows, a door opens at the side, the key to which is kept by certain officers of the department. When the door is opened the central office may be signalled by a call button, and the officer has merely to attach to the contacts the cords of the portable telephone which he carries with him.

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CORRESPONDENCE relating to electricity, or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

PAGE.

Electricity at the World's Fair. Illustrated.....57, 58
Protecting Dynamos. By Foree Bain. Illustrated..... 58
Central Station Lighting. By William H. Bryan.....58, 59
New Electric Elevator Plant. Illustrated.....59, 60
Chicago & North Shore Railway. Illustrated..... 60
A Peculiarly Marked Incandescent Lamp. Illustrated..... 60
New Paris Telephone Fire Alarm Service. Illustrated.....60, 61
Ascertaining the Speed of Trains. Illustrated..... 61
Editorial..... 62
Death from an Electric Shock. Illustrated..... 63
The Italian Submarine Boat, Audace. Illustrated..... 63
Electric Motors for Bridges..... 63
An English Estimate of Mr. Field.....63, 64
English Electric Mining Machines. Illustrated..... 64
The New Time Ball on the Western Union Building, New York. Illustrated..... 64
Greenville Electric Light Station. Illustrated..... 65
Waddell-Entz Electric Exhauster. Illustrated..... 65
The Hart & Hegeman Switch. Illustrated..... 65
Electrical Decorations at Denver.....65, 66
Kolon Primary Battery. Illustrated..... 66
New Roberts Insulating Joints. Illustrated..... 66
Base Ball by Electric Light..... 66
Aphorisms for Central Station Managers..... 66
A Long Electric Light Report Causes Trouble..... 66
Electricity in Railroading..... 66
Electrical Entertainment in Michigan..... 66
Electrical Development in St. Louis..... 66
Recent Telegraphers' Strike in Spain.....60, 67

DEPARTMENTS.

Correspondence.....67, 68
New Incorporations..... 69
Electric Lighting..... 69
Electric Railways..... 69
Trade News.....69, 70
Business..... 70
Electrical Patents..... 70

OUR eastern contemporaries last week announced the death of Cyrus W. Field, and presented biographical sketches and portraits of the dead philanthropist. The WESTERN ELECTRICIAN published in its issue of July 16th, one week in advance of the New York electrical papers, not only the announcement of the death of Mr. Field, but also an excellent portrait and a complete biographical sketch. The eastern journals of that date, published on the ground, failed to cover this most important matter. This is merely one more instance going to show the superority of the WESTERN ELECTRICIAN over its contemporaries.

THERE is a possibility that Chicago may be connected with its beautiful northern suburb, Evanston, by an electric railroad. The city council has passed the ordinance granting the franchise, and it is not unlikely that before long trolley cars will run from the northern terminus of the North Side cable line to the lakeside college town. There are several obstacles in the way of the realization of this desirable project, however. One is the condition tacked on the franchise by the aldermen to the effect that if any practicable underground conduit electrical system is invented the company must adopt it within a year from the date of its promulgation, at the discretion of the mayor and council of Chicago. This provision is distasteful to the company, and may prevent the acceptance of the franchise. It is also understood that there are difficulties regarding the right of way. It is to be hoped that means may be found to remove these objections. It is said that the newly made city of Evanston, with its 15,000 people, is the largest place in the country without street car facilities. The idea of connecting it with Chicago by a well equipped electric railway is an excellent one, and deserves encouragement.

PREVIOUS experience has taught the electrical people never to count on a World's Fair contract until the necessary signatures have been attached to the documents ratifying the agreement. Nevertheless there is good reason to believe that the authorities of the exposition will take final action confirming the decision of the committee on grounds and buildings in recommending that the contract for supplying the launches to operate on the lagoons at the World's Fair be given to a company using electric boats. That the storage battery launches should be able to meet the crack steamboats sent to compete for the contract, and demonstrate their superiority, on the lines laid down by the officers of the Exposition company, is a fact which will afford no little gratification to the electrical fraternity throughout the country. It will have the effect of calling the attention of the American public to a branch of applied electricity to which too little attention has been given in this country, and will doubtless prove of material advantage to manufacturers of secondary batteries and motors. It is not likely that, for many years at least, boats propelled by electricity will prove serious rivals of steam craft in a strictly commercial sense. But for pleasure riding on inland waters, and in special cases like that of the World's Fair, where speed and great carrying capacity are less desired than the pleasure and comfort of visitors, electric boats will find a highly appreciated place. The directors of the World's Columbian Exposition who are members of the committee on grounds and buildings have made no mistake in recommending electrically propelled launches. Should the ways and means committee concur with them at the joint meeting that is announced, the exposition will have secured a feature that will combine the attraction of novelty with a practical utility that has received complete demonstrations.

AN interesting case, in which a live telephone wire played an important part, was recently decided by the Supreme Court of Massachusetts. Action had been instituted by a resident against the city of Cambridge, Mass., to recover damages for injuries which he had suffered by reason of an alleged defect in the highway, occasioned by the presence in the street of a live telephone wire which he came into contact with as he was passing along the sidewalk. Upon the trial the evidence showed that the plaintiff, seeing the wire hanging loose in such a manner as apparently to endanger travellers, or, at all events, to obstruct free passage along the highway, removed it, and in doing so was injured. The trial judge directed a verdict for the city, on the ground that, although the presence of such a loose live telephone wire might properly be regarded as a defect in the highway, for the existence of which the city authorities were liable, yet the plaintiff was negligent himself in touching it. The plaintiff appealed from the decision of the lower court, taking exception to the point made by the trial judge that the plaintiff's action constituted contributory negligence. The Supreme court reversed the decision of the lower court, holding that the action of the plaintiff could not be construed within the meaning of the law as constituting contributary negligence. In his opinion Judge Holmes says: "It seems to us that to throw on one side, out of the way of travel, either with one's stick or one's hands, a light movable object, which is an annoyance or a nuisance where it is, is one of those every-day acts of kindly feeling which fairly may be said to be an incident of travel, as it commonly goes on, and to be within the protection of the law."

LAST week a man was killed by the electric current at Rochester, N. Y., and the coroner's jury returned a verdict to the effect that the victim came to his death by coming in contact with a wire of the police patrol system, which had fallen across the trolley wires of the street railway company, and thus conveyed the current that caused the death.

With a view of obtaining a knowledge of the facts of the case from those in a position to speak intelligently of the accident, the WESTERN ELECTRICIAN communicated with the president of the railway company, and also with the company's electrician. From the statements of these two gentlemen, presented in another column, it would seem as though the coroner's jury had jumped at its damaging conclusion and laid the blame on the electric railway wire when it should have been placed on an electric light wire. Both president and electrician tell a most reasonable story, clearly explaining how the fire alarm wire took its death dealing current from the electric light wire which was suspended above the trolley wires. The broken wire, which sagged and made contact with the victim, was in contact with both the electric light wire and the railway wire, but, according to the electrician's report, the arc light wire was in places bare of insulation.

While it is not our province to take to task coroner's juries performing their duty to the best of their ability, we cannot forbear to point out, that, owing to the necessarily limited technical knowledge of the men who, as a rule, constitute such juries, blame is very apt to be laid at the wrong door. The gentlemen who in the present instance made up the Rochester jury were doubtless intelligent men, but it is fair to presume that not one of the jurymen who agreed to the verdict against the railway wire had more than the vaguest conception of whence came the current which, through the hanging fire alarm wire, did the damage. It is needless to point out that to pass intelligently upon such an accident, one must of necessity possess an intimate knowledge of the two systems of electrical distribution. It would be most unreasonable to suppose that such an understanding was possessed by the Rochester jury. On this account it would appear but fair that popular judgment should not be based upon the surprising verdict of this coroner's jury. There is the more cause for hesitancy in accepting the verdict in the present case in that the electrician of the railway company goes on record in a statement to the effect that both he and several of his men have a number of times received current at the usual railway pressure of 500 volts.

IT is most amusing to notice the way in which some of the daily papers, usually those of the rural districts, grow enthusiastic when they undertake to enlarge upon the future of the electric railway. The verdant editors seem totally oblivious to the fact that an electric road operated from a central station is in reality nothing more or less than a steam driven system. They seem to forget that electricity is merely an extremely flexible agent through which the power of a steam engine or a water fall may be transmitted and applied to the propulsion of cars. It is this lack of knowledge of the true nature of this particular application of the current that maintains the ravenous appetite for extravagent electric trunk line stories. These fairy tales, telling in glowing terms of the doom of the steam locomotive, may be very interesting but they do an immense amount of harm in that the public through their influence is educated to expect too much. That the electric system is destined to usurp steam in certain fields there is now no doubt; but the romancers are a little premature when they jump at the conclusion that there is going to be anything in the way of a swift and radical revolution. The electric motor is obtaining its foothold in the domain of the steam locomotive in a gradual and perfectly natural manner. For instance, reports from New York now lead us to believe that the Pennsylvania rail road will utilize the electric system extensively in the neighborhood of the metropolis; but the application, if made, will be to feeder lines and not to trunk lines. It is in this way that electricity will work to the front, more as a friend, perhaps, than an enemy of steam.

In this connection, therefore, the recent denial of Vice-President Tuttle of the New York, New Haven & Hartford railroad, when asked about the introduction of electricity as a motive power on his lines between New York and New Haven is most amusing and, what is more, is a well merited rebuke for the man who started a false story. Referring to an article in the *Worcester Gazette*, Vice-President Tuttle said:

Bosh, it's nothing but romance, pure and simple romance, without the slightest grounds for truth. We are building four tracks, it is true, and have been at work on them for several years as is well known, but instead of equipping the middle tracks with electric power we are considering the feasibility of utilizing flying machines to supplant steam. This is an age of progress and the flying machine has been so perfected of late that we have every reason to believe they could be operated safely between here and New York at even a more rapid speed than the thirty-minute time accredited the electric cars. Of course, we haven't decided yet just what system we shall use, but when the road is fully equipped with the latest aerial cars we contemplate extending our air line to Liverpool and possibly from there to Singapore, China, but, of course, this is at present a matter of speculation and can only be decided upon as our plans further mature.

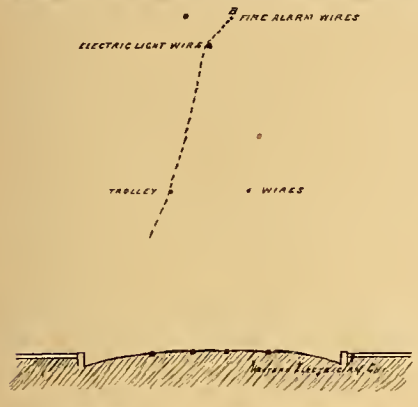
Death from an Electric Shock.

A coroner's jury at Rochester, N. Y., last week investigated the cause of death of Edward A. Twist in that city. It appears that Mr. Twist was struck by a swinging wire of the police patrol or fire alarm system, which had been broken in a storm and which came in contact with other wires underneath. The jury returned the following verdict:

We find that Edward A. Twist came to his death by coming in contact with a wire of the police patrol system, the said wire having fallen across the trolley wires of the Rochester Railway company on Mt. Hope avenue, on the evening of July 15, 1892, thus conveying the electric current which caused his death.

The verdict of the coroner's jury was a complete surprise. It was the first time on record that an electric railway was charged with the death of any person by reason of contact with the trolley wire. Moreover, the evidence reported before the coroner's jury did not seem to warrant such a broad condemnation. Following is a statement of the facts in the case as stated by John N. Beckley, president of the Rochester Railway company, in response to an inquiry from the WESTERN ELECTRICIAN:

On Mount Hope avenue in this city two fire alarm wires were strung about forty feet from the street and directly over the insulated wire of the Rochester Electric Light company. This insulated wire supplied the arc lights in the vicinity with current. Below the electric light wire and fire alarm wires and about eighteen feet from the street were suspended the two trolley wires of the Rochester Railway company. One of the fire alarm wires



DEATH FROM AN ELECTRIC SHOCK.

broke at some distance north of the place where the accident occurred and sagged down in the form of a loop to the ground. The position of the electric light wire was such that the broken fire alarm wire must have rested on the electric light wire. It also hung across one of the trolley wires.

A heavy rain had just ceased falling. The repair wagon of the Rochester Railway company had just reached the location, when Mr. Twist in crossing the street was struck by the fire alarm wire which was swaying in the wind, and was instantly killed.

An investigation made by Mr. Green, the electrician of Rochester Railway company, and by other gentlemen the next morning, disclosed that the insulation on the electric light wire was burned off for a space of about one-half inch in one place where the fire alarm wire must have rested across it. In view of the fact that the employes of the company in the electrical department have repeatedly while at work taken the entire current used in the operation of this road without injury; and in view further of the fact that hundreds, perhaps thousands, of men have taken the entire current used in the operation of an electric railroad in other places without injury, it would seem, independent of the facts which I have set forth, that a 500 volt current should not be regarded as the cause of the death of Mr. Twist. It is, of course, well known that the current used in arc lighting has a pressure of more than 2,000 volts. A current of this pressure, experience has shown, is deadly.

In case any action is brought against the Rochester Railway company to recover damage by personal representative of the dead man, we shall have an opportunity to present the evidence which will show that the cause of death in this case was an electric light current of 2 000 or more volts, and not the current used in the operation of an electric railroad. It goes without saying that an investigation by a coroner's jury is one in which no opportunity is afforded for the cross-examination of witnesses by the party who may be charged with causing the accident which is under investigation.

Accompanying this statement is the following from Alfred Green, chief electrician of the Rochester Railway company:

I was not present at the scene of the accident on the night when it occurred. I did visit the place, however, the next morning and carefully examined the situation and condition of things as they then existed. I found that two No. 12 fire alarm wires on the night of the accident were suspended about forty feet from the street and over the arc light insulated wire of the Rochester Electric Light company, and also over the trolley wires of the Rochester Railway company substantially as shown in the cross section given in the cut.

I conversed with many people who were present at the time of the accident, and the universal testimony of such people was, that the fire alarm wire, shown at *B* in the sketch, was the one which broke and sagged down so as to lay across the electric light wire and the trolley wire in the direction as shown by the dotted line in the sketch. The wire had broken some distance away from the scene of the accident and then sagged down in the form of a loop, or horse shoe, and the angle of the loop was the portion of the wire which came in contact with the man who was killed. I went up on ladders and on the poles

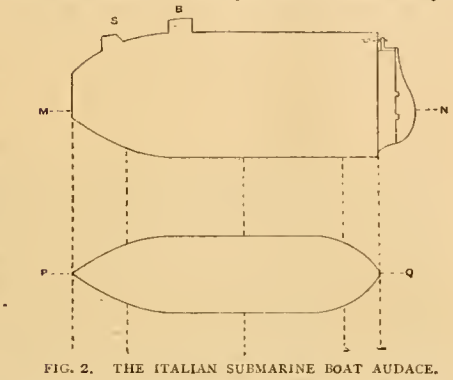


FIG. 2. THE ITALIAN SUBMARINE BOAT AUDACE.

in the vicinity and examined the insulated arc light wire mentioned. I found a portion of the insulation burnt for about fourteen inches from the pole holding the arc wires. This pole was about fifty feet from the scene of the accident. The arc light wire was bare at the place indicated for a distance of about half an inch and had the appearance of having been burnt recently. On the north side of the pole, being the side farthest removed from the accident, I found a bad joint in the insulation of the arc light wire and the wire was bare for a space of about two and one half inches.

I have been engaged in electric railroad and lighting business for upwards of ten years, and have been since the first of February last the chief electrician of the Rochester Railway company. As such I have charge of the wire system, motors and electrical equipment of the company. In working about the motors and on the line I have on several occasions taken the full force of current used in the operation of the cars of that company without injury. I have on many occasions seen workman who were employed under me take the full force of the current without injury. In my opinion it is not possible for an electric current having a pressure of five hundred volts or less to cause the death of a human being, or his serious injury. The current used in the operation of cars of the Rochester Railway company is what is known as a 500 volt current, although it is seldom that the current on the line has a pressure of as much as 500 volts.

The Italian Submarine Boat Audace.

The accompanying cut, Fig. 1, is a general view of a novel form of submarine vessel recently launched in Italy. This boat was designed by Pietro delgli Abbati & Sons and was built in the yard of Migliardi & Vene of Savona, Italy. It is being exploited by a company entitled the Societá Romana per la Pesca e Ricupero dei Valori Subacquei.

London *Industries*, from which the cuts were taken, unfortunately presents but little information as to the details of the boat's construction. All that can be learned is that the vessel, which is of steel, is 28 feet long, 6 1-2 feet feet broad, and 9 3-4 feet deep, and is provided with a screw propeller actuated by an electric motor. Referring to the diagrams, Fig. 2, *B* is the manhole through which the crew, consisting of five men, enter the vessel, and *S* are the portholes fitted with strong glasses. On the left-hand side of the hull, near the stern, a door is provided, Fig. 1, which may be opened from the inside when the vessel is under water for allowing exit to divers, without admitting water into the vessel. The hull is provided with three water-tight compartments, and it is estimated that the crew will be able to remain under water for a period of forty-eight hours.

Fig. 3 shows the outlines of transverse sections of the Audace's hull.

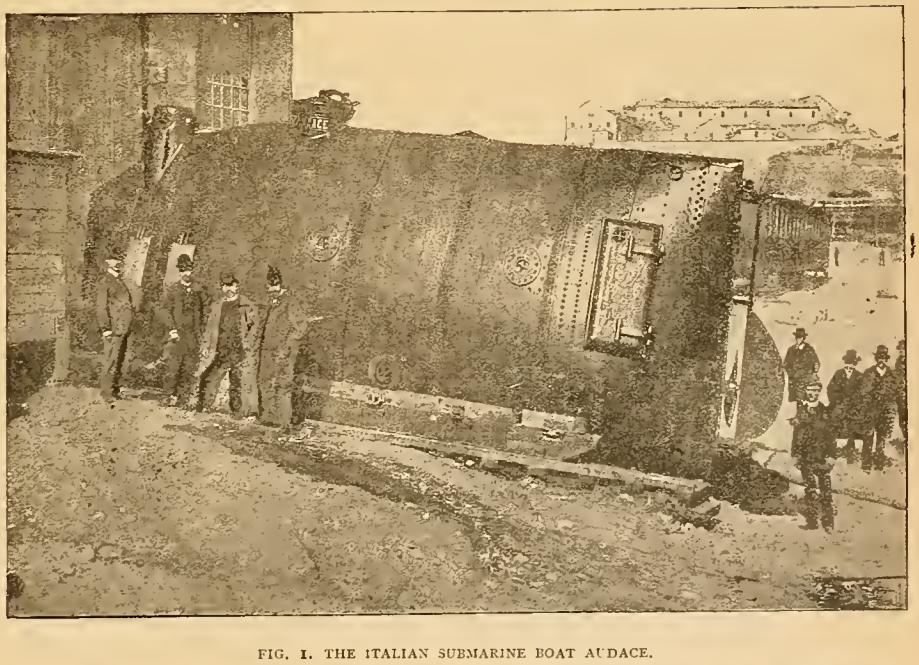


FIG. 1. THE ITALIAN SUBMARINE BOAT AUDACE.

Electric Motors on Bridges.

The application of electricity to drawbridges in Chicago and Milwaukee has been described at length in this paper heretofore. Recently City Engineer Clarke of Chicago had this to say of the installation at the Rush street bridge in this city. "I consider it much superior to steam power for the turning of bridges, being much cleaner, doing away with ashes and the handling of coal. It is equally reliable and cheaper. I shall unqualifiedly recommend the electric motor." Milwaukee has ordered electric motors for five bridges, and it is said to be the purpose of the authorities of the Cream City to put motors on all its swing bridges. The city engineer of Milwaukee recommends it because it puts less dead weight on the bridge than any other motor.

An English Estimate of Mr. Field.

Since the death of Cyrus W. Field the newspapers of the world have published eulogistic obituaries. Here is

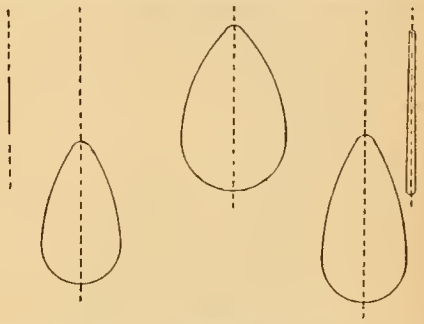


FIG. 3. THE ITALIAN SUBMARINE BOAT AUDACE.

an extract from a discriminating editorial in the *Electrical Engineer* of London:

To Cyrus Field, more than to any man living or dead, Atlantic telegraphy owes its success. He preached submarine telegraphy much as Booth preaches the welfare of the residuum. He convinced friends and enimies as to the possibilities of the venture, and he obtained support where others said "impossible."

A more consummate master in the art of plodding onward through evil and through good report cannot be named. He had his reward in the success of Atlantic telegraphy, in the possession of a large fortune, in the honor and respect of those from whom honor is valued. That his fortune is gone is due to no fault of his—in fact it adds to the appreciation of the man—for the loss is due to his love for, and his trust in, his son. In these days of hurly-burly strife—for lighting and traction—in

the days of high volts and many amperes—submarine telegraphy as it apeared in the days prior to the Russian war can hardly be understood. With us it is a thing of little account; then it was a plunge into the vast unknown. Cyrus Field was the leader who led into the unkoown, and who, like Columbus, had an overpowering persooality. His followers might fret, might fume, might want to turn back from fright, but the goal was in the unknown, and into the unknown they had to go. Such are the men who make history. They require to be convinced, but once convinced there is no looking backward, but a persistent forging ahead till the enterprise is won.

English Electric Mining Machines.

The cuts presented herewith would seem to indicate that English coocerns do not propose to sit still and

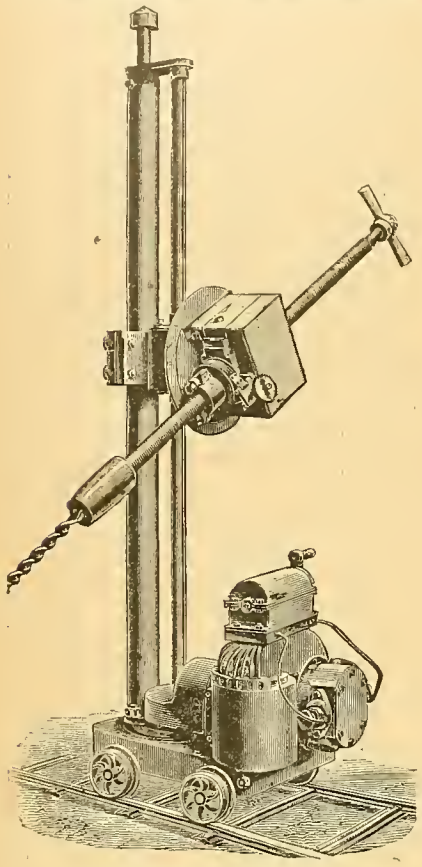


FIG. 2. ENGLISH ELECTRIC MINING MACHINES.

allow Americans to monoplize the entire production of mining machinery. According to London *Industries*, the firm of Goolden & Co., of Harrow Road, London, W., has for the last few years been working in an unobtrusive way an electrical coal and mining plant. The result of this labor has been that almost before electrical firms generally were aware of the fact, these gentlemen had worked out a fairly complete system of mining machinery.

The illustrations show two tools which may be taken as typical of Goolden & Co.'s work. Fig. 1 is a percussion rock drill, for dealing with very hard rock, such as granite or quartz, and Fig. 2 is a small rotary drill. The motor is closely boxed in when exposure would increase the fire risk. The field magnets are cased in sheet metal to withstand rough usage, and the armature, commutator and brushes are enclosed to prevent injury, and to obviate any chance of firing explosive gases. It has been proposed to run a small but continuous stream of carbonic acid gas through the commutator chamber, so that even the most nervous engineer would feel that "firing" is impossible. Carbonic acid can, of course, be obtained very easily in steel containers. Fig. 2 shows the simple form of rock or coal drill which will bore holes from ½ inch to 1¾ inches diameter in coal, shale, or similar material, at from 6

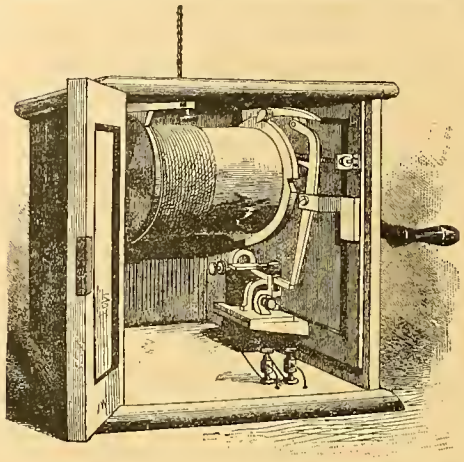


FIG. 2. THE NEW TIME BALL ON THE WESTERN UNION BUILDING, NEW YORK.

inches to 15 inches per minute, and will drill to any depth up to 3 feet, 7 inches. The pillar is arranged so that the drill can be set at any height, and at any angle, without moving the car.

The New Time Ball on the Western Union Building, New York.

Since the fire which destroyed the upper stories of the Western Union Telegraph building in New York, the time ball service has been suspended. The old staff and ball were mounted on the tower in the front of the building. As the new building has been completed another tower has been built for special service of the time ball system.

This tower Fig. 1, according to the *Scientific American*, is built of open iron work, and through its center a ladder runs up to the top. From the top a staff of hollow iron piping, with two feathers running down opposite sides of it, rises and is surmounted by a cap. The tower rests on the roof of the main building, 163 feet above the surface of the street. The base of the tower is 24 feet, 6⅜ inches by 25 feet, 4 inches; the top of the tower is 4 feet, 3 inches by 5 feet, 5⅛ inches; and the height of the tower is 81 feet. A platform 7 feet, 5 inches square surmounts it, and from the center of this the flagstaff rises 20 feet and 6 inches, giving as the total height from the street 264 feet, 6 inches.

The time ball is of very light construction; notched rings

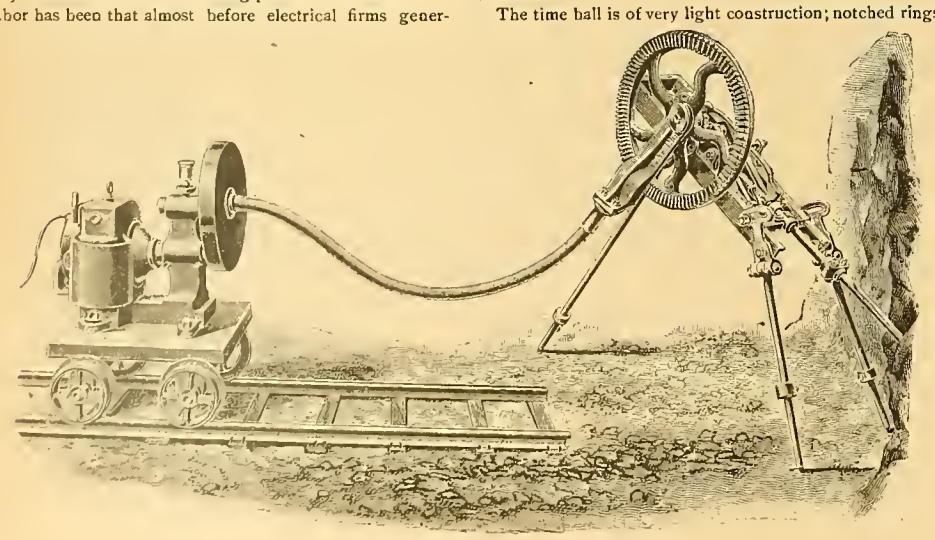


FIG. 1. ENGLISH ELECTRIC MINING MACHINES.

that fit the staff loosely from the top and bottom elements and are connected by four ½ inch iron rods. The contour is secured by hoop iron running in directions corresponding to the latitude and longitude of a globe, and over the whole canvas is fastened. The ball is 3 feet, 6 inches in diameter, and weighs only 35 pounds. The staff passes through its center. To raise it a double lead of rope runs up through the center of the staff; the two ends of the rope pass over two pulleys on opposite sides of the staff near the top and, descending thence, are attached to the ball at the top. The two leads join each other a little distance down, and a single rope runs thence to a windlass, which is contained in a box at the base of the tower.

By tripping mechanism the ball is released at noontime and falls down the staff. To receive it an air box is provided at the bottom which cushions its fall. This is a circular box 4 feet high and 3 feet 6 inches in diameter, and is therefore of just the proper size to receive the ball. A sort of flange or washer of felt is carried around the mouth of the box, so that the ball cannot by any possibility strike any hard material in its descent. As it falls, the air in the box can only escape slowly, so that it forms a true cushioning device.

The tripping mechanism Fig. 2, is contained in the box with the windlass. On a flange projecting from one end of the windlass four notches are cut with which a pawl engages as the windlass is wound up, preventing it from unwinding or turning the wrong way. The pawl is carried by an arm pivoted at one end. If the arm were raised, it is evident that the pawl would be withdrawn from the notch and the windlass would be free to unwind. The tripping

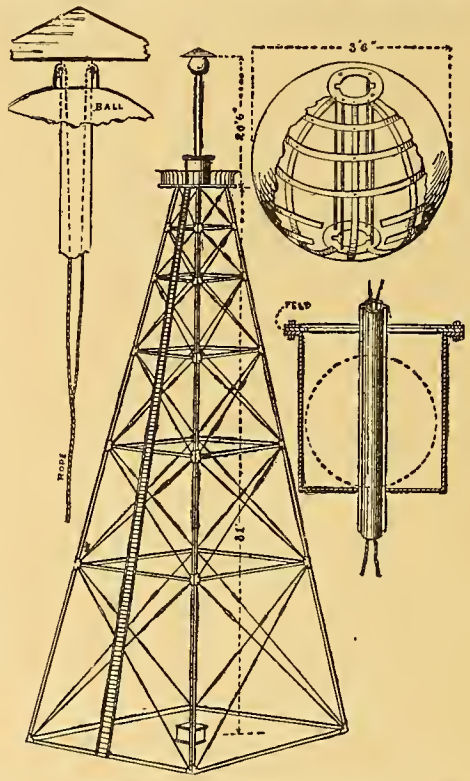


FIG. 1. THE NEW TIME BALL ON THE WESTERN UNION BUILDING, NEW YORK.

mechanism effects the raising of this arm. A lever nearly vertical is pivoted at its center, and a roller at its upper end touches the rear end of the pawl lever, which at this point is bent downward. A spring tends to draw the upper end of this lever backward. If it were so drawn, the end of the latter would be raised and the pawl released, owing to the downwardly curved shape of the pawl lever. To prevent the spring from doing this, the lower end of the lever is caught by a projecting bar attached to the armature of an electro-magnet. The whole is so arranged that by connecting the magnet with an active circuit its armature is attracted, which draws the bar out of engagement with the vertical lever. The spring on the latter draws its upper end back, thereby raising the pawl lever and releasing the pawl. The windlass and tripping devices occupy but little space, the whole being contained in a cubical box only 18 inches each way.

A special clock at Washington is connected to the circuit of the electro-magnet, the whole being on open circuit When the clock in its motion closes the circuit, which it does precisely at noon, the electro-magnet is excited, its armature is attracted, releasing the vertical lever whose upper end is drawn back and trips or releases the drum of the windlass, and the ball at once begins its descent. From the above it will be seen that it is the beginning of the fall of the ball which marks the time of noon. The system formerly in use was different in several respects from the present one. The one illustrated herewith is based largely on the results attained at Washington. The new service has just been inaugurated. The cuts are reproduced from the *Scientific American*.

Greenville Electric Light Station.

At Greenville, Pa., an electric plant has recently been installed for incandescent and arc lighting by the Edison General Electric company, for the Peoples Electric Light company of that town. The steam plant consists of two Buckeye compound non-condensing engines each with a capacity of 75 horse power, steam being supplied from an upright Syracuse boiler of 150 horse power.

The electrical plant shown in Fig. 1 comprises two 45 kilowatts compound wound Edison incandescent bipolar dynamos, and one 40 light Edison arc dynamo. The controlling and measuring instruments are mounted on a skeleton switch-board, Fig. 2, so constructed that it has in it only sufficient wood to support the instruments. The left hand portion is devoted to the appliances for the manipulation of the incandescent system, consisting of regulators, ampere-meters and switches. The lightning arrester used is of the serrated plate pattern. The indicating instruments, such as pressure indicators and volt meters, are mounted on a separate board not shown in the cut. The right hand portion of the board supports the arc light controlling apparatus, an arc light switch-board of white marble, an Edison ampere-meter and two of the recently designed Edison lightning arresters.

The Edison three-wire system is used. The current is distributed from the station through three feeders to the mains in the street, from which the house service wires run. All customers burning more than six lights are supplied with the three-wire service in order to ensure a well balanced system; customers burning less than this number of lights have a two wire service, the lights being carefully arranged against each other. The Edison meter system of measurement has been adopted, the latest type of electrolytic meter being used.

The pole line for the incandescent system is about 2,000 feet in length. Where the incandescent and arc system are common the lines are run on the same poles. In the outlying districts, however, the lighting is done by arc lamps exclusively. The line for the arc system is between four and five miles long.

The dynamos operate so well that they take care of the load with but little adjustment of the field regulators; the load can be thrown from full to no load without the necessity of the attendant moving the resistance in the least.

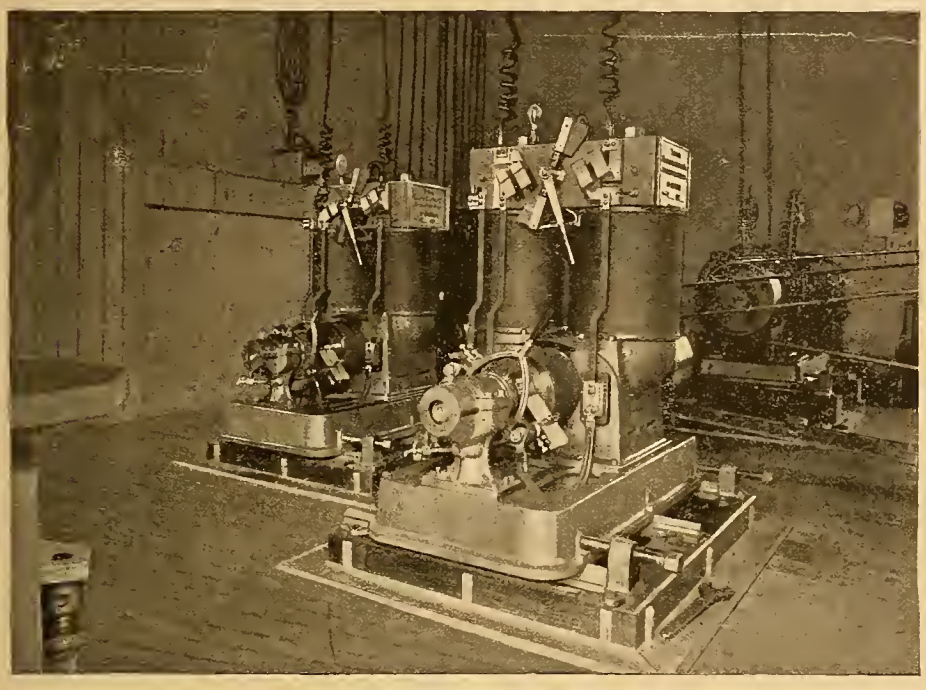
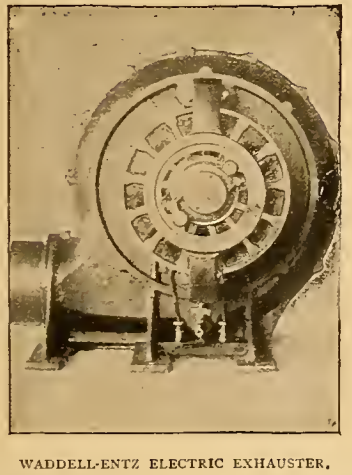


FIG. 1. GREENVILLE ELECTRIC LIGHT STATION.

Waddell-Entz Electric Exhauster.

The accompanying cut illustrates a new portable electric ventilating device recently designed by the Waddell-Entz company, New York, for use on board one of the new United States cruisers.

In this machine the magnets and field coil, which form a compact spool, are mounted directly upon the side of the exhauster shell. The armature encloses the magnet and field coil, and is mounted upon the same shaft that carries the exhauster blades. A single, self-oiling bearing is used. The machine is very compact and carefully designed in all details. The Waddell-Entz company states that the tests of the first of these exhausters have proved so satisfactory that the bureau of equipment has ordered a number of sets for other cruisers. Blowers and exhausters of this type are being built in larger sizes for general use.



WADDELL-ENTZ ELECTRIC EXHAUSTER.

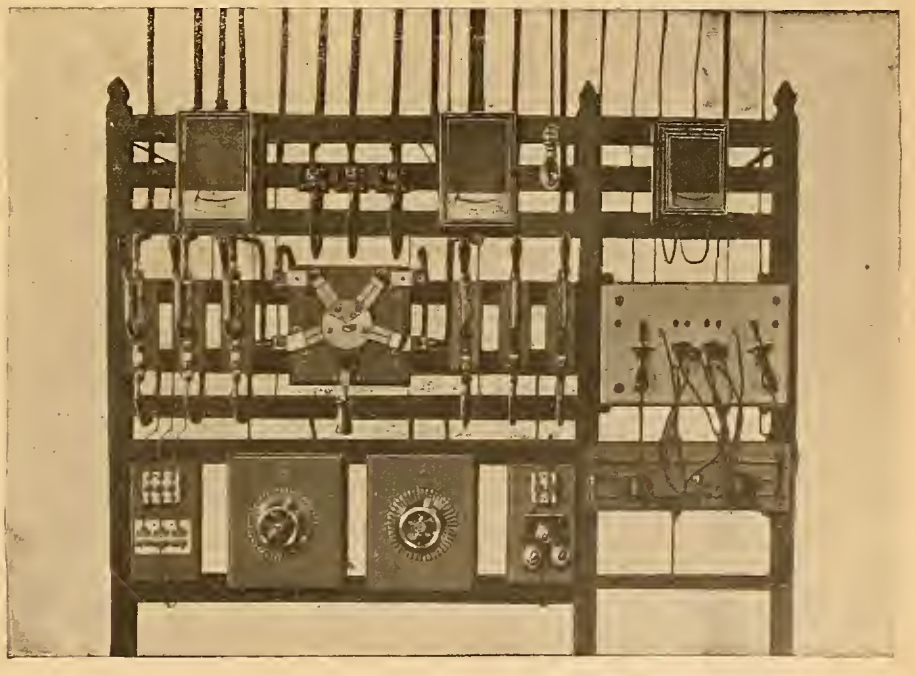
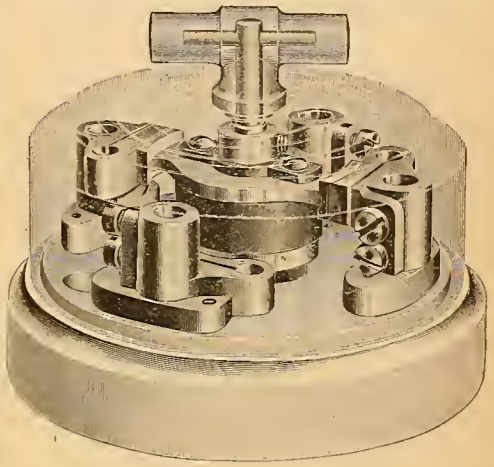


FIG. 2. GREENVILLE ELECTRIC LIGHT STATION.

The Hart & Hegeman Switch.

The Hart & Hegeman Manufacturing company of Hartford, Conn., recently introduced on the market a new switch. The accompanying illustration shows the details of this switch. The device, while large, is very compact, and is mounted only on porcelain or slate. The movement is rotary in one direction by quarter turns, keeping the contacts bright and giving the maximum length of break. The make and break are instantaneous, the switch plate remaining stationary with reference to the contacts until under the control of the spring. The actuating spring is a flat steel three-leaf spring, which is not in circuit, and is therefore guaranteed not to be affected by the current. The current passes from one contact to another through solid metal, and not through pivoted joints. The break is double in all sizes; the circuit is therefore broken at four points by the double-pole switch. The Hart & Hegeman company also manufactures 10 ampere single and double pole switches, and it is now sending to the trade a very neat three-fold circular which gives the dimensions of the various switches made by the company.



HART & HEGEMAN SWITCH.

Electrical Decorations at Denver.

Extensive preparations are making for the electric light display in Denver at the coming conclave of Knights Templar. The Denver *News* is enthusiastic in outlining the brilliancy of the decorations, as will be seen from the following:

No person will be permitted to view this wonderful vision until the hand of the clock points to the hour of eight, Tuesday evening, August 9th. Then, like enchantment, the whole of the business portion of the city will beam with thousands of colored globes and the powerful search lights from four principal points will dispel the darkness from the remotest regions of the city. From myriad lights at street intersections and from immense Templar designs supported on the sides of large buildings the eye will be greeted with

combinations of colors which cannot fail to make an impression never to be forgotten.

It is understood that the Consolidated company will be paid $35,000 for the work, but the officials say that the actual cost of the illuminations will be much greater. Having engaged to carry out the display, the company proposes to do so regardless of expense.

The electricity will be conveyed to the business district by seven distinct circuits, each connected with a powerful generator. Four of these generators have been placed in the power house near the union depot and three are in position at the West Denver house. The designs have been tested and found to be perfect in every detail. Each circuit will be given a preliminary test at some time before August 9th, but these experiments will take place only during the day. The contract calls for four hours' illumination, from 8 to 12 p. m., of Tuesday, Wednesday, Thursday and Friday nights of conclave week. Men will be stationed at various points in the illuminated district to replace globes which may burn out and to repair quickly any breaks which may happen. Every precaution will be taken to make the display thoroughly satisfactory and without flaw.

The Kolon Primary Battery.

The accompanying cuts show the Kolon primary battery which is being expoited by Converse D. Marsh, New York.

Fig. 1 represents the external appearance of the new cell which measures 7⅛x7½x9 inches and bears a close resemblance to a storage cell. This similarity to a storage battery is carried out in its action, the discharge, it is claimed, being equal to that of a secondary battery of the same size.

Fig. 2 shows the carbon cup, which acts in the dual capacity of porous pot and positive electrode. The walls are five-eights of an inch thick and between them are moulded five carbon plates, the whole presenting a very large amount of carbon surface to the action of the

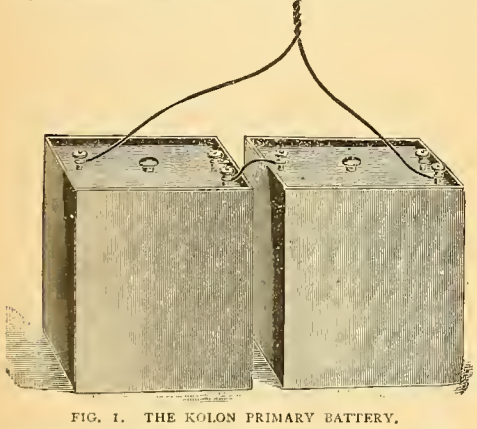


FIG. 1. THE KOLON PRIMARY BATTERY.

chromic depolarizer with which the cup is filled. This cup sets in the hard rubber cell, shown in Fig. 1, which is lined with a thin zinc bent into a rectangular form. The extremely low internal resistance is partially accounted for by the fact that the distance between the zinc electrode and the walls of the carbon cup forming part of the positive electrode, is but one-half inch. The usual acidulated water fills this space.

It is stated that on test, using a Weston ammeter and voltmeter, a single cell repeatedly discharged over 100 amperes at .5 volt with instant recovery of over 2 volts when the circuit was broken. This result was considered all the more interesting when the thick carbon walls, replacing the ordinary thin clay diaphragm, were taken into consideration. While they appear to completely separate the two solutions on open circuit, thus eliminating the bugbear, local action, they offer an extremely low internal resistance. On low rates of discharge the internal resistance was but .025 of an ohm.

In the construction of the cell, although rolled zinc is employed, it is saturated with mercury. There are no fumes, corrosion or creeping salts. The carbon is perfectly uniform and there are only two working parts, so to speak, in the cell.

For fan work, running motors under one-quarter horse power, small incandescent lights, cautery and dental applications, etc., the Kolon is peculiarly applicable.

New Roberts Insulating Joint.

The advantages claimed for this joint by its manufacturers, Vallee Bros. & Co., Philadelphia, are its small size, light weight, superior strength and good insulating qualities. The insulating material is not exposed to the outside atmosphere in any way, so that it is impossible for it to be subject to outside conditions. The cuts show the joint in full size for ¾ by ½ inch, and smaller sizes. It will be noted that this is one of the most compact joints that have been placed upon the market. It is small enough for use on wall brackets and is also strong enough to hold the heaviest chandelier. In many other joints red fibre is used or some other material in addition to the mica. In this joint, however, there is no other insulation except the mica. As will be seen the construction is very simple. To guard against turning of the parts upon each other very ingenious locking devices are used, which do not show in the cuts. It should be added also that Vallee Bros. & Co. state that the Roberts joint has been approved by Inspector Wm. McDevitt, of Philadelphia, Board of Fire Underwriters association.

Base Ball by Electric Light.

A new scheme has entered the enterprising mind of President J. W. Gunnels, says the *Toledo Blade*. He had it thoroughly settled in his mind when he left for Chicago

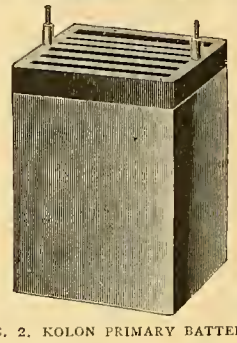


FIG. 2. KOLON PRIMARY BATTERY.

to give Toledo base ball by electric light, if the Western league, or a portion of it continues the season. He has arranged to place forty lights around the fence at Olympic park, several on the stands, and one or two tower lights to aid the players in gauging fly balls. The games will be called at 8 o'clock sharp, all practice being had by the teams in the afternoon. The scheme of racing by electric light was tried recently with success in the West, and Mr. Gunnels will make the experiment in base ball next week. Two amateur teams will play at the park on Mr. Gunnels' return, and if successful all of Toledo's games will be played in the cool of the evening, after the men have had their suppers and feel comfortable. No Sunday games will be played if the scheme is successful.

Aphorisms for Central Station Managers.

W. D. Marks, president of the Edison Electric Light company of Philadelphia, puts some good advice to central station men in the following shape:

Put the price of light and power as low as you can, and thereby secure the permanency of your business as against competition.

Do no free house wiring, but get others to do your wiring, and make it profitable to them by offering premiums, if necessary.

Put no free lamps in first installation, but renew them free of charge.

Own your own meter and service. It is not good policy to let the customer own the service.

Do not try to sell any particular make of meter, and be careful not to express any preference. Offer premiums to agents.

Sell current by meter, but have a minimum contract price to insure earning power of lamps and motors.

Above all things, always give a good light, but not an excessive amount of it.

Don't talk or write to consumers in a threatening way who do not pay promptly.

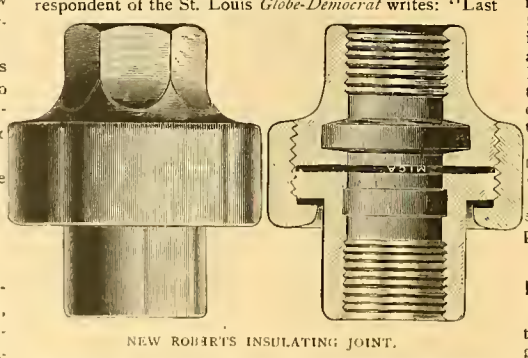
Stand by the meter, and cut off the light when disputes cannot be amicably settled.

Be open and courteous in acknowledgment of errors, and repair any injury unwittingly inflicted.

Don't believe the statements of consumers until fully verified.

A Long Electric Light Report Causes Trouble.

Under date of July 12th the Crawfordsville, Ind., correspondent of the St. Louis *Globe-Democrat* writes: "Last night the city council met to hear the reading of the report on the purchase of the electric light plant, and a most disgraceful scene was enacted. It would have required over four hours to read the report, and all the councilmen went around with crackers, cheese, peanuts, sandwiches and other cold victuals. They munched away quietly at first, but about 11 o'clock began to throw the viands at ex-Mayor Carr, who was industriously reading away on the voluminous report which the council had demanded. Finally the fun grew furious, and the city officials, rising from their seats, fairly filled the air with cheese and sardine boxes, howling and laughing like Comanches. The meeting was broken up by the boisterous conduct and declared adjourned when the report was but two-thirds read. Ex-Mayor Carr, who prides himself on his elocution, is fairly wild."



NEW ROBERTS INSULATING JOINT.

Electricity in Railroading.

Henry Villard, although no longer engaged in the management of electric corporations, has not lost interest in this field. A New York correspondent of the *Chicago Evening News* says:

Mr. Villard stood in the presence of some of the greatest capitalists in this country and spoke to them with enthusiasm of experiments and research which, in his opinion, were speedily to revolutionize the railway business of this country. Mr. Villard did not go into a technical explanation of the system, but he declared that in his opinion within a year some of the railroads of the West, especially those which will be heavily taxed to convey passengers and freight to the World's Fair, will employ this system.

This utterance is not the prophecy of a dreamer or visionary; it was a business speech to business men for business purposes and some of those who heard it command millions of capital, which they are ready to invest in electric railways as soon as it is demonstrated that they are not experimental. Frank J. Sprague in a recent address has spoken with the authority of an expert with more technical accuracy and with greater scientific precision than characterized Mr. Villard's remarks to the millionaires. Mr. Sprague declares it to be his belief that the change from steam to electricity upon our railways is not only possible but probable. He is not sure whether the best system will prove to be that by which an electric motor is attached to the head of a train as steam locomotives are or whether it will be found that single cars containing a motor will serve the commercial purpose more profitably. Experiment, in Mr. Sprague's opinion, will determine this question, just as experiment developed the railway system from its crude beginning to its present enormous growth and scientific and accurate determination."

Electrical Entertainment in Michigan.

The following is an exact copy of a recent notice in the *News* of Laingsburg, Mich.:

Nearly every one has long desired to know more concerning the different kinds and uses of Electricity; what it is and how it does its work. You will now have the chance to see a fine case of electrical instruments, containing many different kinds of batteries. Do not fail to see the Plate Glass Battery and the Dynamo do their work, also the Electric Motor or Engines, Dancing images, Storage batteries, Electric bells, Geissler tubes, Induction coils, etc., etc. Electric lights will be used part of the evening. All kinds and modern uses of Electricity illustrated and explained by Prof. F. W. French, of Byron. Come early, then you can get a front seat and while waiting for the lecture, which begins at 8 o'clock, we will have some lively Readings, such as "Jamie Butler and the Owl," "The Frenchman and the Flee Powder," "The Smack in School," "Socrates Snooks," "An Old Maid's Prayer," etc., etc. Lively! Interesting! Instructive! Plenty of fun. Who'll wear "Dem 'Lectric Slippers" and Take the other Prizes. Those who wish may stay after the lecture to examine instrument or ask questions. At Lebar's Hall, Saturday evening, July 16th. Admission only 15c Children 10c.

Electrical Development in St. Louis.

An electrical engineer and contractor is quoted in the *Age of Steel* as saying: "St. Louis may be in some respects a slow and conservative old town, but I am free to confess that it is quite the contrary so far as electrical supplies are concerned. Within the last three years St. Louis has done more electrical work than any other city in the United States or the world. In that time the Municipal electric light plant, the largest arc plant in the world; the Missouri, the largest incandescent plant to be found anywhere; the Laclede; the various street railroads changed to electric power; the immense amount of electric lighting for office buildings, stores, private residences and manufacturing works—are among the items which have figured in the local record of business. Moreover, the prospects are favorable to continued progress at a fast gait. Mr. McCulloch and associates are now in the East studying the best systems of electrical equipment for the three syndicate street railroads, the Cass Avenue, Northern Central and Union, and will shortly let contracts for the power machinery, wires and rails on bids already in. The Cross-town road will be an entirely new line; the Jefferson Avenue will be changed to electricity, and other improvements of a similar kind are booked. Then another immense electric lighting station will probably be added to existing public and private lighting equipments."

Recent Telegraphers' Strike in Spain.

In describing the recent telegraphers' strike in Spain the *Pall Mall Gazette* of London says: "The strike of government telegraph operators was quite *coup de theatre* in its suddenness. At a given moment all the telegraph stations in Spain stopped transmitting messages. The strikers did not leave their posts, but whenever they were asked to open communication with a given station they declared that the station did not answer their call. In Madrid the home minister himself, and in the provinces the governors in person went to the telegraph offices and asked the operators to call in their presence to other stations. The operators obeyed, but no answer came back.

The mystery had a simple explanation. The strikers had agreed to a certain password and sign, without which no station was to answer a call. In Madrid for some time there was nearly a panic in official and bourse circles, and it was rumored that revolutionary agents had cut all the telegraph lines connecting Madrid with the rest of the world. Fortunately, the railway telegraph wires were available, and these were at once used by the government. The sensation caused by the strike was universal, while business—chiefly stock exchange operations—was almost completely stopped. The grievances of the telegraph operators were old, and had been aggravated during the last few months. Their salary was very small, they were menaced with reductions, and a man of only three years' service, who belonged to the postal staff, had been appointed to the directorship of the Central Telegraph Office in Madrid. On learning of this act of favoritism the clerks resolved to strike."

CORRESPONDENCE.

New York Notes.

NEW YORK, July 23.—Almost every month there is presented new evidence that the steam railroad man sees in the overhead electric railway system a most valuable adjunct to steam locomotive service. While, in spite of all that is being said to the contrary notwithstanding, it may be some time before the locomotive gives place to the electric motor on trunk lines, there is no doubt whatever but that for the equipment of feeding lines the electric station-along-the-route system comes in for first place. In support of this statement it is only necessary now to watch the Pennsylvania railroad. The reputation of this road for good mechanical engineering is well known, and if current rumors be true, perhaps, before long it will be discovered that its superior mechanical knowledge has led to a very thorough appreciation of the applicability of the electric system to the company's needs in the neighborhood of New York City. In other words, reports are now current in Jersey City that the Pennsylvania railroad interests are concerned with a scheme to get ahead of the roads in the Philadelphia and Reading combination by striking at their suburban passenger traffic, and electricity is to do the work. It is alleged that the Pennsylvania railroad is preparing to gridiron Passaic, Essex and Hudson counties with electric railroads, all converging in Newark, thence to Jersey City by way of the plank road, and to New York from Jersey City by means of the Chambers, Desbrosses and Fourteenth street ferries. The Pennsylvania company has long sought a means to increase its local traffic, and at the same time has been searching for means by which its congested tracks between Jersey City and Elizabeth could be relieved. It would now appear by the current rumors that a simple arrangement had been found by which both objects can be accomplished and which at the same time will allow the company to carry passengers into New York City at a lower rate than is now charged by the railroads and still not violate the passenger traffic agreement.

The Pennsylvania Railroad company now has three ferries leaving New York. From the Pennsylvania ferry house, in Jersey City, where these three ferry lines converge, starts the Jersey City and Bergen Railroad company's, a horse car line which practically belongs to the Pennsylvania Railroad company, and which runs to a point on Bergen Heights where it will be an easy matter to connect it with the electric road now being built across the meadows from Newark to Jersey City.

When the New Jersey Traction company was organized and incorporated to operate street railways in Newark and elsewhere it was seen that the scope of the company was a broad one. Through it owners of street railways were guaranteed an interest upon their investment without the trouble of operating the road or appearing in its management. The directors of this company are men who are either stockholders in the Pennsylvania Railroad company or closely allied with the interests of that corporation.

Like the Jersey City line, the Plank Road company is practically owned by the Pennsylvania, and directors of both roads are members of the New Jersey Traction company. Upon reaching Newark the Traction company has under its control an electric line to the Oranges, another to Irvington, and two to cross the city. Besides these it has horse car lines under its management which tap Belleville on the north, and run to Elizabeth on the south. In Passaic and Paterson the Central Electric road connects the two cities, as well as Passaic Falls, and runs for a distance toward Newark.

Besides these lines, already in operation or in course of construction, there are two others, which, if built, would form a complete chain, with the corner of Broad and Market streets, in Newark, as the converging point and the Pennsylvania ferry house in Jersey City as the terminus. In form these roads represent an immense fan extended, the ribs of which would be in a position to command the passenger traffic of sections now controlled exclusively by the Erie, Delaware and Lackawanna, and the roads in the Reading combine.

The connecting links are: A road from the corner of Broad and Market streets, Newark to Elizabeth, which is now covered by a horse car line, but for which a franchise to equip as an electric road has been granted to the Newark Passenger Railway company, whose rights and franchises have been leased to the Traction company. The equipment of this road with electricity would complete the system on the south. At the north there is a long break between the terminus of the Central electric road of Paterson and Passaic and the terminus of the Traction company's line at Belleville.

There were, however, articles of incorporation filed in the Essex county court house for the Passaic Elevated Transit company, with a capital stock of $1,000,000.

It is declared that the object of this company is to construct an electric railway from the present terminus of the Central company's tracks in Passaic through the Passaic valley, following closely the line of the Erie railroad, and connecting at Belleville with the line of the New Jersey Traction company.

If New York does'nt have its tunnels in it will not be due to the laziness of the Rapid Transit commission. In spite of the heat, which causes so many of New York's sweltering citizens to long for Chicago's cool breezes, the members of the commission are working hard over the details of the underground railway, and within a few weeks the franchise will be ready for sale. Although there is rarely a quorum of the members of the commission present except at the regular meetings called by the chairman, conferences are held every day at the commission's offices, 22 William street, and the many knotty points which were brought up during the hearings of the special commission appointed to listen to the arguments of property owners along the line of the proposed underground system are being straightened out.

On Wednesday John M. Bowers of the firm of Platt & Bowers, counsel for the Rapid Transit commission was asked if it was probable that the property owners would take advantage of the sixty days allowed them in which to take an appeal from the decision of the Supreme court affirming the report of the special commission.

"No, I do not think any such step will be taken," said Mr. Bowers. "The gentlemen who represent the property owners are undoubtedly able to foresee that such an appeal would almost surely be futile. There is nothing that can now be done to prevent the construction of the underground railway."

"Could not the property owners, through their lawyers, take out an injunction against the construction of the road?" was another question propounded.

"Certainly not. An injunction could only be taken out against the construction of some work that trespassed without the authority of the law on the property of persons who had not been paid for the damage done to their property. In this case no question of trespass can enter into the case. Of course, after the underground system is completed and in operation property owners may enter suit for damages caused to their property by the operation of the road, but they cannot, without making an appeal—which I do not think they will—prevent the construction of the road on account of any future damage which they fancy will be done to their property, because the court has affirmed the judgment of the special commission, in which it is set forth that no material damage will be wrought in the construction of the system.

"It is highly probable, however, that the company which purchases the franchise, before it undertakes the construction of the road, will make application for the appointment of a condemnation commission in order that the state may fix the prices to be paid for such property as will have to be actually utilized as stations of the underground road. This the company will probably do in order to protect itself from exorbitant demands. The company will, of course, not expect to take the property of other individuals or corporations for nothing, but by the terms of the sale of the franchise the company will have the privilege of asking for a condemnation commission, in order that it may get justice in the acquirement of the property which will be necessary for stations. But I think it highly improbable that property owners who, after the road is built, sue for damage that they claim has been caused simply by the running of the road under the street on which their property is situated, will be able to establish their claims in court.

Inventors as well as politicians, it seems, are liable to constant misrepresentation—so at least Mr. Edison has just discovered. A recent dispatch from London says that the *Daily News'* Paris correspondent writes as follows:

"A French professor having seen a statement that Thomas A. Edison was reported to have declared that he was preparing for the German emperor an infernal machine that would destroy the largest cities from a distance of thirty miles, and which would annihilate a whole army corps, wrote to Edison, asking whether the most glorious American Republic would place its scientific genius at the service of despotism as against liberty, and received the following reply:

"'The assertions are wholly false. I certainly would be the last person to give the slightest help to the enemies of the French Republic.'"

The surface and "L" roads in Brooklyn are fighting over the question of wire stringing privileges. The companies which operate lines through Myrtle avenue, Fulton street and Fifth avenue desired to string their wires along the structure of the elevated roads, and had the aldermen insert a section in their charter giving them the right. But the elevated companies claim that such permission was void, and have insisted upon being paid a good round sum for the right to use their property in that way. Several meetings between representatives of the various roads have been held, but the surface companies assert that the price demanded is excessive and practically prohibitory. Charges of extortion are being heard and the dispute may finally get into the courts.

Mackay and Bennet are being sued by Count Arthur Dillon in the Supreme Court. The count, who now resides in the Duchy of Luxembourg, and who was the projector and promoter of the Commercial Cable company, desires to recover a large sum of money which he claims is due him under an agreement made when the company was first organized. The amount claimed is nearly $2,000,000.

The will of the late Cyrus W. Field was read to the family Tuesday afternoon at Ardsley Park, the Fields' country place, near Dobbs Ferry, Westchester county. It will be offered for probate within a day or two in the office of the surrogate of Westchester county in White Plains. According to the Rev. Henry M. Field, editor of the *Evangelist*, who is a brother of the testator, the will, provided for an equal division of what property his brother left among his children, and there were no public bequests. The bulk of the estate remaining consists of the heavy life insurance carried by Mr. Field, which was between $250,000 and $300,000. But even this, if the suit now pending in the courts to establish Cyrus W. Field as a general partner instead of a special partner in the wrecked firm of Field, Lindley & Co. should succeed, will, it is thought, be swept away.

W. F. O.

Cincinnati, O.

CINCINNATI, July 23.—Work on the new Walnut street theater is going on at a rapid rate, and everything points to its completion within the specified time. It is to be equipped with all the latest electrical appliances, and when complete will be one of the finest theaters in the city. The managers have arranged with the Keystone Electric company of Erie, Pa., and the local agent, Edward Sarran, for two large 220 volt motors, to be used for running elevators and other purposes.

The Cincinnati Edison company is extending its underground mains along both sides of Main and Sixth streets, between Main and Walnut, and Fifth and Sixth, in which territory it has already secured contracts for a large amount of business, furnishing power, incandescent and arc lights. The offices, which for the last year and a half were in the Smith building, are now in the station building on Eighth street. George B. Kerper, formerly president of the Mt. Adams and Eden Park Street Railroad company, is now in charge of the company's business.

The contract for combination fixtures for the new city hall was recently awarded to the Cincinnati Gas Fixture company, whose bid of $14,999.45 was the lowest received.

The Cincinnati Street Railway company is now installing at the Brighton station five new Thomson-Houston generators of 85 horse power each. This will make a total of 18.85 horse power generators now in the station, all driven by three 600 horse power Frick engines. W. E. Winn is the engineer in charge. There is being placed in the roof of the building, for the purpose of drawing the hot air from the dynamo room, exhaust fans, operated by a 7½ horse power motor and controlled by an automatic switch.

The telephone company will be in its new building on Vine street about August 20th.

The Hale Elevator company of Chicago is about to install in the new city building one of the largest and most expensive elevator motors ever made. It is to be a reversible motor of the latest type.

The new Walnut street theater building is being wired

by the Glover Electric company for 1,500 lights. The current is to be furnished by the Cincinnati Edison company.

Edward Klein, foreman of tke Pendelton line, is receiving great praise from the patrons of the road for the excellent and uninterrupted service he has given since the changing of the road from horse cars to the electric system. This is the fastest road in the city, making a circuit of fourteen miles in considerably less than two hours. Notwithstanding this speed fewer accidents have occurred than on any other road in the city.

B. Kilgour, chief inspector of the Cincinnati Street Railway company, has introduced many improvements in the operation of that company's cars, and the service is eminently satisfactory.

The electric plant at the new Alms Hotel, Walnut Hill, will be started running the latter part of this month. This is one of the best equipped isolated plants in the city. There will be a capacity of 1,500 16 candle power incandescent lamps, also a reserve capacity for arc lights. The wiring of the building was done by the Edison company The lamp fittings were furnished by the Glover Electric company. Dodd, Werner & Co. supplied the combination fixtures.

Contracts are about to be let by the Cincinnati Electric company for street poles, to be used for stringing the wires for public lighting.

The new Clifton avenue road has been running only two weeks, yet the patronage has been very gratifying. Current on the hill is furnished from the Hunt street station, and along Elm street from the Brighton station.

Gibson & Co., on Elm street, are now changing from steam to electric power for the operation of their printing establishment.

West, Tice & Co., 116 West Fourth street, have put in their store a 15 horse power motor to run two elevators.

J. M. Dobbins, one of the oldest and best known electricians in this city, is now assistant electrician of the Cincinnati Edison Electric company.

Geo. Cutter, traveling salesman for W. H. Jordan & Co. of New York, was in the city last week.

Edward Jones, secretary of the Queen City Electric company, has, since his connection with the company, more than doubled the business of the concern. Mr. Jones has only been in Cincinnati about six months, but he has succeeded in that time in establishing an excellent reputation for himself in the electrical field.

St. Louis, Mo.

ST. LOUIS, July 23.—The recently organized Delta Electric Light & Power company of Cairo, Ill., is proceeding rapidly with its preliminary work. Contracts have been placed for a 750 light National alternating dynamo, a 150 horse power National multipolar generator of the latest type; two Russell engines, two boilers, feed water heater and boiler feed pump.

The most recent applicant for public favor is the St. Louis, Collinsville & Eastern Electric Railway company, which proposes to build an electric railway between East St. Louis and Collinsville, Ill. The company has been incorporated with a capital stock of $200,000.

The question of an electric railway over the Merchants Bridge, connecting North St. Louis and Madison, continues to be agitated. Work of grading for a new race track will begin in a few days, and it is proposed that the electric cars shall run direct to the track.

An ordinance just introduced into the muncipal assembly authorizes the Forest Park and Fourth Street Railway company, to so change its route as to form a direct connection between the new union depot and the center of the city. Beginning at its present tracks on Eighteenth and Market streets, it desires to run north on Eighteenth to Pine, thence east to Fourth, north to Olive, west to Twelfth, south to Pine, west to Eighteenth and south to Market. This route passes over the existing lines of the Union Depot electric, Peoples cable, Missouri cable and Mound City electric lines.

An ordinance has also been introduced authorizing the North and South Rapid Transit company to build a cross-town line from Eighteenth and Clark avenue, north to Cavalry Cemetery in the extreme northern suburbs of the city. The route extends north on Eighteenth street to O'Fallon, thence to Ifogan, north to North Market, west to Twenty-fifth, north to Hebert, west to Jefferson avenue, north to Natural Bridge road, west to Glasgow, thence to Harper, to Girard, thence over the tracks of the Benton-Bellefontaine electric line, to Florrisant avenue, thence north to the cemetery. The ordinance authorizes the use of storage batteries as motive power.

The large steel stack recently completed by the Missouri Electric Light & Power company at Twentieth and Lucas avenue, is a noteworthy engineering structure. It is 150 feet high, 10 feet in diameter, and is built of about equal proportions of ½, ⅜, ¼ and $\frac{3}{16}$ inch metal. Beginning at about 20 feet from the bottom, it flares out downwardly to a diameter of 20 feet at the bottom, this flaring serving as bracing. The foundation is of concrete 25 feet deep, 35 feet square at the bottom. The smoke flues are connected to the stack underneath the floor, and no opening is cut in the stack itself, thus preserving its full strength. A fire brick lining extends 25 feet high. It has a capacity of 2,500 horse power, and cost, exclusive of foundation, approximately $3,500. The same company has also another stack of similar construction, which is 130 feet high, and 8½ feet in diameter, 1,750 horse power capacity.

The Board of Public Improvement has adopted and recommended for passage to the muncipal assembly, an ordinance providing for the inspection and control of electrical apparatus and conductors, and for the removal of dead wires. It authorizes the supervisor of city lighting to inspect all premises on which generators or converters are located, to ascertain their condition and management; it requires electrical companies to employ competent men, furnish their names to the supervisor, mark wires over streets and buildings so as to be readily identified; provide automatic cut-outs, and run wires with a sufficient space, so that no accidental contact can occur even in the severest storms.

Enthusiastic meetings are being held along the route of the proposed Manchester Road Electric railway, which is intended to run from the city to Kirkwood, and possibly to Meramec Heights. The meetings are held for the purpose of interesting property holders along the line, and assisting in raising the capital necessary to build and equip the road. The towns of Old Orchard and Kirkwood are taking the lead in the project.

It is reported that another electric railway is to be built in East St. Louis in the near future. It will extend from the corner of Sixth street and Collinsville avenue, to Lansdown Heights.

The fight which has existed for sometime between the city authorities of Pine Bluff, Ark., and the Pine Bluff Water & Light company, is reported to have been satisfactorily settled.

The city of St. Louis has contracted for a 15 ton travelling crane to serve the engine room of the new low service pumping station at Chain of Rocks. It will be operated by electricity. The water department also proposes to to put in a small engine and dynamo to furnish power for the travelling crane when needed, and also to furnish current for lighting the buildings and grounds.

The sale on the 12th inst., is reported, of the electric light plant at Pecatonica, Ill. Residents of Rochelle, Ill., were the purchasers. B.

Detroit, Mich.

DETROIT, July 23 —Edward P. Meany, general manager for the American Telephone & Telegraph company, appeared before the city council committee on ordinances recently with a draft of an ordinance prepared by the city counselor, providing for the extension of the company's long distance telephone circuit from Maumee to this city. The ordinance provides for a conduit system within the half mile circle poles on the most convenient streets and alleys outside. The system west of Akron will be completed by September 1st. Mr. Meany stated that seventy miles of line would place both Detroit and Toledo in connection with this immense system, and that the work of constructing the line to this city would be completed and communication opened with outside points within thirty days after the ordinance was passed. The matter was laid on the table for two weeeks. Mr. Meany says that if given the right to enter the city he would arrange, to begin with, for a 40 wire system, although but a part of that number would be put up at once. A central station will be placed in the down town district and substations, about twenty in number, with messenger service attached, will be placed in different parts of the city. The company claims that the circuits are metallic, and are working satisfactorily in all sorts of weather. Mayor Pingree is favorable to the ordinance, as are several aldermen who have given the subject consideration.

The Capital Street Railway company has organized at Lansing, Mich., with a capital of $25,000. An electric line will be built from the city to the agricultural college.

The Fenton, Mich., Electric Light company has purchased a new site, and the capacity of the plant will be doubled.

E. W. Cottrell, of the Citizens' Street Railway company has received assurances from the contractors that the Jefferson avenue line will be equipped for rapid transit by the last of August.

The Harrison Electrical Propulsion company has elected officers and directors as follows: President, Gen. Friend Palmer; secretary, J. B. Peterson; treasurer, B. H. Lau; directors, N. K. Riddle, Thomas Harris, and Messrs. Palmer, Peterson and Lau. The company will at ooce equip a line of track at some convenient point in the city if possible, for the purpose of demonstrating the practicability of the system.

The work of setting the trolley poles of the Fort Wayne & Belle Isle Railroad company is progressing rapidly. The board of directors has accepted the ordinance relative to the double track on Champlain street from Mt. Elliott to Baldwin avenue, and has instructed its architect to receive proposals for the power station at Clark avenue.

The Commercial Electric company of this city has been awarded the contract for lighting the buildings and grounds of the Detroit exposition. It is also making arrangements for an exhibit of electrical machinery and appliances on a larger and better scale than last year. The whole north side of the lower floor of the main building, from the boiler room to the east tower, will be set apart for the electrical display. Several fine exhibitions will be made beside that promised by the Commercial company. There will also be a large increase in the number of electric lights used in and about the buildings and grounds.

When the Fort Wayne Belle Isle Street Railway company gave the contract for the equipment of its line with electricity, it was not expected that the work could be completed until after the close of the exposition, but the General Electric company, through the manager of the railway department, Theodore P. Bailey, says that the road will be done in time for the big fair. The secretary of the company, Ellery I. Garfield, a former city controller of Detroit, is anxious to show his old friends how fine a road he can equip. The poles are to be of the round iron type in the central portion of the city, and octagonal wooden poles will be used in the outskirts. The old tracks will be used. Mr. Bailey thinks Detroit is making a mistake in requiring the grooved rail, as it is bad for electric cars, and not satisfactory to drivers. He thinks the T rail is the best pattern for cars as well as other equipages, if the pavement is laid flush with the track between and outside of the rails.

Just ten days after receiving the contract the H. W. and Sons Lumber company delivered the first consignment of five cars of poles for the Fort street railway line. These poles are of red Norway pine, octagonal in shape and nicely painted, and are the best of the kind ever turned out by that company. The General Electric company, from which they obtained the contract, is using about 1,500 of these wooden poles.

The Detroit Citizens' Railway company has decided to comply with the ordinance in the matter of heavy grooved rails, and on Woodward, Grand River and Gratiot avenues, which are to be repaved, they will lay 77½ pound rails, paving between the tracks with brick on Woodward and Grand River and with granite on Gratiot avenue.

The Electrical Workers' union recently elected the following named officers: President, Thomas H. Forbes; vice-president, John Lyons; recording secretary, W. Miller; financial secretary, Geo. Raviler; inspector, W. H. Scuhert; foreman, S. K. King; trustee, James Kinsular.

The Harris Electrical Propulsion company (limited) has been formed. The company is capitalized at $1,000,000, the 100,000 shares of which are held as follows: Edward Hartford 65,000 shares, the consideration for which is an invention known as patent 416,298; Friend Palmer, Nelson K. Riddle, and Thomas Harris each 11,670 shares. The company is organized to manufacture and sell electrical apparatus, cars and motors, obtain franchises, and operate electrical plants.

The order recently issued by the board of public works for the removal of all poles on Grand River avenue does not, as was supposed, mean that the wires are to be placed underground. It is merely intended to move the poles back to the new curb line.

Some years ago the Detroit Electrical Works fitted out the Sault Ste. Marie Street Railroad company with an electrical plant at a cost of $8,977.25. Of this amount $3,150 was to be paid on May 5, 1890, and the balance in sight drafts at regular intervals. In a petition in the Wayne Circuit Court for an order restraining the railroad company or any of its officers from disposing of its bonds, the Detroit Electrical Works allege that the railroad company has not only not paid its first note, but has also ignored all subsequent drafts made upon it. The company did, however, renew its notes several times, according to the plaintiffs' bill of complaint, and when asked for security individual stockholders in the railroad company turned over certain certificates of stock, but it is alleged that these were made non-transferable. The court is asked to order these certificates negotiable. G.

PERSONAL.

W. D. Packard, treasurer of the New York & Ohio company Warren, O., was in Chicago for a day or two last week, leaving the city Wednesday night for Eau Claire and St. Paul.

Geo. B. Shaw of Eau Claire has been nominated for Congress by the republicans of the Seventh district of Wisconsin.

A movement is on foot in London, backed by the most prominent electrical engineers, having for its object the presentation of a testimonial to S. Varley.

Geo. F. Card has recently been appointed electrician in charge of the factory of the Electric Supply & Contracting company, Cincinnati. Mr. Card is a son of Jno. F. Card, the well known electrician and organizer of the Card Electric Dynamo & Motor company, Cincinnati, and although quite a young man has already made an enviable reputation for himself.

Among the appointments reported to the senate by President Harrison last week was that of Cyrus W. Field as consul to Brunswick. The new consul is the son and namesake of the great philanthropist and projector of the first Atlantic cable, so lately deceased. Young Mr. Field is a graduate of Williams college and has had wide experience. The appointment is not only a just recognition of his father's distinguished public services, but of his own ability as well.

NEW INCORPORATIONS.

Otis Electric company, Yonkers, N. Y.; capital stock, $350,000; to manufacture and sell electric motors.

Alton & Suburban Electric Railway company, Alton, Ill.; capital stock $50,000; to build and operate an electric railway; Manning Mayfield, Alton. Ill.

Orange Ice, Light & Water Works company, Orange, Tex.; capital stock, $60,000; to maintain an electric light plant, etc ; J. T. Hart, Orange, Tex.

Howe Electrical Concern of New Jersey, Newark, N. J.; capital stock $100,000; to manufacture and sell all kind of electrical or mechanical devices, etc; J. R. Hardin, 800 Broad St., Newark, N. J.

Nanticoke & Newport Railway company, Nanticoke, Pa.; capital stock, $50 000; constructing and operating an electric street railway from Nanticoke, Lucerne county, to Glen Lyon; John T. Lenahan, Wilkesbarre, Pa.

Applegate Electric Light & Power company, Chicago, Ill.; capital stock, $1,000,000; to manufacture, buy and sell electric lighting devices, machinery, apparatus, etc.; Eugene W. Applegate, 1405 Ashland block, Chicago, Ill.

Diamond Light & Power company, Sheldon, Ia.; capital stock, $50,000; to acquire, own, construct and operate electrical plants, supplies and apparatus at Sheldon, O'Brien county, Ia ; Diamond Light & Power company, Sheldon, Ia.

Overhead Cable Traction company, incorporated in W. Va.; New York City. N. Y.; capital stock, $1,000,000; building, operating, selling and leasing overhead cables for railway cars and canal boats; Adam E, Schatz, Pulitzer building, New York City, N. Y.

Capital Land company, Deer Lodge, Mont.; capital stock, $100,000, dealing in land and water rights in Deer Lodge, Mont , supplying water for domestic, irrigating, manufacturing and other useful purposes; laying out town and town sites; dealing in electricity; operating street railways.

ELECTRIC LIGHTING.

An electric light plant for Martin's Ferry, W. Va., is being advertised for.

The electric light plant at Chanute, Kas., was recently totally destroyed by fire.

The Crisfield, Md., Ice Manufacturing company, intends to put in an electrical plant for lighting the town.

The council of Hannibal, Mo., has passed an ordinance for a municipal electric light plant. Commercial lighting by the city is contemplated.

The Madison, Wis., *Democrat* conveys the surprising intelligence that an "800 light indicator" has been added to the plant of the electric light company at that place.

All the bids recently put in for the electric light plant at the county hospital, Chicago, were rejected, and the superintendent of public service was instructed to advertise again.

The proprietors of all theatre at Washington D. C have been notified by the commissioners of the District of Columbia that their houses must be fitted throughout with electric lights.

A special meeting of the stockholders of the Toledo, O., Electric company will be held on August 9th, to consider the advisability of increasing the capital stock of the company to $500,000.

The Vandalia Electric Light Works of Mexico, Mo., were destroyed by fire recently. The station was the property of E. G. Bucklin and the loss is estimated at about $9,000 ; insurance, $4,500.

The Ball Light & Power company of Montgomery, Ala., has changed its name to the Mutual Light & Power company. The old officers were re-elected and the capital stock was increased from $25,000 to $100,000.

The electric company of Burlington, Iowa, intends to remodel the old steam supply plant which it has bought from the Steam Supply company for $30,000. It will build an addition to the present building on the north side 75x120 feet. The entire sum to be expended will reach $125,000.

The plan now proposed by Comptroller May of Chicago, for increasing the city's electric light system—namely, that the city shall establish plants and property owners shall have the privilege of extending the wires along their streets by special assessment—will probably meet with favor in some quarters and result in the supplanting of gas by electric lights on a number of the best streets.

The question of largely increasing the plant of the Edison Electric Light company of Philadelphia, by an addition to the capital stock of from $500,000 to $1,000,000 was thoroughly discussed at a meeting of the board of directors held recently, and this, together with the proposed contract with the General Electric company of New York, caused the directors to call a special meeting of the stockholders to be held early in September.

Frank B. Rae, electrical engineer for the new Union Depot company of Detroit, has prepared plans and specifications for an electric light plant for the depot, and the contract will be awarded soon. There are to be 800 incandescent and thirty-five arc lights, and the plant will consist of two engines and three dynamos.

The New York *Commercial Bulletin* says: R. A. C. Smith of this city, representing the consolidated gas companies of Rochester, has carried to a successful termination the consolidation of the Edison Electric Illuminating company of Rochester, the Rochester Electric Light company, and the acquisition of the Brush Electric Light company. The consolidated corporation is to be known as the Rochester Gas Electric company, and will have the following named officers: President, J. Lee Judson; vice-president, William Runkle; second vice-president, Frederick Cook; chairman of executive committee, R. C. Smith; treasurer, G. C. Archer; secretary, George C. Hollister; assistant secretary and treasurer, H. G. Runkle. The capital of the consolidatedc orporatioo will be $4,300,000; 21,500 shares of the stock are to be preferred, bearing 6 per cent. cumulative dividend The stockholders of the Rochester Gas company will receive 20,500 shares, the stockholders of the Edison company 6,000 shares and the stockholders of the Rochester company 4,000 shares, in each case one-half common and one half preferred. The directors are authorized to employ the stock remaining in the treasury for the purchase of not less than two-thirds of the capital of the Brush company The consolidated corporation is to assume the bonds of the companies in the consolidation.

ELECTRIC RAILWAYS.

The Charleston, W. Va,, Street Railway company is arranging to equip its road with electricity.

The first electric car in New Haven, Conn., was run over the West Haven street railroad on July 14th.

Minnehaha Park is now connected with Spokane, Wash., by the extension of the Ross Park electric line.

The construction of an electric railroad from Stone Mountain to Atlanta Ga., a distance of about fourteen miles, is contemplated.

The new electric railway connecting Toronto with the suburb of Mimico was recently opened. The Rae system with double decked cars is used.

The Electric Railway company of Los Angeles, Cal., has secured a controlling interest in the first mortgage bonds of the cable company of that city.

The committee on streets and alleys south of the Chicago city council recommended the ordinance of the Calumet Electric Railway company for a line on Stony Island avenue, between Sixty-fourth and Seventy-ninth streets.

The Rochester, N. Y., Railway company has begun work on the extension of its South avenue electric line from Linden street over the South avenue hill to Stewart street, from which point the tracks will cross over to Mount Hope avenue.

The Mobile & Spring Hill company, and the Mobile Street Railway company of Mobile, Ala., have been granted an extension until February next of the limit of time for the commencement of work on the equipping of their roads with electricity.

At a recent meeting of the directors of the Elgin, Aurora & Fox River Electric Railway company, held at Chicago, the following named officers were elected: President, William Grote; vice-president, John M. Egan; secretary, Henry A. Gardner; treasurer, H. H. Evans; auditor, A. M. Beaupre; general solicitor, T. E. Ryan. Books of subscription to the capital stock were opened and steps taken to obtain the right of way. An examination of the proposed line is to be made shortly.

A dispatch from New Orleans states that prominent local capitalists acting partly with an outside syndicate, have made offers for the purchase of some of the street railroads. The scheme is to consolidate all the street railways in the city under one management and to operate all the lines by electric power. The Carrollton company is now converting its roads into an electric line and this fact is having much to do with hastening the combination. The deal involves $10,000,000.

An extension of the electric line running from Cincinnati to O'Bryonville and that vicinity is being agitated. If made, it will start from St. Francis de Sales church and run over Chapel to Gilbert avenue, thence to McMillan street, to Symmes, to Morgan, to Hunt, and thence over the Avondale road. The Cincinnati Street Railway company is about to formulate an application for this extension. It will afford better access to the hills and the sparsely settled places beyond O'Bryonville and Hyde Park.

An electric sprinkling cart is to be placed on the Troy division of the Albany, N. Y., electric railway. It will have a capacity of 2,000 gallons of water. When filled the car will weigh fifteen tons and will sprinkle a strip three quarters of a mile in length. The machine will be made to spread 120,000 gallons per day.

In a recent issue the *Financial News and Price Current* of Pittsburg said: "The Westinghouse Electric Manufacturing company will probably bring all the electric street railways using the trolley system to time for infringement of the Finney patents owned by it. Its latest movement in that line has taken the form of suits against two local companies, the Duquesne Traction and the Pittsburg Allegheny & Manchester Traction, such as were instituted some time ago against the Birmingham and compromised."

TRADE NEWS.

The Perkins Electric Switch Manufacturing company of Hartford, Conn., reports a very brisk trade for the month of July.

Waterhouse Bros. of Hartford, Conn., are receiving many orders for their arc lamps for arc and incandescent circuits.

C. L Towles of the Jewell Belting company of Hartford, Conn., will represent that company at the Paper Manufacturers' convention at Saratoga.

The Buckeye Electric company reports mid summer orders coming in freely. This company's coiled filament lamps of 16 and 32 candle power appear to meet with popular favor.

George Cutter is designing a full line of enamel rheostats, which will be made by the company just organized by him. This company controls the patents on embedding wire in an insulated enamel, and will operate factories both at Chicago and in the East.

The capital stock of the Sioux City Electrical Supply Company of Sioux City, Iowa, has been increased to $12,000. This company is now operating a brass foundry, making a specialty of castings for the electric trade, in brass, copper, lead, zinc, tin, aluminum and in the making of solder, babbitt metal, commutator bars, etc.

The Electrical Fiber Carbon company of Detroit, Mich., is sending out a very neat little folder showing a number of specialties including several forms of carbon batteries, a new medical battery, etc. This company will make special goods to order from patterns or drawings and invites correspondence.

The Electrical Supply & Contracting company, Cincinnati, has recently installed an isolated Eddy plant of 150 lights in the new Stang brewery at Sandusky, O., and a 250 light Eddy plant in the Watchtel office building, Cincinnati, Mr. Perry of this company is pushing the Eddy apparatus and is meeting with most gratifying success.

The New York Central Railroad company has just placed an order for 300 miles of eight conductor Day's Kerite cable. The order requires over twelve and a half million feet of wire, and is probably the largest single order ever placed in this country. F. W. Cushing, the general western agent, reports that Kerite is steadily gaining in favor with consumers, as is evidenced by increasing sales every month.

The Hine Eliminator company of New York has in course of preparation a new catalogue larger than any it has ever issued, and one that is very unique in style. Steam users who are in need of a steam separator or an oil extractor will find it to their interest to send for a copy. A recent order has been received by the Hine company for four of its eliminators, which will go into the new State University at Columbus, O.

Sales of the Sunbeam incandescent lamp, notwithstanding the hot weather, are apparently being pushed with energy. During the past week a patron in California wrote Manager Terry of the Sunbeam company as follows: "Your lamps have proved to be even better than you claim. We have one that has been burning for nine months on an average of nine hours a night, and still looks as bright as ever."

The Consolidated Electric Manufacturing company, Boston, has fitted up new offices at the factory, 353 and 355 Congress street. The company has also opened a branch office in Chicago, and is represented here by C. E. Spofford, formerly New England agent. This concern makes a specialty of manufacturing the Heymann arc lamp for incandescent circuits, the Lyon brake handle, and about a dozen other patented specialties.

Queen & Co. of Philadelphia announce that the cable testing keys illustrated in the WESTERN ELECTRICIAN of the 2d inst. were suggested to them by E. W. Stevenson, electrician of the Brush Electric Illuminating company, New York. Mr. Stevenson has had wide experience in such matters, and hence knows probably as well as any one what the actual requirements are. He has used a set of keys similar to those of Queen & Co.'s make for some time past with very satisfactory results.

On account of a rapidly increasing trade the house of A. B. Lyman & Co., Cleveland, O., was obliged, about June 1st, to rent a larger store room on the first floor at 36 S. Water street and remove from its old quarters. The new room has been fitted up in a most attractive

style and there is to-day no finer salesroom in the West for the sale of electric supplies and specialties. A large stock is carried and great care is used in filling mail orders, so that entire satisfaction is guaranteed to all customers.

New Haven, Conn., has recently received an addition of importance in the Standard American Electrical company, which has taken the large building, formerly a packing house, at 140 to 156 Winchester avenue. This building has a frontage of 140 feet and is 200 feet deep. The company is now busy installing the running machinery. It will manufacture the arc lamps of the New American Electric Arc Light company of New York, with which it has been consolidated. This company expects to place a new line of motors on the market, which will possess many features of interest.

The Electrical Supply company, Chicago, has lately made arrangements with the Crocker-Wheeler Electric Motor company for the sole agency for Chicago and distributing agent for the territory covered by the company's regular traveling men. The Electrical Supply company will make the motor department entirely separate from the rest of its business, and has engaged H C. Hutchison, who for two years has been manager of the motor department for the Chicago office of the Edison General Electric company, to further the interests of the new department. Mr. Hutchison will have several assistants who are well known motor salesmen as well as skilled engineers. Mr. Hutchison is now fitting up a motor exhibit at the Electrical Supply Company's building, which is said to eclipse anything of the kind ever shown in Chicago.

The following are among the recent sales made by the Hill Clutch Works, Cleveland, O. Each contract covers the shafting clutch pulleys and all power transmitting appliances complete: Excelsior Electric company, Port Huron, Mich.; U. S. Electric Light & Power company, Dubuque, Ia.; Armour Packing company, Kansas City, Mo.; Union Pacific railway, Rock Springs, Wyo.; Cleveland Electric Light company, Cleveland, O.; Harrisburg Electric Light & Power company, Harrisburg, Pa; Hartford Light & Power company, Hartford, Conn.; M. C. Bullock & Co., Chicago, for the Belle City Street railroad company, Racine, Wis.; the Schiller theatre, Chicago; and several other large contracts are under way, one of them being with the Risdon Iron Works of San Francisco, Cal. Estimates have been made for a large amount of work in addition to the above and at no time during the past three years has the outlook been so bright.

BUSINESS.

The Hart & Hegeman Manufacturing company of Hartford, Conn., has sued H. T. Paiste of Philadelphia, alleging infringement on eccentric snap switches.

Again there comes a long list of recent sales from the Ball Engine company of Erie, Pa. On the list of purchasers are the following names: Prohibition Park Railway company, Port Richmond, N. Y., one 150 horse power engine; Baltimore, Md., Traction company, two 130 horse power, heavy duty; Metropolitan Telephone & Telegraph company, New York, one 60 horse power; H. Ward Leonard & Co., New York, one 150 horse power; Royal Light, Heat & Power company, Front Royal, Va., one complete steam plant, 100 horse power engine and 125 horse power boiler; Hot Springs, Va., Electric company, one complete steam plant 100 horse power engine and two 80 horse power boilers for Guantananmo, Cuba, one 80 horse power. F. R. Chinnock, sales agent for the Ball company, writes also that he has just closed a contract with the Buffalo, N Y., Board of Trade for a 60 horse power engine.

Julius Andrae, Milwaukee, Wis., has made the following sales: T. H. Brown Carriage company, one three, one six and one one-fourth horse power motor; J. C. Iversen company, picture frame makers, one two horse power motor; Geo. Tillema ice cream maker, one one horse power motor; Louis Kindling & Co., cigar manufacturer, one one horse power; F. Sekowskey, artificial limb manufacturer, one horse power; Dr. Huntington, dentist, one one eighth horse power; *Herald* company, newspaper publishers, one one-eighth horse power; also six ceiling fans for Carpenter & Underwood's bakery. A contract has also been made to install a 250 light incandescent plant in a new saw-mill at Matchwood, Mich. Mr. Andrae has sold, too, one watchman's clock, 10 station, of the Holtzer-Cabot make, to the Mayhew Manufacturing company. Mr. Andrae sold a number of "Sunbeams" last month. To one central station alone 800 of these lamps were furnished. It should be mentioned also that Mr. Andrae, having recently been appointed Wisconsin state agent to handle Okonite, is now pushing this product for all it is worth.

The following is a list of sales recently made by the New York Safety Steam Power company through its western agent Milton Thomas: Waco Ice and Refrigerating company, Waco, Tex., one 15 horse power; T. M. Maguire, Minneapolis, Minn., one 6 horse power; Cutter & Crosette Elgin Ill., one 30 horse power; Jacob Riswig, Chicago, one 40 horse power steam plant complete; Wilmington Electric Light company, Wilmington, Ill., one 60 horse power steam plant complete; Moffet Scale company, Chicago, one 10 horse power engine, one 15 horse power boiler; Barnhart Bros. & Spindler, Chicago, one 100 horse power engine; Pullman company, Chicago, one 14x16 vertical for laundry, (this is the twelfth engine of this type in use by the Pullman company); Garden City Fan company, Chicago, for Hotel Metropole one 20 horse power; Columbus Electric Light and Power company, Columbus, O., one 100 horse power engine (this makes the fifteenth engine of this size and type now in use by this company); L. H. Prentiss; Chicago, one 5 horse power vertical; Brevoort House, Chicago, one 50 horse power engine; Fort Wayne Electric company, Metropolis, Ill., two 60 horse power engines, Davis & Randall, Kentland, Ind., one 5 horse power engine and boiler; Lambert & Havens, Du Page, Ill., one 5 horse power; Chas. E. Gregory, 260 State street, Chicago one 50 horse power engine. Anheuser-Busch Brewing company, Houston, Tex., one 6 horse power boiler; Chas. Yordorf, Fourteenth street and Blue Island avenue, lighting station, Chicago, one 60 horse power engine; Ames Sword company, Chicago, one 5 horse power.

The petroleum engine of Priestman Bros., limited, of Hull and London is now being manufactured in Philadelphia, Pa. A Priestman engine, designed on the straight line principle, with all the working parts accessible, and made with a view of great endurance, has been built and tried and the makers agree that it will be wise to give the Americans what pleases them the best. It is quite evident that the line produced by the Priestman company in adopting a design that has become a favorite in America, a design that is theoretically correct in principle, has at once tended to disarm criticism, and such engines as have been constructed on this plan have demonstrated the correctness of the principle. There is in this country a great want for a quick running prime motor that can be adapted to lighting and pumping for farm work, and driving light machinery generally, the demand being for some independent installation where steam is not available for many reasons. The Priestman petroleum engine does not, therefore, come in competition with steam engines and boilers, as it is not subject to the laws that govern the management of steam and can be operated by any person of ordinary intelligence. When once started it needs no attention as long as the supply of fuel in the tank holds out. It is to be classed with the higher type of labor-saving device. The great rapidity with which electric lighting has come into favor in America makes a growing necessity for an engine of this kind that can readily be erected and operated without the skilled attention required by steam engines and boilers.

ELECTRIC PATENTS.

Issued July 19, 1892.

479,006. Lamp Post Sign. Charles F. Kuechler, Chicago, Ill.

479,007. Electric Arc Lamp. Maurice S. Logan, Otterville.

In this invention a coil is permanently located in the arc circuit, a feeding coil in a shunt around the arc and an auxiliary coil also in a shunt around the arc, and means are provided for switching the auxiliary coil in parallel with the coil permanently located in the arc circuit.

479,017. Hanger for Electric Arc Lamps. Charles A. Pfluger, Chicago, Ill.

479,020. Incandescent Electric Lamp. Max A. Richter and James G. Nolen, Chicago, Ill.

479,029. Electric Arc Lamp. Elmer A. Sperry, Chicago, Ill.

Two pairs of carbons are used in this lamp in connection with feeding clamps for the upper carbon rods, one of the rods being held permanently in an elevated position until disengaged by the gradual feeding of the other carbon.

479,030. Armature for Electric Machines. Elmer A. Sperry, Chicago, Ill.

A sheath consisting of a series of thin annular metallic rings covers the coils and the core and is insulated therefrom.

479,035. Safety Device for Electric Circuits. Mandeville Thum, Louisville, Ky.

A guard conductor is placed in proximity to the conductor to be protected and contact devices are adapted to complete an electrical connection between them upon undue displacement of one of the conductors.

479,046. Electric Signal for Mine Shafts. Frederick W. Bacon, Marysville, Mont.

Conductors are provided upon the sides of the shaft, each grounded at one end, the other ends being open. Trolley wheels upon the cage engage with the conductors and a push button upon the cage closes the circuit through signaling apparatus at the engine room.

479,052. Electric Wire Support. William B. Bragdon, Cumberland Mills, Me.

479,062. Speaking Attachment for Telephones. Daniel Eldredge, Boston, Mass.

A flexible tube provided with a mouth piece is adapted to be attached to the transmitter.

479,101. Rheostat. John Waring, Manchester, Conn.

479,107. Telephone Switchboard. Wilhelm Oesterreich, Berlin, Germany, assignor to Mix and Genest, same place. Filed Aug. 7, 1889. Serial No. 320,069. (No model.) Patented in Germany March 16, 1887, No. 45,143; in Austria Hungary June 28, 1888, No. 27,801 and No. 49 268, and in Italy Aug. 25, 1888, XLVII, 229.

The springs nominally rest against the sleeves to complete the circuit; and the obliquity of the spring jack switches increases toward the top of the board.

479,118. Dynamo Electric Machine. Rudolf Eickemeyer, Yonkers, N. Y.

The invention embodies improvements in that class of dynamos which consist of a drum armature and a field coil which surrounds the armature longitudinally and is adapted to secure completed magnetic circuits diametrically through the armature core.

479,121. Electric Arc Lamp. William E. Irish, Chicago, Ill.

A thermo-expansive strip is employed to operate the clutch.

479,134. Insulator. Chauncey Eugene Conover, Cincinnati, Ohio.

479,138. Signal for Electric Railways. Frank F. Loomis, Akron, Ohio.

479,139. Thimble for Light Fixtures. John J. Miller, Pittsburg, Pa.

479,147. Electric Belt. Duane P. Andrus, St. Louis, Mo.

479,167. Electrical Meter. Arthur E. Kennelly, Orange, N. J.

An electric motor serves to drive the meter, the armature of the motor being provided with short circuited coils to put a load on the motor.

479,168. Electrical Meter for Three Wire Systems. Arthur E. Kennelly and John F. Ott, Orange, N. J.

A coil is connected to the positive main and another coil to the negative main, both coils operating on the same pointer or indicator.

479,169. Electro-Magnetic Machine. Arthur E. Kennelly and John F. Ott, Orange, N. J.

The pole pieces are attached to the frame of the machine by straps set into the face of the pole piece.

479,170. Compound Wound Alternating Current Dynamo. Hermann Lemp, Lynn, Mass.

The work circuit section of the armature operates in series with another section of the armature, which latter section is connected in circuit with the field coils.

479,171. Electric Meter. John F. Ott and Arthur E. Kennelly, Orange, N. J.

The object of this invention and the one following is to provide mechanism for advancing the counters at each operation a distance exactly dependent on and corresponding to the current strength and then to disengage the driving mechanism from the meter.

479,172. Electric Current Meter. John F. Ott and Arthur E. Kennelly, Orange, N. J.

479,178. Telegraphic Repeater. Rhoderick H. Weiny, New York, N. Y.

One winding of an auxiliary differential magnet is included in a circuit controlled by the armature of the opposite receiving magnet.

479,179. Armature for Dynamo Electric Machines. Merle J. Wightman, Scranton, Pa.

The point of connection between the armature wires and the lead wires is clamped against vibration by a wire of the next section being wound directly upon it.

479,183. Reflector for Arc Lights. Robert S. Dobbie, Brooklyn.

A refractory block adapted to become incandescent is placed near the arc.

479,184. Fac-simile Telegraph. Thomas A. Edison, Menlo Park, N. J., and Patrick Kenny, New York, N. Y. Filed Dec. 6, 1881. Serial No. 47,216. (No model.) Patented in England July 19, 1881, No. 3,140; in Belgium Sept. 15, 1881, No. 55 623; in Canada Oct. 19 1881, No. 13,577, and in France Nov. 3, 1881, No. 144 646.

The transmitting circuit of the telegraph is controlled by the depressions produced by marking autographically upon paper.

479,187. Alternating Current Motor. Thomas H. Hicks, Detroit, Mich.

In this invention the field magnets are each wound with two distinct conductors, one conductor traversed by current impulses of one direction and the other by impulses of an opposite direction, the current impulses being separated by a commutator.

479,207. Shade for Incandescent Electric Lamps. William J. Edmond and Thomas J. Keon, Philadelphia, Pa.

479,216. Clamp for Electric Conductors. John Ingmanson and Rudolph Lorang, Chicago, Ill.

479,225. Switch and Signal Apparatus. Jens G. Schrender, Edgewood, Pa.

479,226. Telephone. George F. Shaver, Yonkers, N. Y.

479,227. Telephony. George F. Shaver, Yonkers, N. Y.

Two distinct sounds are transmitted over a single conductor by causing electrical undulations similar in form to the vibrations of the air accompanying one of the sounds and mechanical vibrations similar in form to the vibrations of the air accompanying the other of the sounds.

479,282. Electric Alarm. Robert L. Keith, Brazil, Ind.

479,308. Individual Alarm Signal Apparatus. Paul Seiler, San Francisco, Cal.

479,321. Electric Brush. Robert E. Williams, Dallas, Tex.

479,322. Connector for Electric Circuits. John F. Wollensak, Chicago, Ill.

479,325. Connector for Electric Circuits. William E. Gill, Chicago, Ill.

479,327. Conduit Trolley for Street Cars. Arthur H. Heeatzman, Baltimore, Md.

The trolley arm is provided with a horizontal arm and a vertical toe on the arm and an elastic connection between the arm and toe.

479,333. Electric Railway Signal. Theodore A. B. Putnam, New York, N. Y.

479,358. Electric Stop Motion for Textile Machinery. Samuel L. Foster, Wilmington, Del.

479,359. Incandescent Lamp Socket. Isaac Goldkind, New York, N. Y.

479,360. Incandescent Electric Lamp. Henry Green, Hartford, Conn.

The leading in wires are composed of a core of glass carrying a coat of platinum.

479,386. Cast Joint for Armored Conductors. Frederick M. Bennett, New York, N. Y.

479,390. Elevator. Marvin Y. Calcutt, Seattle, Wash.

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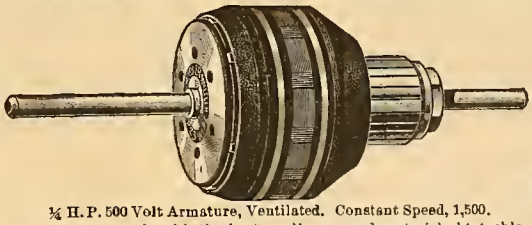

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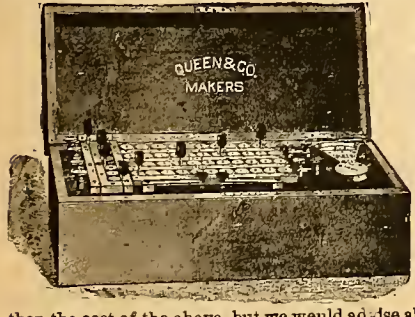

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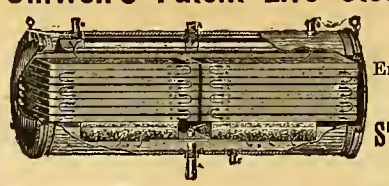

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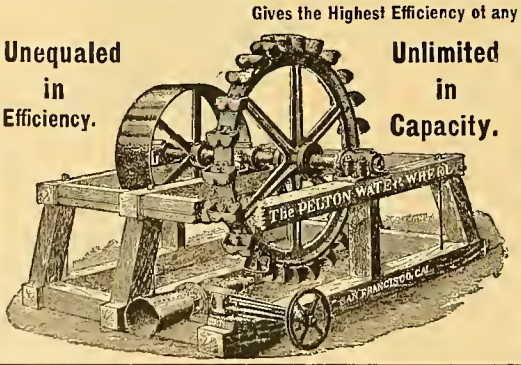

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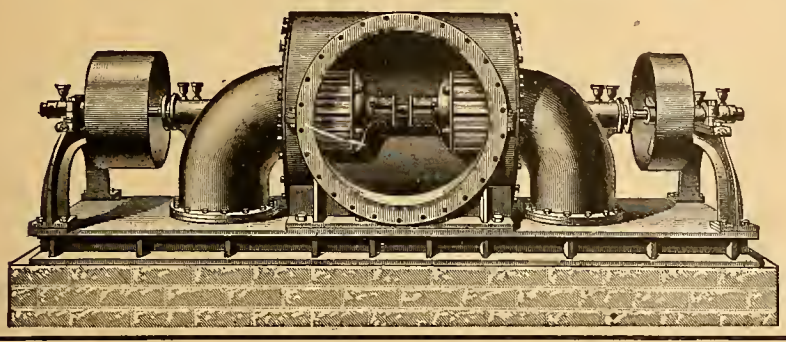

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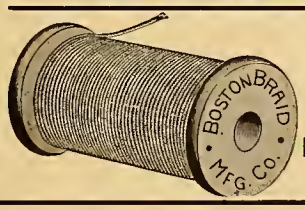

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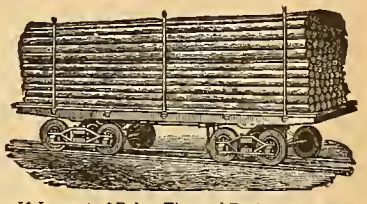

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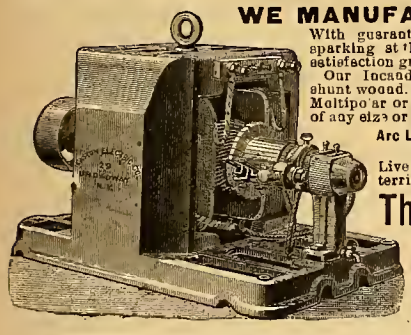

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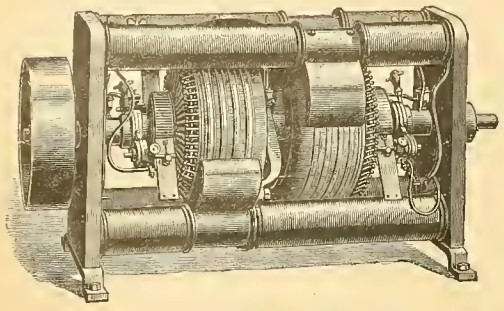

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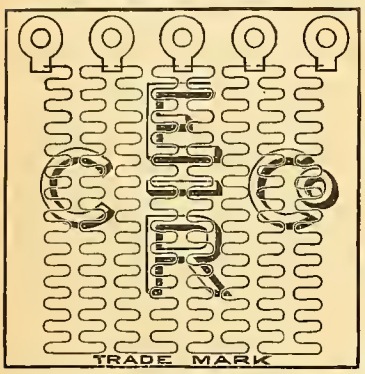

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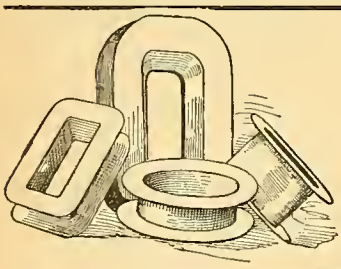

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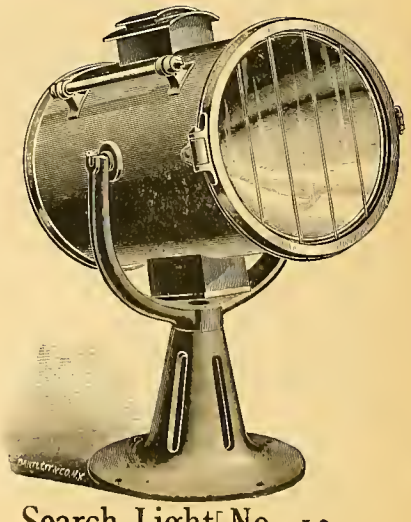

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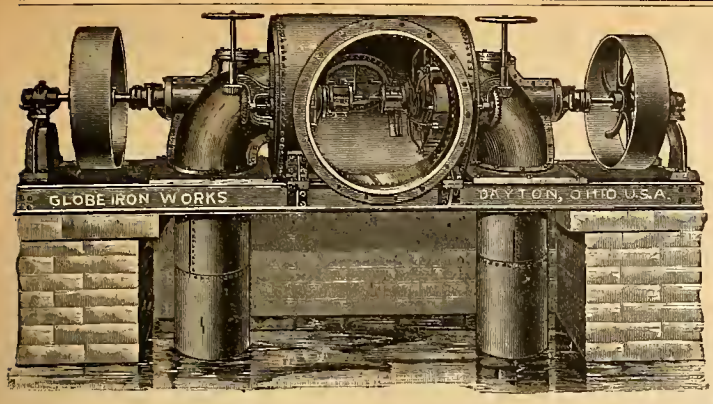

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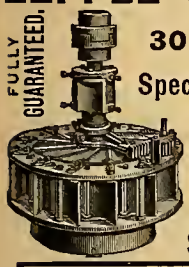

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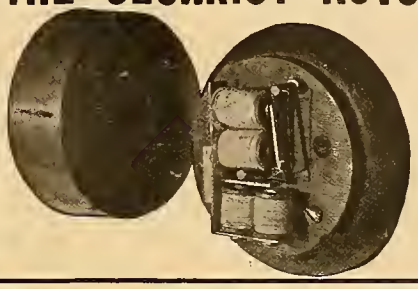

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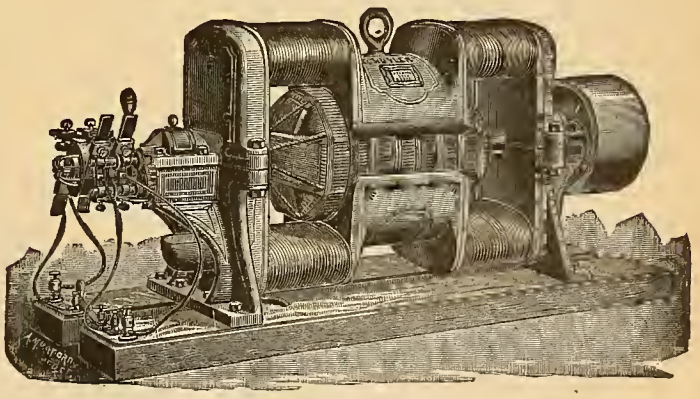

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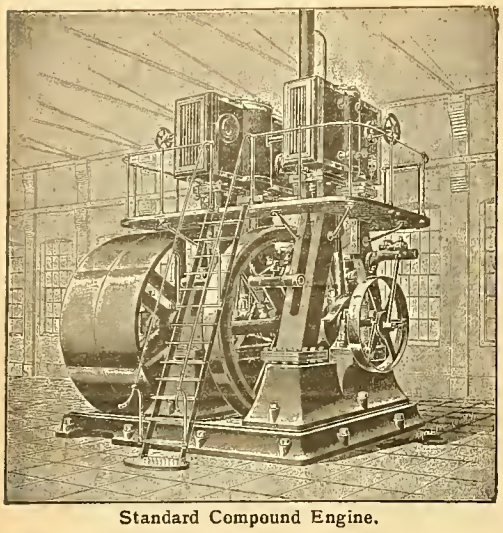

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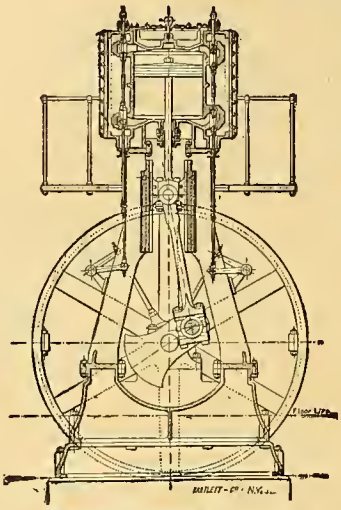

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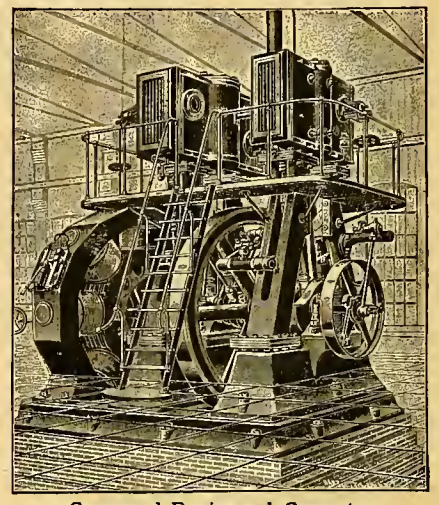

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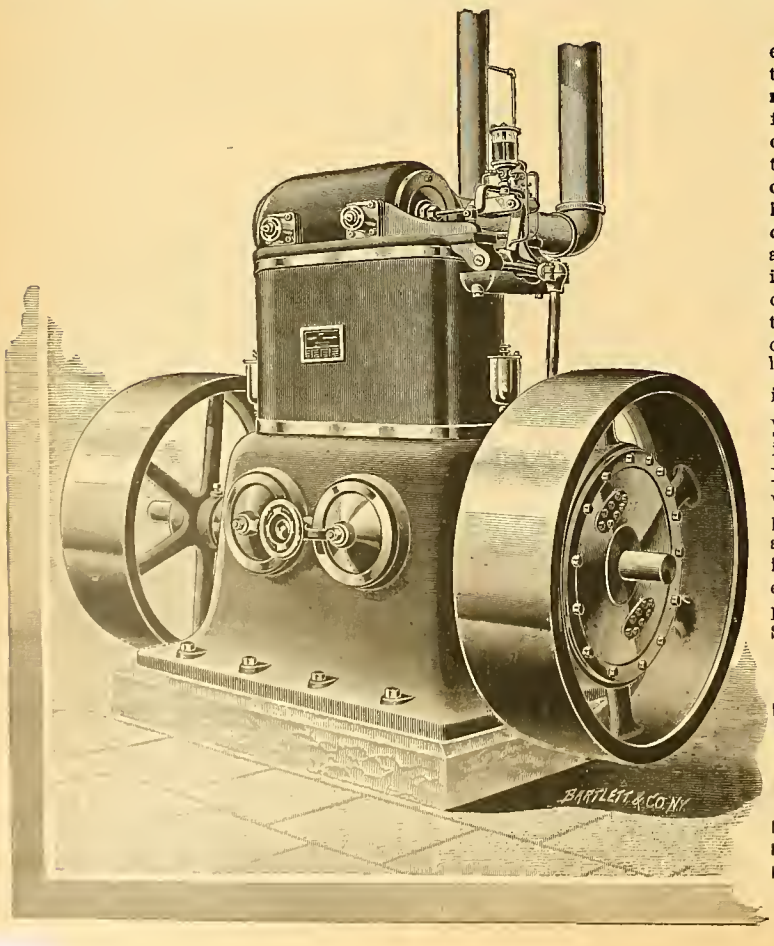

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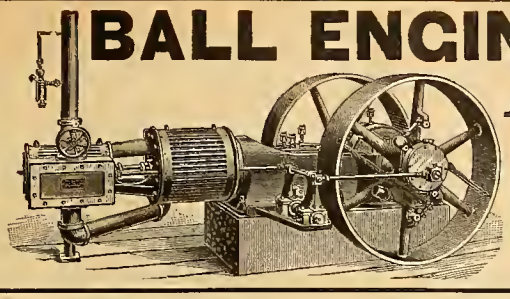

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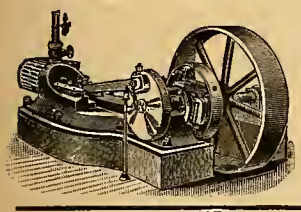

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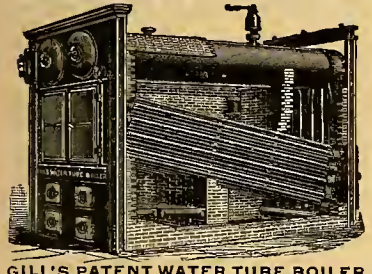

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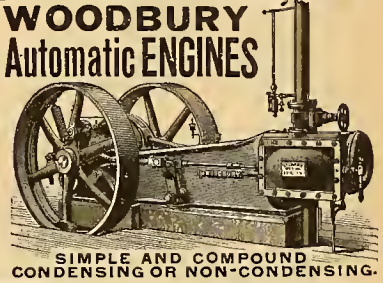

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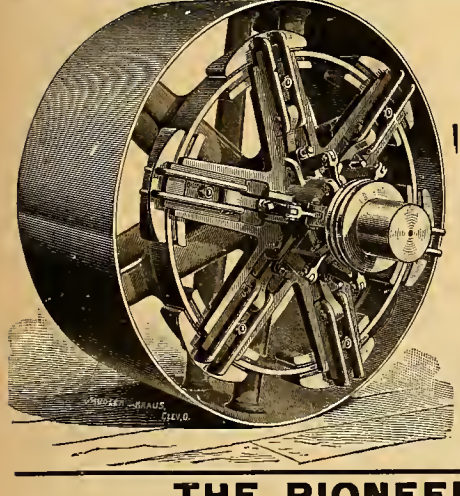

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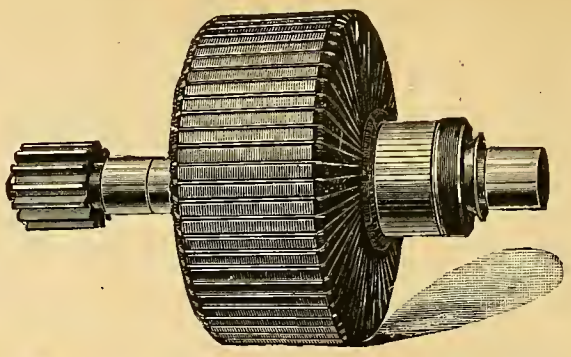

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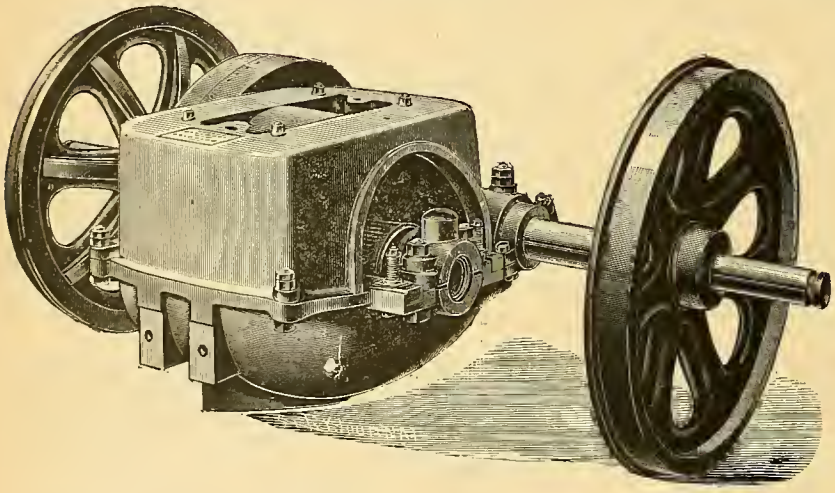

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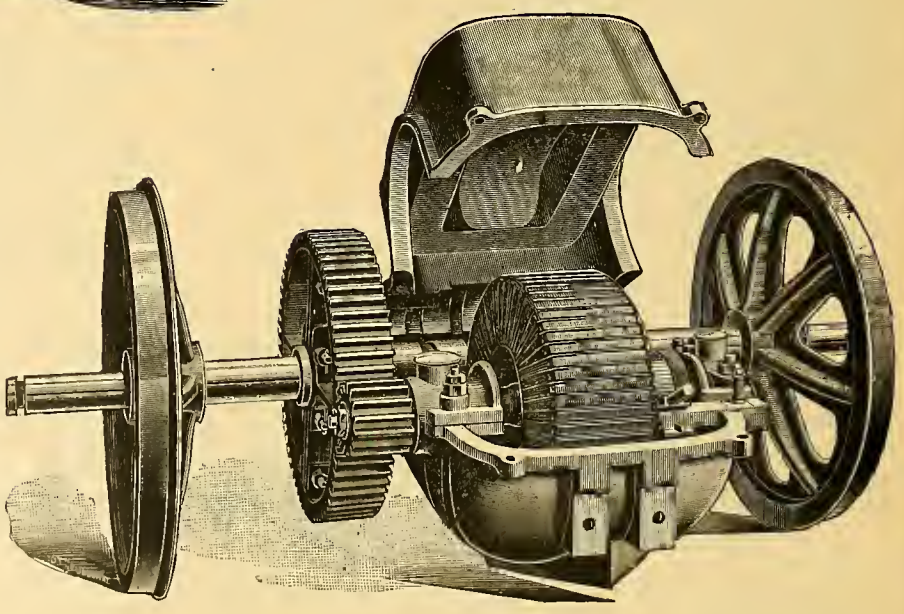

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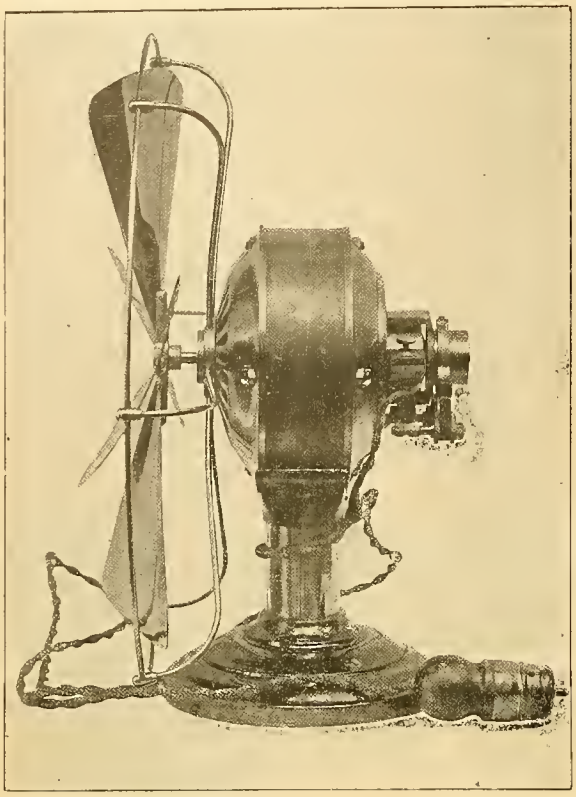

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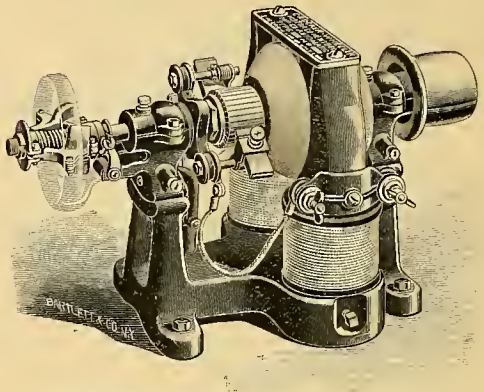

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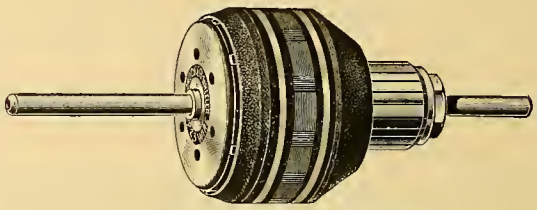

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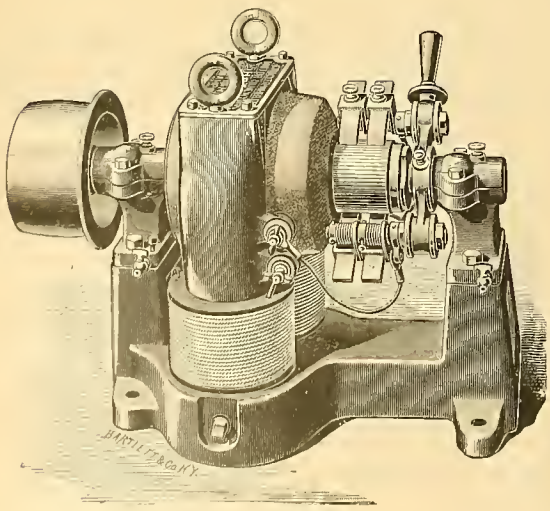

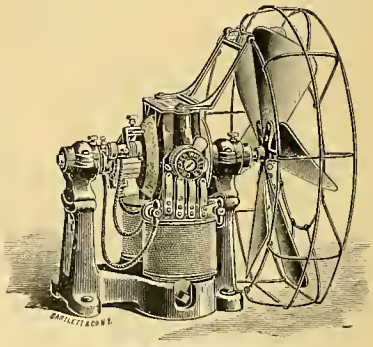

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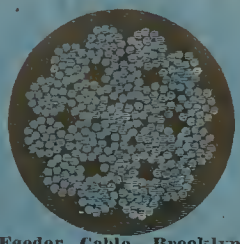
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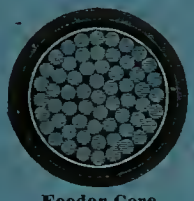
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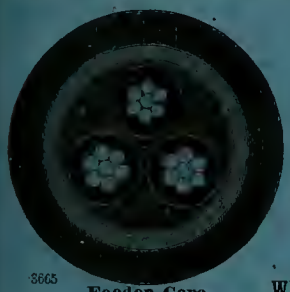
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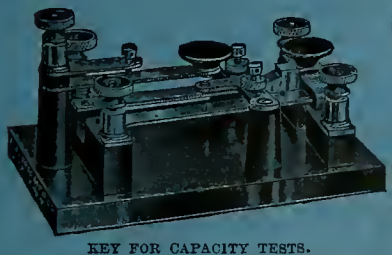

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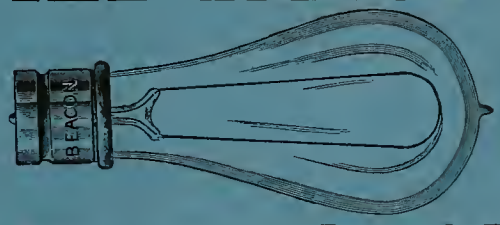

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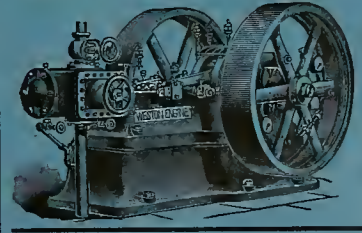

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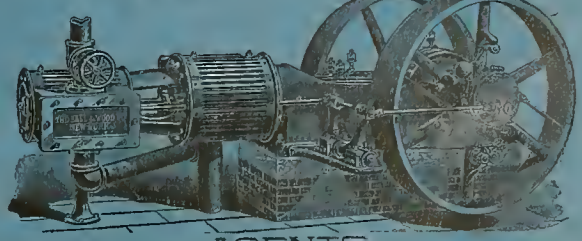

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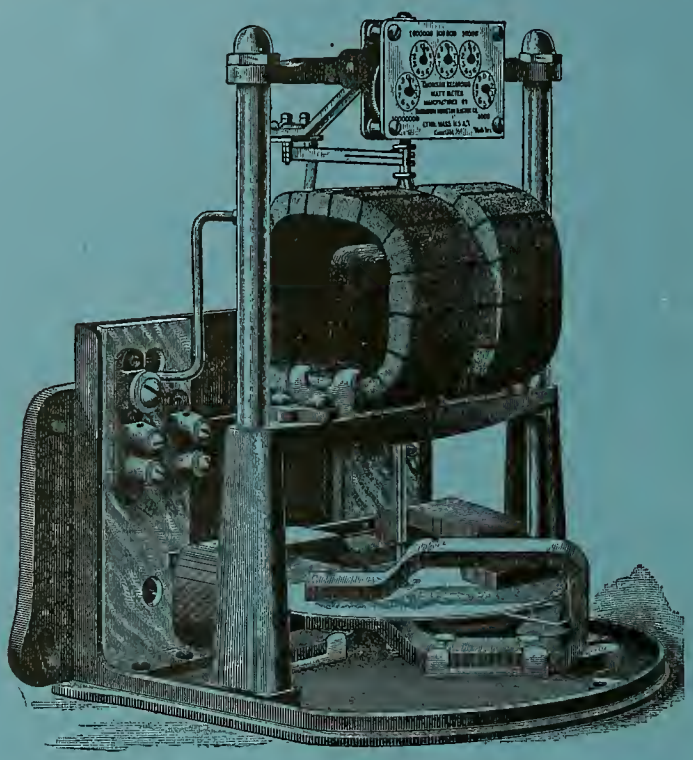

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(Signed) E. F. Cooley, Supt.

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INDEX AND CLASSIFICATION OF ADVERTISEMENTS.

ALPHABETICAL LIST.

American Battery Co..... vi
American Desk & Seating Co..—
American Engine Co..... xii
Andrae, Julius..... xii
Andrews & Co., A. H..... xiv
Babcock & Wilcox Co., The.... i
Baggot, E..... xiv
Ball Electric Light Co..... ix
Ball Engine Co..... xix
Ball & Wood Co., The i
Beacon Vacuum Pump & Elec. Co.i
Becker Mfg. Co., John..... —
Beggs, J. E., Mcb. & Supply Co. x
Bernstein Electric Co..... iv, xii
Boston Braid Mfg. Co..... xviii
Bowers Bros..... xvi
Bristols' Mfg. Co..... i
Brookfield, Wm..... xii
Brush Electric Co viii
Bryan, W. H.. xiv
Bryant Electric Co..... —
Buckeye Electric Co., The..... ix
Butler Hard Rubber Co..... iv
Carpenter Enamel Rheostat Co. xvi
Central Electric Co..... v
Chicago Electric Motor Co..... —
Chicago Rawhide Mfg. Co..... xix
Crescent Ins. Wire & Cable Co. xiii
Crocker-Wheeler Electric Co.. xiii
Cushing, F. W..... vii
Cutter, Geo..... —
Cutter Electrical & Mfg. Co... vi
Dayton Globe Iron Works Co..xvii
Densmore Typewriter Co..... —
Detroit Electrical Works..... xxiv
Diamond Electric Mfg. Co.... —
Diehl & Company..... ix
Dixon Crucible Co., Jos..... vi
Dudley & Co., W. W..... xvi
Duplex Electric Co., Ltd..... xii
Eastern Electric Cable Co..... xiii
Easton Electric Co..... —
Eastman Kodak Co..... xiv
Edison General Electric Co.....viii
Electric Cons. & Supply Co... vi
Electric Engr'g & Supply Co .. ix
Electric Secret Service Co..... x
Electrician Pub. Co...xvi, xviii, xix
Electrical Construction Co., The.xiii
"Electrical Progress"..... xvii
Electrical Supply Co., The... xxii
Elektron Mfg. Co..... —
Empire China Works..... x
Enterprise Electric Co..... xv
Falls Rivet & Machine Co..... ix
Ferracute Machine Co..... —
For Sale Advertisements..... x, xiii
Fort Wayne Electric Co..... —
General Electric Co..... ix
Gravity Purifier Co..... xviii
Greeley & Co., The E. S..... i
Gregory, Chas. E..... i
Hart & Hegeman Mfg. Co..... x
Heisler Electric Co..... iv
Hill Clutch Works..... —
Hine Eliminator Co..... xii
Holmes, Booth & Haydens.... xiv
Illinois Electric Lamp Co..... xv
India Rubber & G. P. Ins. Co. xxiii
Institute of Technology..... xiv
Interior Conduit & Insulation Co. x
International Okonite Co..... i
Jewell Belting Co..... i
Johns Mfg. Co., H. W..... —
Kartavert Mfg. Co..... xvi
Kelly Brothers..... xix
Knapp Electrical Works..... xxi
Lake, J. H. & D., Co xiv
Lake Erie Engineering Works.xviii
Lane & Bodley Co..... xviii
La Roche Electric Works..... vi
Law Telephone Co..... xiii
Leclanche Battery Co., The .. xvii
Lefmann, Julius xviii
Leffel, & Co., Jas xvii
Leonard & Co., H. W..... xviii
Link Belt Machinery Co..... xiv
Loud, H. M. & Sons Lumber Co. xiv
Lovell Mfg. Co., Ltd..... xiii
Mather Electric Co..... xvi
Morse & Co., A. M..... xv
Munsell & Co., Eugene..... xiii
National Carbon Co..... xiv
National Electric Mfg. Co v
National India Rubber Co i
New York Insulated Wire Co. xv
N. Y. Safety Steam Power Co.. x
New York & Ohio Co..... i
Ostrander & Co., W. R..... xix
Page Belting Co..... xix
Partrick & Carter Co..... —
Pearson & Co., W. B..... xviii
Pelton Water Wheel Co..... xiv
Perkins Elec. Switch Mfg. Co.—
Phoenix Glass Co..... —
Pioneer Armature Co..... xiii
Porter-Leavitt Elec. Motor Co. —
Premier Electric Co., The..... —
Queen & Co..... xiii
Racine Hardware Mfg. Co..... xii
Rae, Frank B..... i
Railway Equipment Co..... x
Ries Electric Specialty Co..... x
Roebling's Sons Co., J. A .... —
Rose Elec. Light Supply Co.. —
Royal Electric Co..... xii
Samson Cordage Works. xii
Sawyer-Man Electric Co..... xi
Schindel & Schindel..... xviii
Schuyler Electric Co..... iv
Sechrist, Albert..... xvii
Shultz Belting Co..... —
Siebert, G..... xiii
Siemens & Halske Electric Co. xiii
Sioux City Elec. Supply Co., xviii
Sioux City Engine Works.... xix
Smith, A. T..... xv
Smith, Thos. G. Jr..... vi
Somoff, J. L..... xv
Sperry Elec. Mining Mach. Co. xvi
Standard Electric Co..... xxiv
Standard Paint Co vi
Stanley Electric Mfg. Co..... —
Star Electrix Co... xv
Stearns Mfg. Co..... xix
Sterling, W. C..... xv
Stilwell & Bierce Mfg. Co. xiv, xv
Sunbeam Incand. Lamp Co... xxiii
Taylor Engine Co..... x
Thomson-Houston Elec. Co.. ii, xx
Union Hardware Co..... xii
U. S. Electric Lighting Co.. xi
Utica Elec. Mfg. & Supply Co. x
Van Nuis C. S..... —
Vulcanized Fibre Co..... xv
Waddell-Entz Company..... xii
Wannopee Pottery Co..... vi
Want Advertisements.....xiii, xiv
Western Electric Co..... xiv
Westinghouse, Church, Kerr & Co..... xvii
Westinghouse Elec. and Mfg Co —
Weston Engine Co..... i
Woodhouse & Rawson, Ltd.... xvii
Worthington, Henry R..... —

CLASSIFIED LIST.

Annunciators.
Central Electric Co.
Detroit Electrical Works.
Electrical Supply Co., The.
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Ostrander & Co., W. R.
Partrick & Carter Co.
Western Electric Co.

Bells, Magneto.
Central Electric Co.
Detroit Electrical Works.
Greeley & Co., The E. S.
Knapp Electrical Works.
Partrick & Carter Co.
Western Electric Co.

Belting.
Chicago Rawhide Mfg. Co.
Jewell Belting Co.
Link Belt Machinery Co.
Page Belting Co.

Boilers.
Babcock & Wilcox Co., The.
Lane & Bodley Co., The
N. Y. Safety Steam Power Co.
Stearns Mfg. Co.
Weston Engine Co.

Books, Electrical.
Electrician Publishing Co.

Burglar Alarms.
Central Electric Co.
Detroit Electrical Works.
Electrical Supply Co., The.
Greeley & Co., The E. S.
Knapp Electrical Works.
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(See Insulated Wires.)

Cables, Electric. (See Insulated Wires), **Copper, Sheet and Bar**
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Western Electric Co.

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Eastman Kodak Co.

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Brush Electric Co.
Central Electric Co.
Electrical Supply Co., The.
Knapp Electrical Works.
National Carbon Co.

Clutches, Friction.
Falls Rivet & Machine Co.
Hill Clutch Works.
Lake, J. H. & D. Co.

Cordage.
Samson Cordage Works.

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Electrical Construction Co., The.
Knapp Electrical Works.
Rae, Frank B.
Smith, Thos. G. Jr.
Western Electric Co.

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Babcock & Wilcox Co., The.
Ball Electric Light Co.
Ball Engine Co.
Ball & Wood Co., The.
Bryan, W. H.
Brush Electric Co.
Detroit Electrical Works.
Diamond Electric Mfg. Co.
Edison General Electric Co.
General Electric Co.
Heisler Electric Co.
Lake Erie Engineering Works.
Lane & Bodley Co., The.
La Roche Electric Works.
Lefmann, Julius.
Leonard & Co., H. W.
Mather Electric Co.
Morse & Co., A. M.
N. Y. Safety Steam Power Co.
Pearson & Co., W. B.
Racine Hardware Mfg. Co.
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Siemens & Halske Electric Co.
Sioux City Engine Works.
Smith, Thos. G. Jr.
Standard Electric Co.
Taylor Engine Co.
Thomson-Houston Electric Co.
Waddell-Entz Company.
Westinghouse Electric & Mfg. Co.
Westinghouse, Church, Kerr & Co.
Western Electric Co.
Weston Engine Co.

Copper Wires and Tapes.
Central Electric Co.
Crescent Ins. Wire & Cable Co.
Cutter, Geo.
Detroit Electrical Works.
Edison General Electric Co.
Electrical Supply Co., The.
Enterprise Electric Co.
Holmes, Booth & Haydens.
International Okonite Co., The.
Knapp Electrical Works.
National India Rubber Co.
Roebling's Son's Co., J. A.
Sperry Elec. Mining Machine Co.
Western Electric Co.

Cross-Arms.
Central Electric Co.
Detroit Electrical Works.
Electrical Supply Co., The.
Lefmann, Julius.
Loud, H. M. & Sons Lumber Co.
Railway Equipment Co.
Schindel & Schindel.

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Andrae, Julius.
Bryant Electric Co.
Central Electric Co.
Cutter, Geo.
Cutter Electrical & Mfg. Co.
Electric Engineering & Supply Co.
Electric Secret Service Co.
Electrical Supply Co., The.
Enterprise Electric Co.
Hart & Hegeman Mfg. Co., The.
Knapp Electrical Works.
Perkins Elec. Switch Mfg. Co.
Sechriet, A.
Utica Elec. Mfg. & Supply Co.
Van Nuis, C. S.

Dynamos.
Ball Electric Light Co.
Brush Electric Co.
Detroit Electrical Works.
Diamond Electric Mfg. Co.
Duplex Electric Co., Ltd.
Easton Electric Co.
Fort Wayne Electric Co.
General Electric Co.
Gregory, Chas. E.
Heisler Electric Co.
La Roche Electric Works.
Lovell Mfg. Co., Ltd.
Mather Electric Co.
National Electric Manufacturing Co.
Rose Electric Light Supply Co.
Royal Electric Co.
Schuyler Electric Co.
Siemens & Halske Electric Co.
Standard Electric Co.
Waddell-Entz Company.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

Electric Lava Gas Tips.
Smith, A. T.

Electric Railways.
Detroit Electrical Works.
Edison General Electric Co.
Rae, Frank B.
Siemens & Halske Electric Co.
Thomson-Houston Electric Co.
Westinghouse Electric & Mfg. Co.

Electrical and Mechanical Engineers.
Bryan, W. H.
Leonard & Co., H. W.
Rae, Frank B.

Electrical Instruments.
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Electrical Supply Co., The.
Greeley & Co., The E. S.
Western Electric Co.

Electrical Intelligence.
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Leonard & Co., H. W.
Rae, Frank B.

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Andrae, Julius.
Bryant Electric Co.
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Cutter Electrical & Mfg. Co.
Electric Engineering & Supply Co.
Ries Electric Specialty Co., The.
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Electrical Supply Co., The.
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Detroit Electrical Works.
Thomson-Houston Electric Co.

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Ball Engine Co.
Ball & Wood Co., The.
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Lane & Bodley Co., The.
Morse & Co., A. M.
N. Y. Safety Steam Power Co.
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Taylor Engine Co.
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Kartavert Mfg. Co.
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Knapp Electrical Works.
Partrick & Carter Co.
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Knapp Electrical Works.
Sperry Elec. Mining Machine Co.

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Detroit Electrical Works.
Knapp Electrical Works.
Partrick & Carter Co.

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Andrae, Julius.
Beacon Vacuum Pump & Elec. Co.
Bryant Electric Co.
Central Electric Co.
Cutter, Geo.
Cutter Electrical & Mfg. Co.
Detroit Electrical Works.
Edison General Electric Co.
Electric Cons. & Supply Co.
Electric Engineering & Supply Co.
Electrical Supply Co., The.
Enterprise Electric Co.
General Electric Co.
Greeley & Co., The E. S.
Hart & Begeman Mfg. Co.
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Vulcanized Fibre Co.
Wannopee Pottery Co.
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Insulated Wires and Cables.
Magnet Wire.
Central Electric Co.
Crescent Ins. Wire & Cable Co.
Cushing, F. W.
Cutter, Geo.
Detroit Electrical Works.
Eastern Electric Cable Co.
Edison General Electric Co.
Electrical Supply Co., The.
Enterprise Electric Co.
Holmes, Booth & Haydens.
International Okonite Co., The.
India Rubber & Gutta Percha Insulating Co.
Knapp Electrical Works.
National India Rubber Co.
New York Insulated Wire Co.
Roebling's Sons Co., J. A.
Sperry Elec. Mining Machine Co.
Waddell-Entz Company.
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Edison General Electric Co.
Electrical Supply Co., The.
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Van Nuis, C. S.

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Crocker-Wheeler Electric Co.
Chicago Electric Motor Co.
Detroit Electrical Works.
Diehl & Company.
Easton Electric Co.
Edison General Electric Co.
General Electric Co.
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Worthington, Henry R.

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Detroit Electrical Works.
Lefmann, Julius.
Railway Equipment Co.
Schindel & Schindel.

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Andrae, Julius.
Central Electric Co.
Cushing, F. W.
Crescent Ins. Wire & Cable Co.
Eastern Electric Cable Co.
Edison General Electric Co.
Electrical Supply Co., The.
India Rubber & Gutta Percha Insulating Co.
International Okonite Co., The.
New York Insulated Wire Co.
Standard Paint Co.

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Central Electric Co.
Electric Secret Service Co.
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Knapp Electrical Works.
Western Electric Co.

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Detroit Electrical Works.
Western Electric Co.

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Greeley & Co., The E. S.
Knapp Electrical Works.
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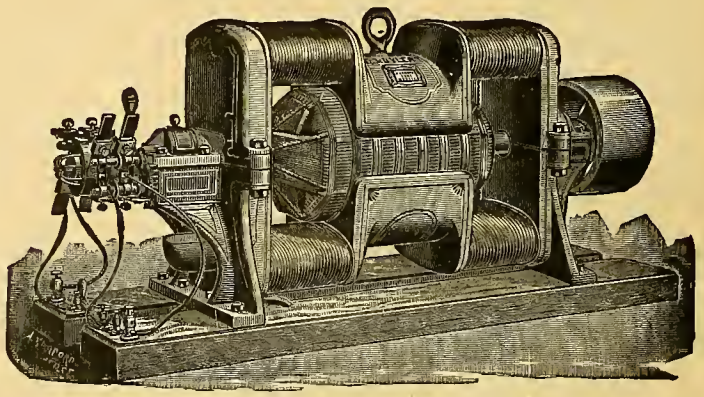

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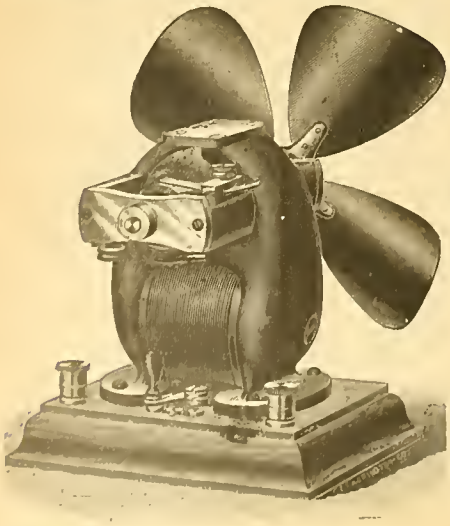

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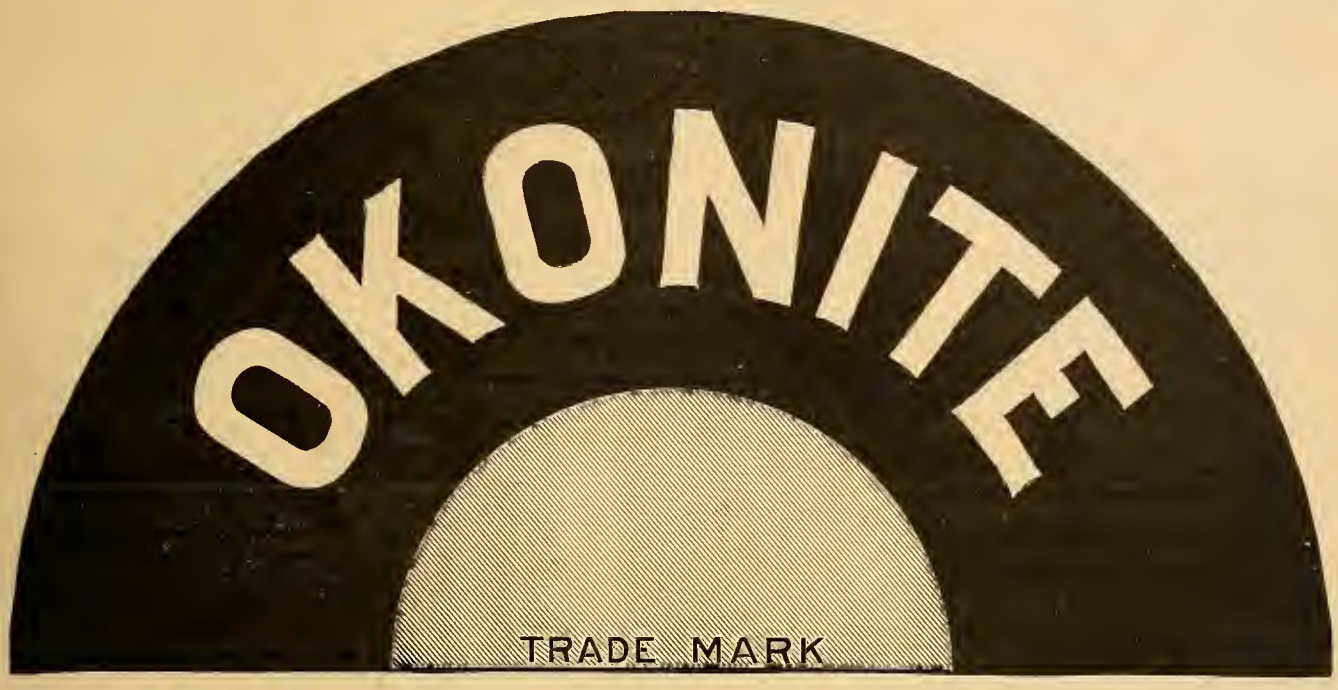

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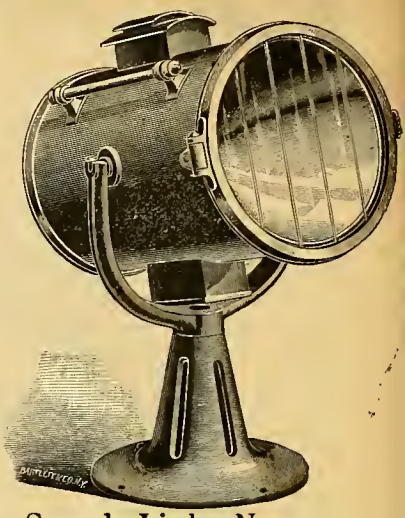

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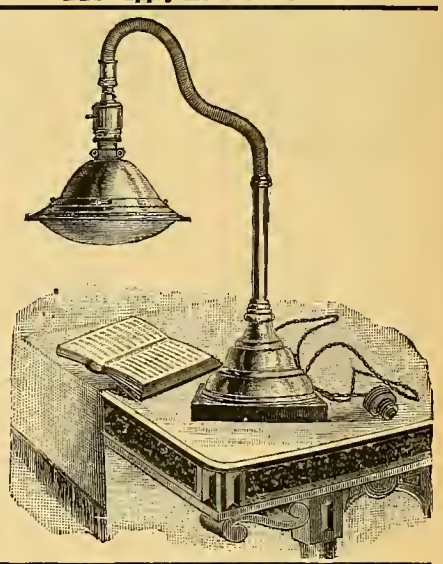

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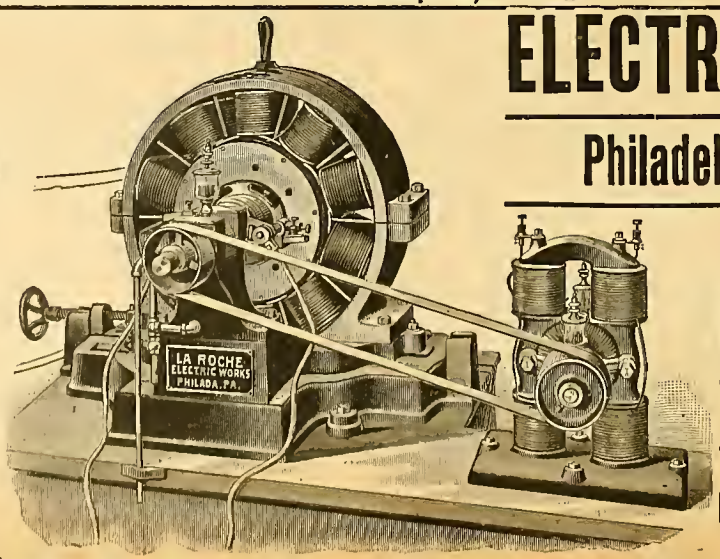

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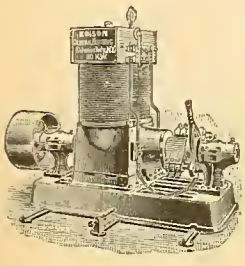

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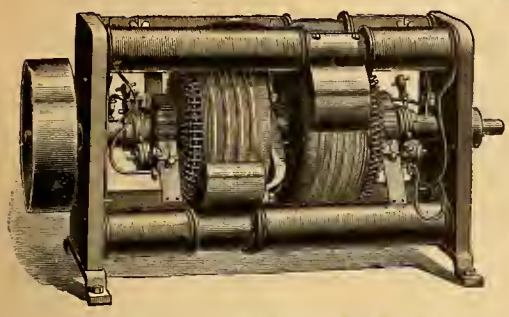

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The BALL ELECTRIC LIGHT COMPANY is proud of its past record. It has conducted its enterprise upon strict business principles, and has gained a reputation which, though often attacked by the make-up of the present "Combine," has never yet been injured. The Company's stockholders are happy; so are its patrons. It is now prepared to go "a step better," and herewith announces the completion of the new

BALL AUTOMATIC DYNAMO.

Beginning with the season now opening, we are placing on the market an AUTOMATIC DYNAMO. Do not think from this that we are offering in place of our celebrated dynamo any new and untried departure, or that we are offering our old dynamo with some external complicated mechanism called "an automatic regulator" of little merit save in name only.

We are placing the justly praised BALL **Dynamo** as simple as of old, but containing **within itself** the power of self-action and adjustment to the varying conditions of the load that may be brought upon it.

The AUTOMATIC DYNAMO is as much superior to a dynamo with an automatic regulator as the modern automatic cut-off engine is superior to the old slide-valve with its external throttling governor.

We extend our thanks to our business rivals and their agents, who in the past have materially assisted us with the admissions that "the Ball was a good, or was the **best**, arc dynamo, **but it had no regulator**."

Its merits have been so generally recognized by the trade that it is not here for us to praise it now. We will only say that in the future, as in the past, we will have nothing in it to excuse or apologize for.

We ask intending purchasers to write us for quotations before purchasing elsewhere.

SEND FOR NEW ILLUSTRATED CATALOGUE NO. 17. JUST ISSUED.

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Factory: 281 to 289 Ninth Avenue and 404 to 416 West 27th Street, New York City.

GENERAL ELECTRIC COMPANY.

MAIN OFFICES:

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173, 175 Adams Street, Chicago, Ill.
Gould Building, Atlanta, Ga.
264 West Fourth St., Cincinnati, O.
44 Broad Street, New York City.
509 Arch Street, Philadelphia, Pa.
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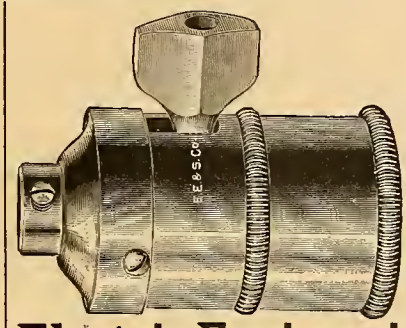
401-407 Sibley Street, St. Paul, Minn.
15 First Street, San Francisco, Cal.



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For all Standard Systems.

Porcelain or Rubber Key.

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QUADRUPLED SALES

Attest their Great and Increasing Popularity.

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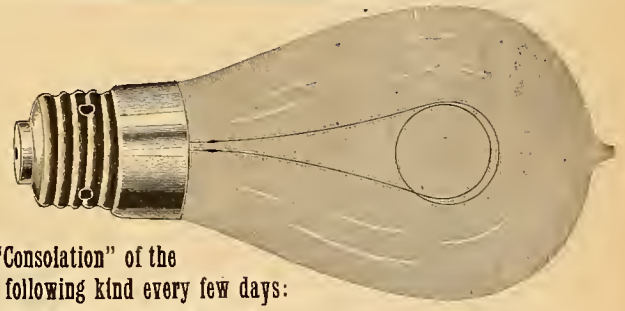

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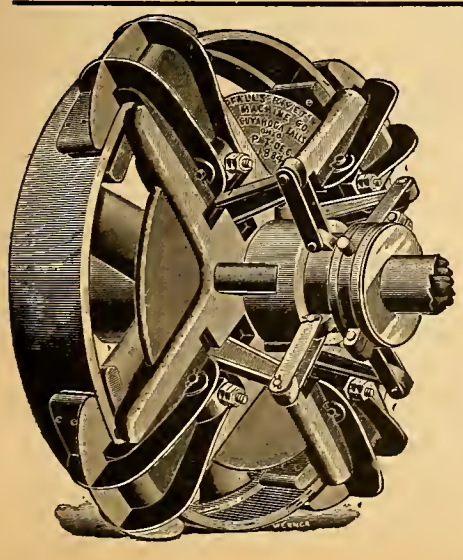
GENTLEMEN:—The 250 "Buckeye" Lamps prove satisfactory. You may enter our order for 1,000 to be shipped at your early convenience. Very truly yours, ...

LONG LIFE, SPLENDID LIGHT, NON-BLACKENING. } *SOME of the "GET THERE" Qualities of the* **"BUCKEYE."**

THE BUCKEYE ELECTRIC CO., Cleveland, O.

CHICAGO, 437 "The Rookery."
NEW YORK, 611 Mail and Express Building.



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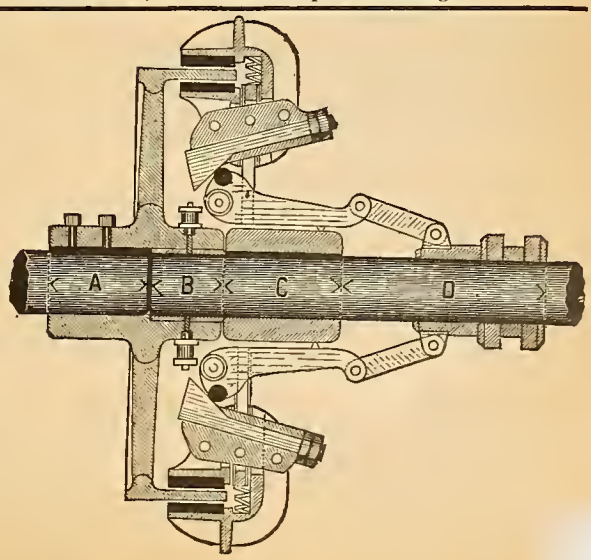

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FOR ALTERNATING CURRENT INCANDESCENT LAMPS, IS BEING UNIVERSALLY ADOPTED.

THE RIES ELECTRIC SPECIALTY CO., Sole Patentees and Manufacturers, BALTIMORE, MD.

NOTICE TO THE TRADE.

We have sued H. T. Paiste, of Philadelphia, Penn., for infringement of our patent on Eccentric Snap Switches. The trade will please note that we have no intention to annoy them, but have sued the manufacturer of the infringing switch. The case will be pushed to an early hearing and it is not too much to ask that the trade will in the meantime respect our patent rights and await the decision of the Court in the case.

THE HART & HEGEMAN MANUFACTURING CO.,

Manufacturers of the Hart Switch. HARTFORD, CONN.

FOR SALE CHEAP.

Three 500 Lt. T.-H. Dynamos, Compound Wound, 110 volt, with Base, Rheostat and Ammeter.
Two 1,000 Lt. Fort Wayne Alternators, complete.
Two 25 Lt. American 2,000 C. P. Arc Dynamos.
One 50 Lt. Sperry 2,000 C. P. Arc Dynamo.
One 600 Lt. Edison Dynamo—not the latest style.
Twelve Knowles 12 Lt. Arc Dynamos with Lamps.
Nine 30 Lt. Westinghouse Arc Machines, 2,000 C. P.
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One 60 Lt. Vandepoele Arc Machine, with two Armatures and 25 Double 2,000 C. P. Lamps.
Twelve 50 Lt. Schuyler Dynamos, 2,000 C. P.
One 20 Lt. U. S. Arc Machine with 20 Single L'ps.
One 300 Lt. U. S. Dynamo, 110 volt, with complete Station Fixtures.
One 300 Lt. U. S. Dynamo, 50 volt, no Fixt. but Base.
One 200 Lt. Mather Dynamo, 110 volt, no Fixtures but Base.
Six 30 Lt. Excelsior Dynamos, Arc, 2,000 C. P. with Single Lamps.
One 100 B. P. Ball Engine.
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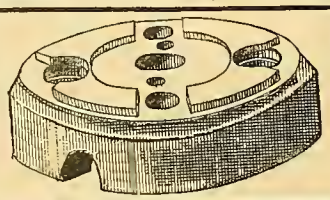
Non-Conductive Blocks, Rosettes and Bases for Cut-Outs and Switches.

Also Insulators, Cleats, Lamp Trimmings and other Electrical Supplies.

Our production is a dense body. The glazing and body of our ware are of same composition, and are baked alike, which are the features of

True Hard Porcelain.



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UTICA, N. Y.

MANUFACTURERS OF

"HERCULES" SWITCHES for Arc and Power Circuits.
"UTICA" QUICK BREAK—ABSOLUTE LOCK—KNIFE SWITCHES for any voltage and amperes.
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CARBON BRUSH HOLDERS for Generators, Motors and Dynamos.
CARBON HOLDERS, CIRCUIT JUMPERS and CONNECTORS.
Also General Dealers in ELECTRIC LIGHT and POWER SUPPLIES.

TAYLOR ENGINE COMPANY,

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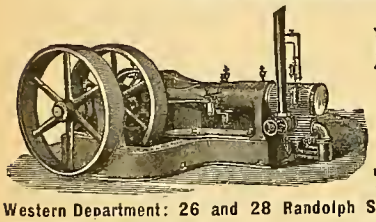

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Two horse power to three hundred horse power.

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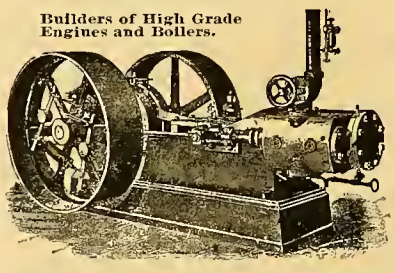
NEW YORK SAFETY STEAM POWER CO.,

Builders of High Grade Engines and Boilers.



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Complete Steam Plants Installed.

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MILTON THOMAS, Agent.
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Electric Railway Supplies

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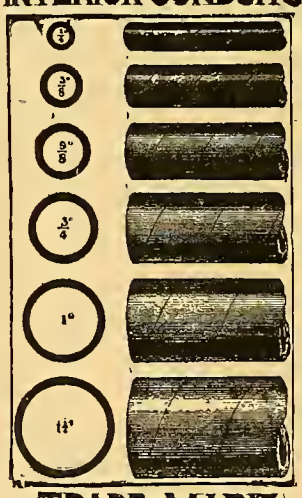

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Wherever and for whatsoever purpose employed, is to be found in the

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SAVES MILEAGE OF CIRCUITS.

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SECURES PAYMENT FOR ALL CURRENT USED.

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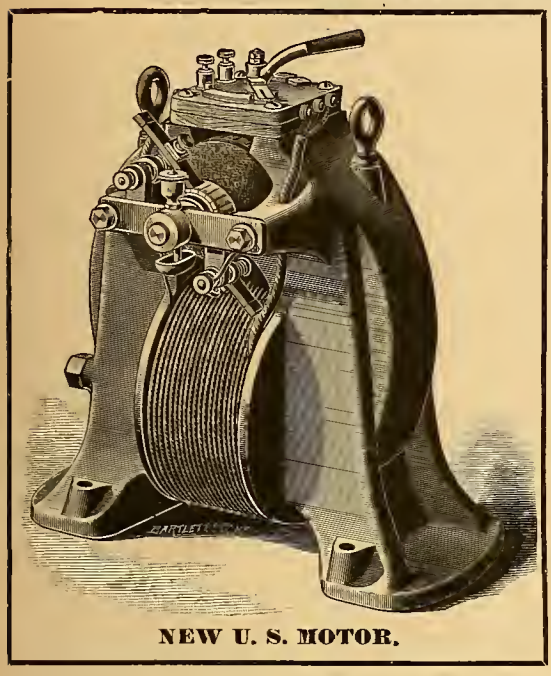

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Automatic Dynamos. — Perfect Devices.

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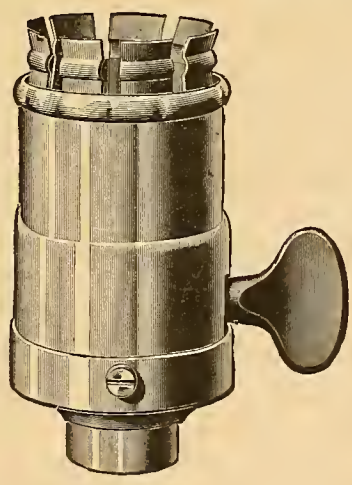

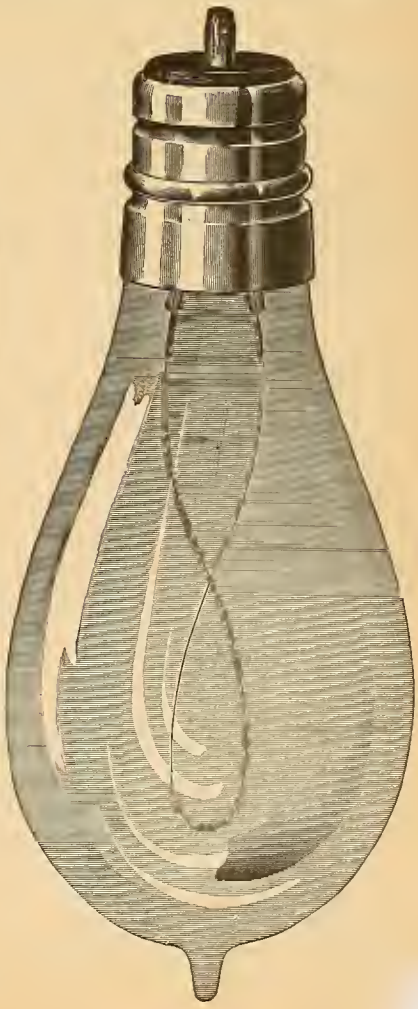

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AUTOMATIC ENGINES

SUPERIOR REGULATION AND ECONOMY FOR ELECTRIC LIGHTING AND GENERAL PURPOSES

16 SIZES CARRIED IN STOCK

WE TEST EACH ONE OF OUR ENGINES BEFORE SHIPPING

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EVERY ONE KNOWS

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We can furnish at bottom prices

Leclanche, Andrae Carbon, Laclede, Samson and Law Batteries.

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Is the most durable for hanging Arc Lamps, Trolley Cord, Covering Field Magnets, Seeh Cord, etc., etc.

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Alternating and Continuous Current Dynamos and Motors,

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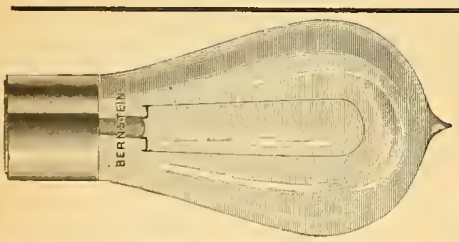
THE MOST COMPLETE ALTERNATING SYSTEM NOW ON THE MARKET.

Agents Wanted for Exclusive Territory.



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SLOW SPEED, MULTIPOLAR DYNAMO.

ADVANTAGES: Slow speed, small floor space, direct driven, self-oiling bearings, little external magnetism, etc.

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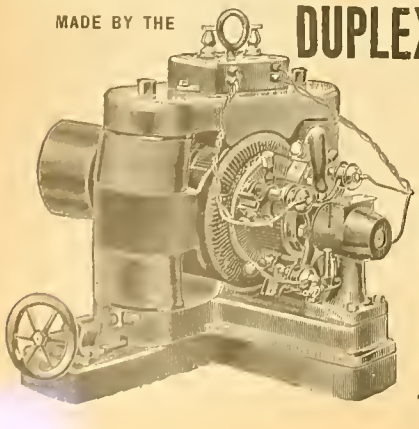

Boston Office—H. C. Hawke, Manager, 620 Atlantic Ave.
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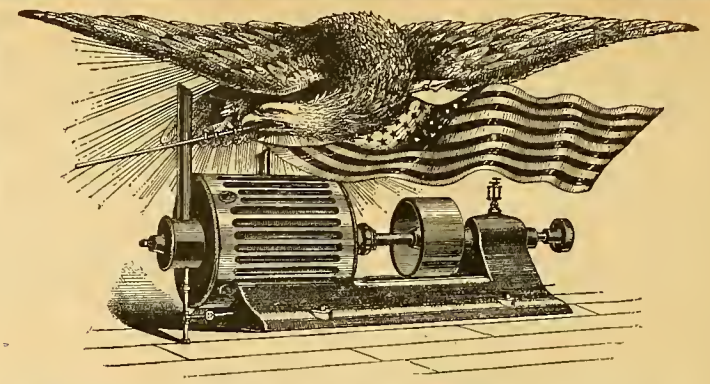

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This Engine revolutionizes the manner of applying steam in generating power. It can be regulated so as to run at any speed desired, up to

1000 OR MORE REVOLUTIONS PER MINUTE !

It is not a rotary Engine, yet the motion of its parts is such that there are no "dead centers." It takes steam and exhausts four times at each revolution. For

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this Engine has no equal. It possesses many striking advantages over all other Engines, either slow speed or so-called high speed. Its speed is closely regulated by a sensitive and reliable automatic governor. Built of any required size,

FOR ALL STATIONARY AND MARINE PURPOSES.

It can be **coupled directly** to dynamos, fans, blowers, fire engine and other rotary pumps; in fact, to **any** machine requiring great velocity. It is smooth running and **noiseless.** Being light and compactly built, it takes up less room than any other Engine of equal power. No heavy foundations are required. This Engine is

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No skilled engineer is required.

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HINE'S ELIMINATOR.

THE ACKNOWLEDGED SUPERIOR OF ALL

Steam Separators and Oil Extractors.

In twelve trials in the "Cornell" Separator test, it averaged 98 7-10 per cent Dry Steam. Outstripping all competitors.

Send for Circular and Cornell test report.

VERTICAL.

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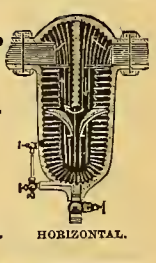

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The WADDELL-ENTZ COMPANY,

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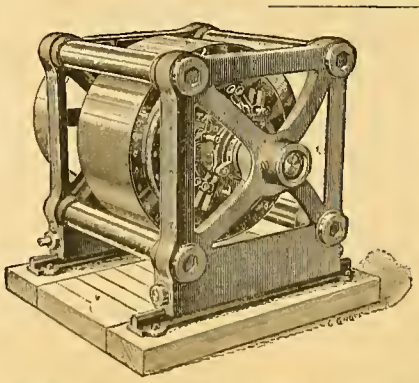

Improved Slow-Speed Generators and Motors. "DIRECT-DRIVEN" Slow-Speed Generators for Electric Lighting and Power. Low Running Expense. Insulated Wire and Flexible Cords. Estimates furnished. Isolated Plants a specialty.

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WORKS AT BRIDGEPORT, CONN.

Western Electrician.

EVERY SATURDAY.

Vol. XI. CHICAGO, AUGUST 6, 1892. No. 6.

Electricity at the World's Fair.

No decision in relation to the contract for the electric launches at the World's Fair was arrived at by the ways and means committee last week. A joint meeting of that committee and the committee on grounds and buildings was held on Tuesday. It was agreed that electricity should be used and then it was left with the ways and means committee to definitely award the contract. Although the Columbian Launch company was recommended by the construction department, the bid of that company was not so favorable to the Exposition as that of the Electric Launch & Navigation company. When the bids were opened on March 17th it was seen that the former company offered the Exposition company 31 per cent. of its gross receipts for the privilege, while the bid of the latter was 33⅓ per cent. This fact, of course, had due weight with the committee on ways and means, which keeps a sharp eye on the finances of the exposition. H. N. Higinbotham, who is chairman of the committee and acting president of the Exposition company, met representatives of the rival companies at his residence and suggested a compromise by which each company should have a portion of the business at a uniform percentage. It is claimed that the Columbian people refused to agree to this, however, and no conclusion was reached. It was announced on Saturday that a decision might be expected in a few days. It is highly important that the matter be settled as soon as possible to enable the successful company to begin work on the boats.

Second in interest only to the electricity building itself, at least to the electrical fraternity, is machinery hall, which will contain the great central station plant for light and power. This building is the second largest on the grounds, and consists, essentially, of three series of arches. Its present appearance is indicated by the excellent photographic reproduction presented on this page. The space set aside for the dynamos, engines and boilers of the electrical plant is on the southern side of the building and contains about 70,000 square feet. A diagram of the ground floor of the building, showing the portion reserved for the service plant, was published in the WESTERN ELECTRICIAN of January 16th, and a brief outline of the arrangement of the dynamos was given last week.

Francis Broadnax, of the Mt. Morris station, New York city, has been appointed by the New York Insulated Wire company chief engineer of the wiring and construction work for the Westinghouse incandescent installation at the World's Fair, the former company having the sub contract. Mr. Broadnax is in charge now, and has a desk in Superintendent Keller's office in the horticultural building. About fifty men are now employed on the work, but after August 20th, the date of Mr. Broadnax's return from a contemplated trip to New York, the number will be rapidly increased until the force numbers three or four hundred. The work of wiring the woman's building for 3,000 lights has already been begun. The Connecticut state building and art gallery are next in order. About half of the ducts and converter pits have been laid. For the lighting of the buildings during the dedication ceremonies in October the Westinghouse company will use two of its familiar alternators, each having a capacity of 4,000 lights. These machines will be belted directly to two 400 horse power engines and will afterward form a portion of the Westinghouse exhibit. The new quarter-phase machines will be coupled directly and will have a capacity of 10,000 lights each. Strictly speaking, each outfit consists of an upright engine and two 5,000 light dynamos on one shaft, but the whole is on one base and is counted as one machine.

The Gamewell fire alarm telegraph boxes will be used at the World's Fair. About 150 will be needed, and half of this number have been installed. The key-holes will be covered with glass panels, which must be broken before the box can be opened in case of fire.

The Lawyers' Surety company of New York has written to the World's Columbian Exposition asking to be relieved from its $500,000 bond guaranteeing the Westinghouse company's contract. It takes this course not from any fear that the Westinghouse Electric & Manufacturing company cannot perform its contract, but because an indemnity bond was required for the surety company itself. This, the Lawyers' company thinks, will have a tendency to discredit its business. The supplementary bond was required by the World's Fair authorities because the New York company gave a bond for the full amount of its capital stock. Attorney Carlisle has advised the Exposition company to keep its bond, and his advice will probably be heeded.

The department of electricity is making every effort to have a complete display of historical apparatus, and Chief Barrett is conducting a large correspondence with this end in view. In reply to a recent request for assistance, W. H. Preece, chief electrician of the British government telegraph service, writes from London that he is "busy collecting historical apparatus for Chicago, and that he hopes to have a full and complete exhibit of instrumeots, showing the growth of telegraphy in England." It is probable that nearly, if not all, of the historical exhibits will be included in the displays of individual exhibitors, and will not be grouped together. Thus, Mr. Preece's showing of English telegraph instruments will undoubtedly be displayed in the British section, while the Western Union company will exhibit some historical apparatus, and the development of the telephone will be illustrated by the elaborate exhibit of the American Bell Telephone company. Other exhibitors will show interesting apparatus used by Franklin, Faraday, Henry and other scientists. The present plan does not contemplate a general departmental exhibit of this character, as was at one time projected. It will, however, admit of a complete, although segregated, display, without expense to the exposition.

President C. C. Bonney of the World's Congress Auxiliary of the World's Columbian Exposition, has received an interesting letter from Prof. Elisha Gray, the head of the department of the electrical congress, who is now in Europe. The letter was written at the Hotel Windsor, in London, and is dated July 14th. Following is an extract:

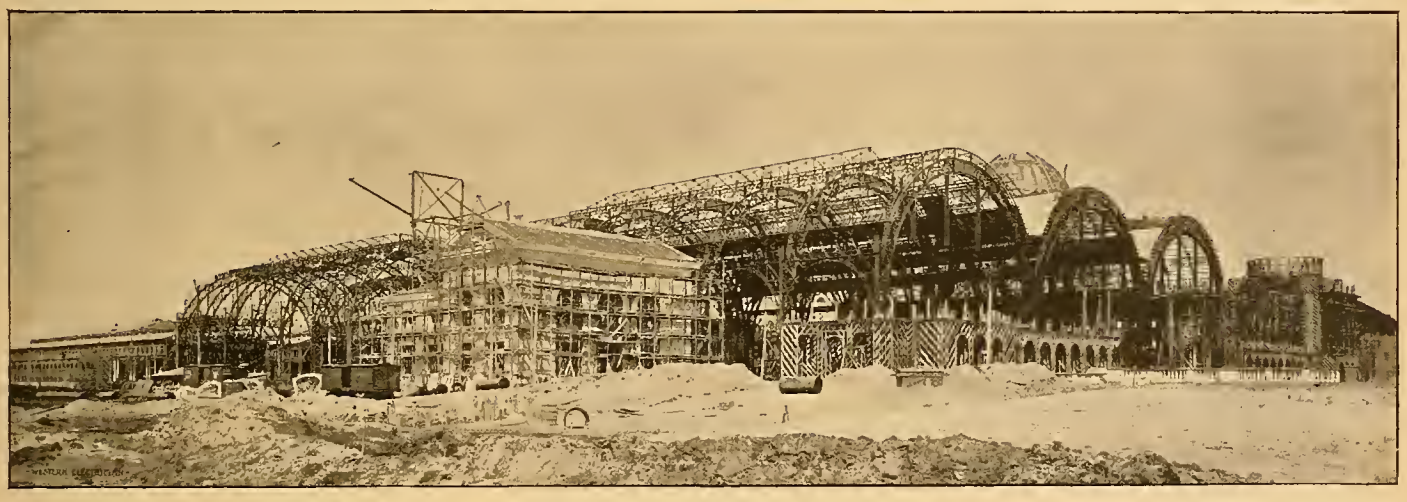
I promised to drop a line to you from this side, and tell you how things seemed to be shaping for our electrical congress next year. I have had an extended trip on the continent, including Italy, Greece, Turkey, Austria, France, etc. Of course there is not much to be expected from these far-off countries in the matter of electricity, but everywhere I found preparations going on for the great fair. Casts were being made of the celebrated pieces of statuary in Rome, Athens, Constantinople and other cities,

I passed hurriedly through England and France to join my family in Rome, leaving the work to be done on my return trip. Each city I visited gave me a warm reception but notably Vienna, Paris and London, where many electricians reside and where I am best known.

I was presented to the scientific societies of France, which gave me opportunity to present the matter of electrical congress in the most favorable way. While France and Austria were very cordial in their support, and did everything they could, they are still not able to give that support, in numbers at least, that England will. I find the scientific people here very cordial and quite in earnest, and anxious to make the coming World's Congress of Electricians the most notable ever held. An active branch of the advisory council will be organized here to co-operate with the American branch in organizing the congress.

In its issue of July 15th the London *Electrician* says:

The application for space in the electrical section of the Chicago Exhibition by English firms is not surprisingly small, but the representation of English electrical engineering is ridiculous. Only 5,000 square feet have been taken up out of the 20,000 which have been allotted. More than one-fifth of this will be occupied by Elwell-Parker machinery, while the only other specimens of dynamo machinery which are promised are those of Parsons and Ferranti. No better types could, perhaps, be selected to attract attention on account of their strong originality. The makers of the biggest dynamo and of the fastest running one ought not to be absent from such a show, and we hope that they will not be disappointed in their venture. One other substantial firm is exhibiting, and Mr. Binswanger knows well what he is doing, but after these a deluge of electrical ventilators and homacoustic speaking tubes and the like. After reading Mr. Preece's list, we are almost inclined to think that there may be something in his idea of a syndicate and a comprehensive show to cover, say another 5,000 feet, with some really first rate selections; but it is not improbable that many dynamo makers agree with the steam engine makers as to the policy of exhibiting at all.



ELECTRICITY AT THE WORLD'S FAIR.

It is reported that negotiations are in progress for the sale of the Electric Railway & Lighting company of Pueblo, Colo., to a syndicate.

Testing Dynamos.

By Foree Bain.

A most important qualification for a good dynamo man is that he possess a fair knowledge of methods of testing. It is, of course, impossible for any one merely to look at a dynamo and say that it is in good condition and that it will behave properly when driven by a belt. The coils of the machine may be painted in the most artistic manner and yet there may still be a "nigger" in it somewhere which will render it useless.

A well informed dynamo man should be able to tell the capacity, condition, and very closely the speed at which a dynamo should run without looking at the maker's card. He should know what the machine's insulation should be, etc.

Between the frame and conducting wires, the insulation resistance should be at least 1,000 ohms or higher for each volt capacity. I would recommend that 1,000 ohms be taken as a minimum resistance and new machinery having a lower resistance should not be accepted. To illustrate, a

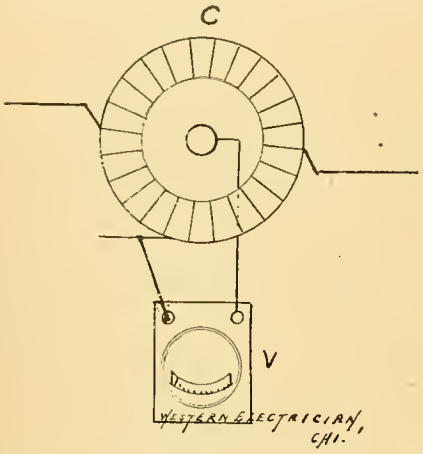


FIG. 1. TESTING DYNAMOS.

dynamo having a capacity of 115 volts should measure, with brushes down, 115,000 ohms between the commutator and the frame of the machine; in this case the armature and commutator alone should measure 230,000 ohms, and the fields should measure 230,000 ohms when put in place with the brushes down. The first thing I hear on presenting the above suggestion is a grumble from the average dynamo man to the effect that he has no Wheatstone bridge. He does not need one though. A Wheatstone bridge is not needed around an ordinary electric light or power station; we can do all that is usually required with a good voltmeter and amperemeter; other devices needed are easily made.

Suppose we want to measure the insulation resistance of a certain dynamo. We are, say, in a railway power plant. We have a good sensitive voltmeter whose resistance we find marked upon it somewhere. Say the marking is 60,000 ohms. Connect this voltmeter across the buss bars and measure the potential; call this reading 500 volts. Leave one end of the voltmeter connected to the buss bar, and connect the other end to one terminal of the dynamo to be tested, which must not be running or be in circuit. From the other buss bar bring a wire and touch the shaft of the suspected dynamo. Suppose you get a 350 volt deflection on the voltmeter, Now to get the resistance in ohms; call the first deflection D, the second deflection d, and the resistance of the voltmeter R. We have the simple formula

$$\frac{D \times R}{d} - R = \text{ohms, or } \frac{500 \times 60{,}000}{350} - 60{,}000 = 25{,}714$$

ohms. This is the insulation resistance of the entire machine, and it is only 5% of what it should be. Now to locate the portion of the machine which contains the "nigger." Raise the brushes from the commutator and repeat the operation. Suppose this time we get a deflection of only 3 volts. This is the measurement of the field without the armature. By the same formula we find the insulation to be nearly ten megohms. The trouble is, therefore, evidently in the armature. It may be that the armature is "green," that is, has not been sufficiently baked. In this case the leak is not confined to any special coil but is distributed through all of them. This trouble, as is well known, can be remedied by baking in an oven for five or six hours at a heat not exceeding 150 degrees. If you cannot tell by looking at the armature whether it is simply "green" or has a bad coil, put a belt on, close the field circuit and run it at proper speed and connect the voltmeter as shown in Fig 1. If the armature is simply "green" the needle will be deflected eight or ten volts. You will note that in the diagram the contact on the commutator is made at a point nearly midway between the brushes so as to obtain a low potential. The object of this is to prevent a too violent swinging of the needle should the trouble be in only one or two coils. It should be borne in mind that all that is wanted in this case is to get a deflection; the degree of deflection is immaterial. If the trouble is confined to only a few coils the needle will vibrate violently over five or six degrees, that is, the pointer will appear as an indistinct blur. Now we have found that there is a connection between one or more coils and the core of the armature. The next thing to do is to locate these coils so that they may be removed if necessary.

Referring to Fig. 2. B is a single cell of storage or other good battery. Several Leclanche cells in parallel, however, will answer. Connect an adjustable resistance R in series with this battery and touch the terminals 1 and 2 opposite segments in the commutator. The ampere meter A should be very sensitive and not register more than 25 amperes. A few turns of heavy wire, say, No. 10 or 12 magnet wire with a compass inside, will answer instead of the ampere meter. Connect one side of this instrument to the armature shaft, and the remaining terminal to the commutator midway between brushes 1 and 2. The contacts on the commutator and shaft should be made so that the armature can be easily turned in its bearings. Adjust the resistance so that not more than three or four amperes will pass between the brushes 1 and 2. Now close the circuits and the needle of the ampere meter will be deflected more or less. Gently rotate the armature, a section at a time, until the neeedle of the armature returns to zero or until there is no current through the ampere meter circuit; you will find the damaged coil immediately under brush 3, or directly opposite it.

The larger the capacity of the armature, the greater care must be exercised in making this test, and the needle must be placed so as not to be affected by the magnetism of the armature.

It sometimes happens that a short circuit in a commutator or a short circuit within one of the coils on an armature will be discovered after it has been all connected after rewinding. A defect like this can be found in the usual way, that is, by running the armature in an excited field and waiting to see which coil will burn out. This remedy, however, is like killing a horse to determine whether he was in good health. There is a better way to locate such a trouble. Refer now to Fig. 3, which is identical with Fig. 2, except that both terminals of the ampere meter are connected to the commutator at points directly opposite and midway between brushes 1 and 2. These brushes, 3 and 4, are connected on an arm together and must be moved around slowly until the needle comes to rest at zero. If this point is found when the brushes 3

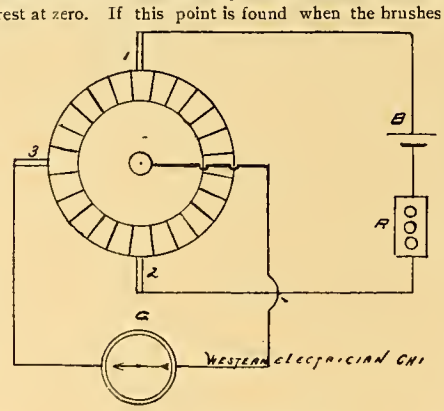


FIG. 2. TESTING DYNAMOS.

and 4 rest on sections exactly intermediate between brushes 1 and 2, then the two sides of the armature are of exactly equal resistance and no short circuit exists in either the commutator or armature. If it becomes necessary, though, to move brushes 2 and 3 to the right or left in order to get the needle to zero, then the short circuited section is in that portion of the armature opposite the space on the commutator marked by the greatest number of sections embraced between brushes. By marking the sections under the brushes and then turning the armature to new positions, the short circuited coil may easily be located.

The advantages of these tests are that the trouble can be found without unsoldering a connection and without burning out or injuring in any way any part of the armature. It frequently happens that if you know the coil in which there is trouble, you can find and remedy it without rewinding.

A dynamo will frequently "sweat" and cause heavy leaking to the frame. This is caused by currents of hot and cold air alternately striking the machine, or in very many cases it is caused by cold dynamo rooms. When a dynamo or a motor is located in a cold place it should not be started on a full load. The heating of the coils by the flow of current around the heavy masses of cold iron causes a condensation of moisture. Then if the insulating medium between the frame and conducting coils contains any free acid or alkali, this will so increase the conducting quality of the moisture as to produce a very sensitive leak or short circuit. For this reason asbestos is a bad insulator. Pure water is a very poor conductor, but a trace of acid very materially increases its conductivity.

If you have a machine that has become damp and leaks, put it into the bake oven, at the same time put current into it from another source, and gradually increase the current for a period of six hours until about 20 per cent. more than its rated capacity is reached. Fasten the armature so that it will not turn around during the leakage process; by this means you can dry it out without injury.

The best way to test for capacity, is by a run on a full load for ten hours. The conducting wires should not heat more than 50 degrees above normal temperature. After the run is over, immediately place a thermometer on the armature wires; take some putty and plaster around and over it and leave it in this position forty minutes. Place another thermometer on the field coils in like manner, and place one also on the pole pieces. In a dynamo place it on that horn which the armature leaves; in a motor place it on the horn that the armature runs toward. All of the heat does not come from the conducting coils; a great deal of it is due to hysterisis and eddy currents. To test for these, leave the armature circuit open, and energize the field from another source, and run it for ten hours and test the heating effect in the same manner.

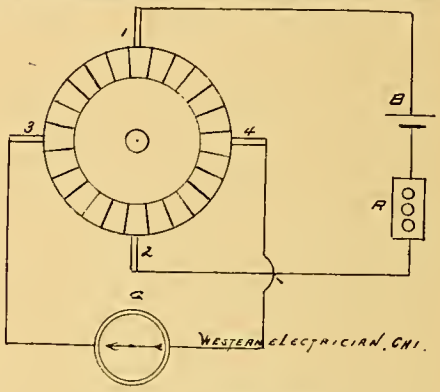


FIG. 3. TESTING DYNAMOS.

If a dynamo is properly proportioned and constructed, the size and length of wire on the armature should very closely determine its capacity. But this is not always the case. There are a great many conditions that vary the capacity of a machine. As an illustration a certain 10 ampere arc dynamo, well known to the trade, has its armature wound with about equal quantities of No. 10 and No. 11 American gauge wire; another maker of 10 ampere arc machines equally as well known as the former winds his armatures with No. 18 American gauge wire.

Convention of Edison Companies.

The annual convention of the Association of Edison Illuminating Companies will be held at Toronto on August 9th and may continue three days. The business of the association at this meeting promises to include several features of special interest. Officers of the General Electric company, it is announced, will be present with the view of becoming personally acquainted with the members of the association, and of discussing, if opportunity offers, matters of general interest. Arrangements have been made for several papers of practical importance and reports of committees chosen at the meeting of last year. The headquarters of the association at Toronto will be at the Rossin House.

The Toronto Incandescent Electric Light company has arranged an attractive programme for the entertainment of the delegates in the form of a moonlight sail on Toronto Bay, calling at Toronto Island, where refreshments will be provided for the delegates at Hanlan's Hotel; also a drive in carriages around the city.

It is probable that a trip to Peterborough, where the shops of the Canadian department are located, may be made, leaving Toronto at 9 A. M., arriving in Peterborough at 11:45; taking lunch at the Oriental and devoting the afternoon to an inspection of the works; leaving at 5:45 and arriving in Toronto at 8:10 P. M.

The officers of the association are: President, John I.

Beggs, Harrisburg, Pa., vice-president, C. L. Edgar, Boston, Mass.; secretary, W. J. Jenks, New York city; treasurer, Wilson S. Howell, New York city; executive committee, A. L. Smith, Appleton, Wis., chairman; C. P. Gilbert, Detroit, Mich.; Thos. P. Merritt, Reading, Pa.; H. J. Smith, New York city; John I. Beggs (ex-officio), Harrisburg, Pa.

It is probable that the next meeting of the association will be held at Chicago during the World's Fair.

The Strowger Automatic Telephone Exchange Apparatus.

In the Strowger system the telephones in use are not changed in any way, but the Strowger machine takes the place of the operator at the switch-board, and makes all connections automatically.

In this system there is on the subscribers' telephone shelf, Fig. 1, a row of keys, five in all. These keys are marked units, tens, hundreds and thousands, the fifth key being the "release key." To obtain a connection the subscriber

FIG. 1 THE STROWGER AUTOMATIC TELEPHONE EXCHANGE APPARATUS.

taps out the desired number on the key-board. This number registers automatically on the exchange machine, Fig 2, and through the action of the exchange apparatus the wire of the subscriber is connected with that of the telephone he desires to reach. The connection is made simultaneous with the taps on the key board. A subscriber wishing to place his transmitter and receiver in connection with those of another can do so by successively pressing the keys which cause the circuit closer to move. For instance if a man at telephone 288 wishes to place himself in connection with telephone 315 he can do so by pressing the keys marked hundreds three times, then the key marked tens once, and the key marked units five times. His circuit closer is now in contact with wire terminal 315, and the person at the telephone No. 315 can take down his telephone and the two are then able to converse with each other.

The whole of one Strowger mechanism, Fig. 3, takes up a space of 6x4x4 inches. A circular disk constructed of hard rubber is the central figure in the machine. This disk is provided with perforations arranged in transvertical and vertical rows. Through the perforations extend the wire connections to the main line wires; their use when in contact with the circuit-closing needle is to conduct the electricity by way of the line wires to the desired sub-station.

A circuit closing arm made in parts, of which one is a circuit-closing sleeve, is firmly attached to the lower end of a sleeve rod. Within this circuit closing sleeve there is closely fitted a circuit closing needle held by a spring in such a manner as to be in perfect electrical contact with the wire terminal. A rod is located along the center line of the cylinder and is free to rotate and move longitudinally. The lower end of this rod is sleeved and into the sleeve is inserted the upper portion of a rachet rod. This sleeve construction allows the rachet rod to have a longitudinal motion only, thereby keeping the rachet teeth continuously toward an attendant pawl. The rachet rod is provided outside of the cylinder, and conveniently below it, with a series of rachet teeth, by means of which the rods are moved longitudinally. Two wheels, through which the rods extend with a feather and groove connection, are kept in contact with the rachet teeth and levers, which have pawls pivoted in their ends. Each lever has a vibratory movement and is oscillated by the alternate energizing and de-energizing of its respective magnet, thereby imparting motion to its adjacent ratchet teeth and consequently to the circuit closing needle.

Each push on the button at the subscriber's station causes, through the channels thus described, the circuit closing needle at the exchange to move from row to row and from wire to wire with its respective lettered magnet. It is understood, of course, that both ends of the wire are grounded or connected with a return tap and also that a battery is used to generate the electricity. This battery is located at the subscriber's station between the keys and the ground. Each perforation of the cylinder is numbered with respect to an initial or starting point.

To end a conversation the telephone is hung on its hook and the release key pressed. Pressing the release key causes the magnet at the exchange to be energized, attracting the armatures, thereby withdrawing the several pawls from engagement with ratchet teeth, and allowing the circuit closer to fall and return to its initial point.

The subscriber is never isolated from the exchange. If number 215 is busy talking with 1,374 and 501 wants 215 he can ring him up, and in this way notify him (215) that there is some one desiring to converse with him. There can be, it is stated, no errors in the call, the same numbers being registered on the disk at the central office; that is the person calling 398 through the key board sees 398 registered on the dial on the telephone in front of him.

The Strowger Automatic Telephone exchange, with a capital of $5,000,000, has been incorporated under the laws of the state of Illinois, M. A. Meyer, president, and J. Harris, secretary, have opened offices at 458 Broadway, New York. The company proposes to begin operations in the East at once. A number of systems, it is said, are now being built and will soon be in operation. The New York offices will be in charge of J. H. Theobald, manager, A. E. Keith, electrician, and H. M. Underwood, contracting agent.

High Tension Transformers in France.

Experiments in high tension work have been carried out hitherto almost exclusively by German, English and American engineers. France is now taking her part in this field of work, and a series of high tension transformers have been recently constructed for MM. Hutin and Leblanc, to be used at the Societe de la Transmission by M. Labour, engineer to the Societe L'Eclairage Electrique. The experiments of MM. Hutin and Leblanc

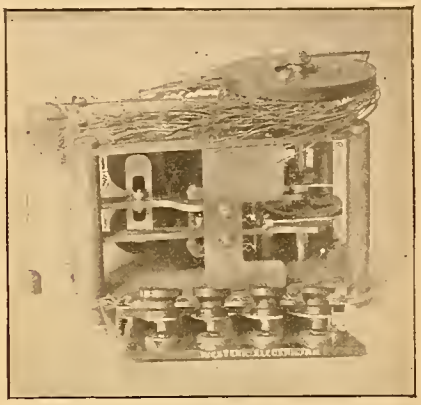


FIG. 3. THE STROWGER AUTOMATIC TELEPHONE EXCHANGE APPARATUS.

have necessitated the construction of transformers of special output. One of these is for a capacity of 6,000 watts, transforming from 150 up to 10,000 volts, with an efficiency of 94 per cent. at a frequency of 80; this transformer can be run up to 30,000 volts without difficulty. Two other transformers of 15,000 watts capacity transform from 25 volts up to 10,000 volts, with an efficiency of 88 per cent. at the minimum, at a frequency of nine, and by increasing the frequency the pressure can be run up without inconvenience to 36,000 volts. Special precaution, says the London *Electrical Engineer*, have been taken to guard against faults. The primary and secondary circuits are entirely separated from each other, and immersed, for one of the transformers, in paraffine and in the two others in oil arranged to circulate freely. It is interesting to note that the length of one of the primary circuits is about 8½ miles. These transformers are constructed for the system of double transformation, transforming both at the generator and at the receiver. This system is now acknowledged to have considerable advantages over the direct method for high tension work. The

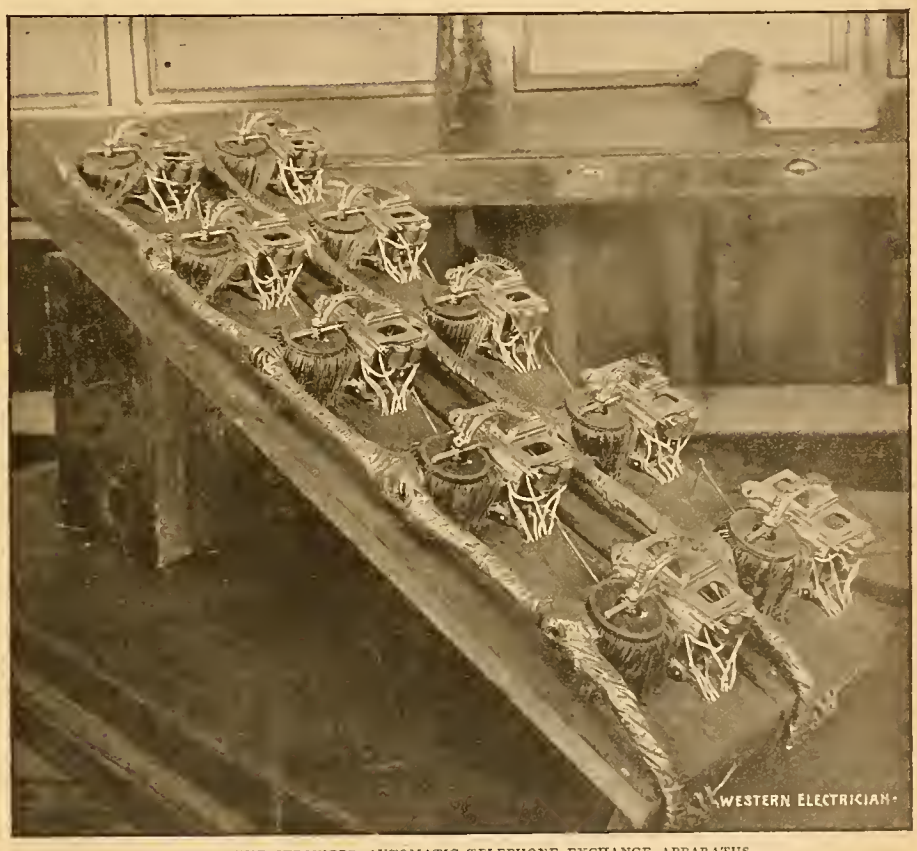


FIG. 2. THE STROWGER AUTOMATIC TELEPHONE EXCHANGE APPARATUS.

low tension dynamos are less expensive, more efficient, and much easier to manage. The danger to the attendants is less, and the material used is cheaper. The efficiency of the transformers is taken in the following manner: The average output of the transformers was raised to 4,000 watts at 25,000 volts, and with a frequency of 43. Two transformers were coupled together for double transformation. The thick wire of the first was connected to a low tension dynamo, and of the second to a set of variable resistances without self-induction, and the two fine wire circuits, at 25,000 volts, were connected together. The energy given at the terminals of the low tension circuit of the first transformers and that received at the non-inductive resistances of the second was measured by ampere meter and volt meter. It was found that the efficiency of each transformer was 94 per cent. at half load. It must be noticed that this supposes the apparent self-induction of the transformers themselves to be nil, and the real efficiency is therefore rather higher than that found. These transformers are the first of their kind built in France, and the result of the experiments has given great satisfaction to the designers and manufacturers.

The Stanley-Kelly Alternating Current Motor.

If an alternating current be caused to flow through the armature coils of an ordinary type of motor having a commutator and armature winding similar to those existing in continuous current generators and motors, and also a field magnet (which should be laminated) energized by

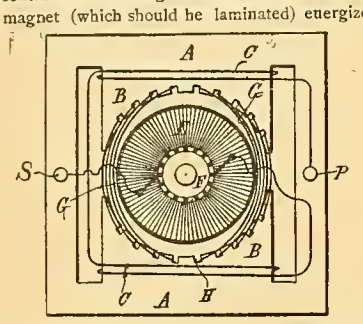


FIG. 1. STANLEY-KELLY ALTERNATING CURRENT MOTOR.

coils in series with, or in derivation to, the armature circuit, such a motor, will, as is well understood, be subject to a given retardation due to the self-induction of the armature. It has been found that this retardation may be, and generally is, sufficient to very seriously impair the efficiency of the machine. This retardation may be neutralized in its effects by the employment in the circuit of a condenser of suitable capacity. But when the whole of the energy to be transmitted must pass through the condenser the latter becomes a large and costly adjunct and the apparatus as a whole becomes less available for general service.

It will be understood, though, that if on the armature a second winding were applied symmetrical with the first, but in which the current passes in a direction opposite to that of the current of the first, no self-induction, and in consequence, no lag, would result. With both windings attached to the armature core, however, no effective torque

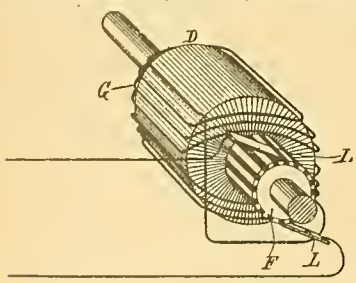


FIG. 2. STANLEY-KELLY ALTERNATING CURRENT MOTOR.

would be developed, as it will readily be seen that each coil would be impelled in an opposite direction.

If, however, only one of such windings be made fast to the revolving armature core while the other is fixed in space, the maximum torque is secured, while the self-induction is reduced to a minimum, since the two windings, as before, will neutralize one another, so far as self-induction is concerned, while the stress due to the field will be transmitted from but one of them to the core. It is not necessary that the two windings should be exactly alike, if only the magnetizing effects shall be approximately equal and opposite.

In direct current motors and generators a somewhat similar disposition of coils to that above described has been employed to neutralize the magnetism imparted by the armature coils, and for the purpose of preventing change of lead. In the Stanley-Kelly alternating current machines the coils are placed exactly parallel to the field magnetization and organized so that they serve as anti-induction rather than anti-magnetization coils. They are closed upon themselves, so that they will be acted upon inductively by the moving armature coils and by the current generated within, and tend, so to speak, to check the rise of magnetism in the armature rather than its ultimate development.

The Stanley-Kelly motor, therefore, consists in the combination, in a machine of the kind described, with the rotating armature and coil or coils on it, of a stationery coil or coils closed upon itself or themselves, adapted to pro-

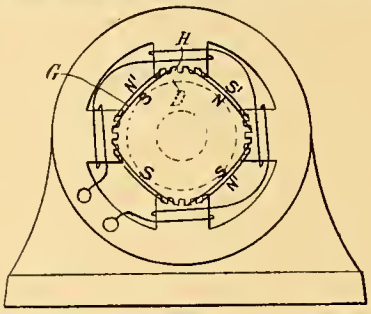


FIG. 3. STANLEY-KELLY ALTERNATING CURRENT MOTOR.

duce an effect approximately equal but opposite to that of the coil carried by the armature, whereby the self-induction and consequent retardation in the armature will be neutralized or overcome.

Such a motor is illustrated in the accompanying cuts.

Fig. 1 is an end view of the motor. Fig. 2 is a perspective view of an armature, exhibiting, diagrammatically, the special winding. Fig. 3 is an end view of a multipolar field magnet with the improvements applied for it.

In Fig. 1, *A A* represent the field core of any ordinary motor; *B B*, the polar projections between which the armature is mounted, and *C C* the energizing field coils surrounding the polar projections. *D* is the armature core, *E* the armature coils and *F* is the usual commutator. *G* designates the stationary coil. This coil is wound in convolu-

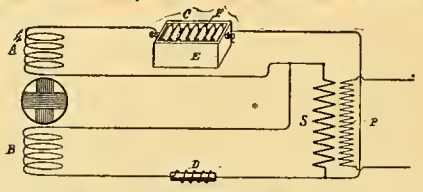


FIG. 4. STANLEY-KELLY ALTERNATING CURRENT MOTOR.

tions parallel to those on the armature and is conveniently contained in grooves *H*, cut in the faces of the pole-pieces.

The relations of the two armature coils are better illustrated in Fig. 2. The armature *D* in this case is wound in the usual way, with a conductor laid, parallel with its axis, in coils connected with the segments of the commutator *F*. The line of commutation is shown by the position of the brushes *L L* and the stationary coil *G* is shown as surrounding the armature, its convolutions being in planes at right angles to the line of commutation.

In Fig. 1 the armature and field coils are in series and the stationary coil is closed upon itself. The stationary coil is shown more clearly in Figs. 2 and 3 as having its ends connected together, the coil being thus in closed circuit.

In Fig. 3 the field core is provided with a number of pole pieces, being, in fact, a type of multipolar machine.

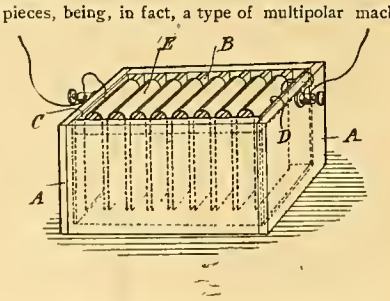


FIG. 5. STANLEY-KELLY ALTERNATING CURRENT MOTOR.

The stationary coils in this case are wound in grooves in adjacent pole pieces, so as to produce an opposite magnetizing effect upon, or in, the armature to that of the armature coils. For example, if the tendency of an armature coil is to produce a north pole in its core at any given point, as *N*, the corresponding stationary coil will have an equal tendency to setting up at the same point an opposite pole. So, in general, where the armature coils act to establish poles *N S* the stationary coils neutralize such action by establishing poles *N' S'*, as indicated in the diagram. The stationary coils *G*, it will be observed, do not sensibly affect the magnetic conditions of the field, owing to their position, but their magnetizing influence is manifested in the armature core, where it opposes that of the armature coils.

In practice the conductors of the supplemental or stationary coils, will be bent aside at one or both ends of the armature to permit the latter to be introduced in, or withdrawn from, the field-magnets, as indicated in Fig. 1.

This arrangement is more particularly applicable to motors; but it may be used to advantage when the machine is run as a generator, for preventing lagging of the current.

Messrs. W. Stanley, Jr., and J. F. Kelly of Pittsfield, Mass., who designed the above described motor, have recently devised what might be termed an improved chemical means of obtaining a difference of phase between two or more alternating currents, such as are derived from a single source, as for example, the secondary of a transformer.

It is well known that if two conducting plates be immersed in an electrolyte by which they are not chemically affected and a current passed from one to the other through the electrolyte, the condition of what is known as "polarization" is realized and an electromotive force established which manifests itself on the fall of the potential which produced it. If in a circuit of alternating currents such a polarization cell be included, the electromotive force of polarization will be greater the greater the number of

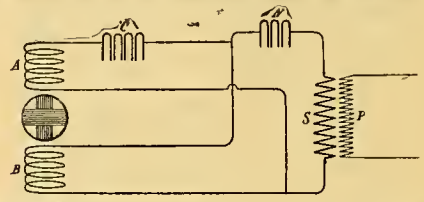


FIG. 6. STANLEY KELLY ALTERNATING CURRENT MOTOR.

couples or pairs in series, and the higher this electromotive force the greater will be the negative lag of the current. In other words, the phases of current will be ahead of the impressed electromotive force in proportion to the excesses of electromotive force of polarization over that of the self induction, which is practically always present. On the other hand, the higher the electromotive force of self-induction in a given circuit the greater the positive lag of current, or, in other words, the farther the phase of current will be behind the impressed electromotive force. Messrs. Stanley and Kelly utilize these effects, they claim, in an efficient and economical manner in any case where it is desired to obtain between two alternating currents a given difference of phase.

The diagram, Fig. 4, illustrates the application of the method to a motor or other device having two energizing circuits through which are to flow alternating currents differing in phase. To explain, let *A B* designate the energizing circuits of a quarter-phase motor to which current is to be supplied from the secondary *S* of a transformer of which *P* is the primary. In one of the circuits or branches from the secondary including one of the energizing coils, as *A*, a polarization cell *C* is connected. This cell should

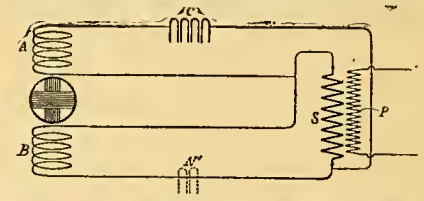


FIG. 7. STANLEY KELLY ALTERNATING CURRENT MOTOR.

have an electromotive force sufficiently high to impart a negative lag of forty-five degrees to the current passing in the circuit. In the other circuit, or that containing the coil *B*, a self induction device *D* is included, that produces a positive lag of forty-five degrees, so that the total difference of phase between the two currents will be ninety degrees.

The manner in which the cells are constructed is indicated in Fig. 5, in which *A* is an insulating trough or box divided into compartments by the partitions *B*. In each partition is a pair of plates, the whole being connected in series through the electrolyte that fills the trough. In the end compartments are plates *C D*, connected with the terminals, and other plates *E*, bent upon themselves, are hung or supported over the partitions *B*. The plates may be of carbon in acidulated water, or of sheet-iron in a solution of caustic potash, and are disposed, as shown, in series.

It is to be observed that in all cases the polarization cell should be so constructed as to perform its proper func-

tion without the breaking down or electrolysis of the electrolyte, and the maximum electromotive force which the cell as a whole is ever called upon to yield should be safely below that which would produce electrolysis. A further point to be observed on account of greater efficiency is to make the resistance as low as practicable.

If the polarization cell in one circuit and the self-induction in the other, are so adjusted as to balance, or, in other words, so that the positive and negative lag will counterbalance, then the current in the main conductor will coincide with the impressed electromotive force, since it will be opposed by a dead resistance only. But such conditions would rarely obtain in practice, so that a lag in the main circuit may usually be expected. To overcome this and therefore to utilize the entire output of the generator in operation of the motor, there is introduced in the main circuit a polarization cell *N*, Fig. 6, the electromotive force of which will neutralize that of the self-induction producing the lag.

It is obvious that no special appliance for producing self-induction need be used if the circuit itself has a sufficiently high self-induction, and it also follows that since both circuits possess more or less self-induction under all circumstances the balance between the positive and negative lag may be secured by inserting the polarization cells of proper capacity in both circuits, Fig. 7, one of the cells N' being indicated in dotted lines.

In the practical application of the invention, compensation for lag by means above described should be made for full load, as it may not be made for variable loads, owing to the reaction of the armature, which is greatest when the full load is on.

American Street Railways.

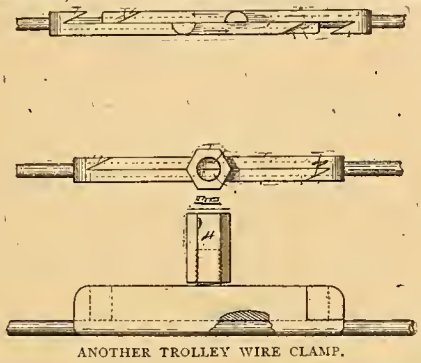
There is probably no other department in which the people of this country have made such marked advancement as in that of transportation. The history of the American street railway is interesting as showing the characteristic tendency of the people toward taking advantage of every minute. The New York *Sun* has printed some very interesting statistics on this subject. According to this authority, the New York and Harlem, now commonly known as the Fourth and Madison avenue line, has the honor of being the first street railway in the world. This line was incorporated on April 25, 1831, and the first cars were run in November, 1832, from Prince street to Harlem bridge. The cars were almost like the stage coaches that were in use then, each having three compartments with side doors. They had leather springs, and the driver sat on an elevated seat in front and moved the brake with his feet.

The opening of the road excited a great deal of interest, and the streets along the route were crowded with spectators. The mayor and the members of the city council and other invited guests occupied the cars. It was thought by many that there would be great difficulty in stopping the cars and avoiding accidents to other vehicles. One of the officers of the road determined to demonstrate that the cars could be brought to a dead stop with ease, and, after having instructed the driver, he stationed himself with some witnesses at the corner of Bond street and the Bowery to await the arrival of the first car. At his signal the driver was to stop with all possible haste. The driver of the first car, having had some experience, brought his car to a stop easily, but the driver of the second car forgot the lever of the brake and simply drew hard on the horse lines and shouted "Whoa." The car slid along and the tongue crashed into the rear of the forward car and caused the occupants thereof to jump out. No one was hurt, and the cars moved on their way to Harlem bridge. This is the first street car collision on record.

For some reason the street railway was not very popular with the residents of the city, and for a time it was not much used by them. Doubtless much of its unpopularity was due to the objectionable nature of the rail employed, it projecting too much above the surface of the street, and was injurious to vehicles. The first rails were made with grooves, or iron gutters, to guide the wheels. The low-step rail now in use was invented and first used in Philadelphia in 1855.

In 1851 street railways in New York were revived by M. Loubat, a French engineer, who recommended wrought iron rails and wooden sleepers, and constructed in 1852 the second street railway in the city—the Sixth avenue line—the charter for which was granted on Sept. 6, 1851. The Second avenue line received its charter on Jan. 21, 1853, and the Third avenue line on Oct. 8th, of the same year. M. Loubat returned to France in the summer of 1853, and the following year he introduced in Paris the new system of American street railways, known abroad generally as tramways, by laying a line of rail from the Place de la Concorde to Passy on the Avenue de la Reine. That was the first horse tramway in France. George Francis Train introduced the horse car line in England at Birkenhead in 1853.

There are 958 street car plants in the United States and Canada now, of which 589 are operated by animals, 50 by cable, 246 by electricity, and 73 by steam. The railway companies in New York seem to prefer the cable to any other improved method of traction. The changes in the Third avenue and the Broadway lines are in that direction. The most serious objections to the cable system are its first cost, the cost of operating and depreciation, and cost of repairs, etc. The cable in use generally measures 1¼ inches in diameter. It is manufactured in lengths of 20,000 feet and weighs about 13,000 pounds to the mile. Its life varies from six to fifteen months, while some have lasted only a few weeks. Each cable of ordinary



ANOTHER TROLLEY WIRE CLAMP.

length costs from $6,000 to $10,000. San Francisco leads the world in the number of its miles of cable roads. In California the cables last longer than anywhere else in this country, owing to the absence of frosts and the comparatively light loads drawn.

The twenty-five city car routes in New York have been operated by seventeen companies, of which the Third avenue line is practically the largest, its total length of track, sidings, etc., being 28 37 miles. Last year it owned 421 cars and 1,740 horses. The Second avenue line last year had 1,900 horses in use. The total length of all the city car lines, excluding the elevated, is 268 miles. Last year 2,378 cars were in use, and 15,280 horses were required to operate the roads. There are 963 miles of tramways opened for passengers in Great Britain.

The working stock consists of 4,067 cars, and animal traction is still the favorite method. In 1891, 9,000 horses were employed and 579 steam locomotives; 565,000,000 passengers were carried, and the receipts were $16,451,000. The value of the tramways is about $70,000,000. The value of the roads in the state is $73,000,000.

The total length of the elevated lines in this city is 32.40 miles. They operate 921 passenger cars, 27 service cars and 291 locomotives, and they carried in 1891 185,833 632 passengers, or an average of 509,132 a day. The shortest street railway in the city is the line through the Central park transverse, from Eighty-fifth street and Fifth avenue, to Eighty-sixth street and Eighth avenue.

The Metropolitan Traction company was organized in 1891, with a capital of $20,000,000, to operate the roads controlled by the Broadway and other companies. It now owns the stock of the Houston, West Street Pavonia Ferry Railroad company, a controlling interest in the Twenty-third Street Railroad company, and all the stock of the Broadway Surface Railroad company.

The movement of passengers over the street cars and elevated roads increased in five years from 272,000,000 in 1884 to 397,000,000 in 1889, an increase of 46 per cent. If the increase for the next five years be proportionate the movement of passengers over the lines will be nearly 580,000,000.

Another Trolley Wire Clamp.

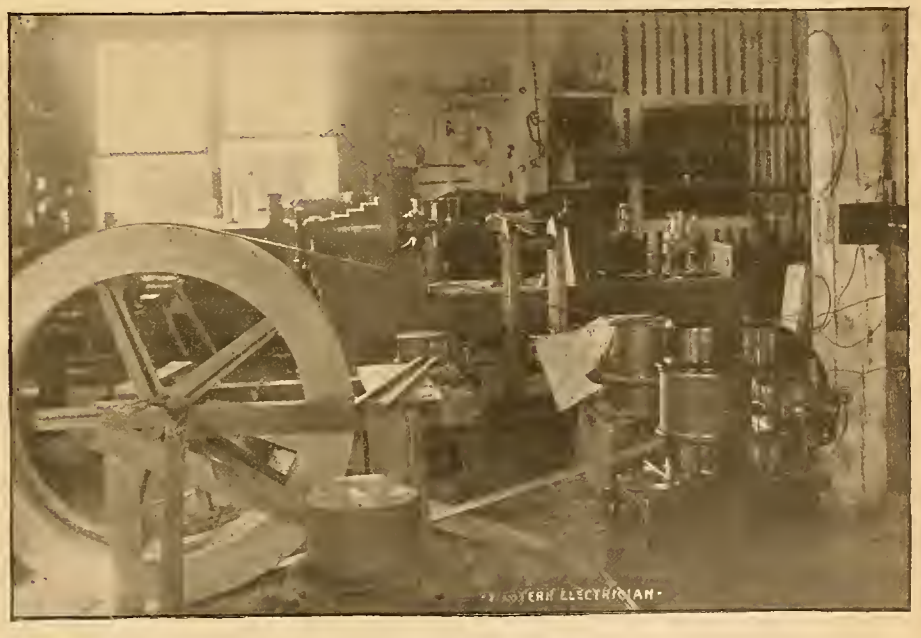
The inner faces of the two jaws which make up this wire clamp are flat save for a rounded groove extending along their lower edges. Above this groove at one end, a tongue projects toward the opposite end of the jaw, the side of the tongue adjacent the inner face of the jaw being so inclined as to leave as shown a *V* shaped space between them. The end of the jaw remote from this tongue has its outer face beveled off above the groove to a plane parallel with the inner face of the tongue so as to form a shoulder. A half cylindrical stem projects upward from the jaw at its middle and has screw threads on its curved side, its flat side being flush with the inner face of the jaw.

To clamp a wire, the two jaws are placed with their inner faces together with the conductor in the grooves. The jaws are then slipped endwise on each other, as indicated, until the tongues engage the beveled ends, the inclined faces of the tongues acting as cams for forcing the jaws tightly together. This clamps the conductor and at the same time locks the jaws together so far as lateral movement is concerned, bringing the flat sides of the two parts of the stem together. An internally screw-threaded nut is then turned onto the stem and securely binds its two parts together. This sleeve also serves as a means for coupling the clamp to its support.

This hanger was devised by J. Ingmanson and R. Lorang, of Chicago.

Unique Motor Installation.

In the installation illustrated in the accompanying cut there is an excellent example of how an electric motor was brought into use through a little Yankee ingenuity to serve



UNIQUE MOTOR INSTALLATION.

purpose of an expensive piece of machinery. The installation is at the Packard lamp works of the New York & Ohio company, Warren, O. The company needed for immediate use a large wooden rim friction pulley, but as there was no lathe at hand suitable for turning the rim the pulley was belted to a motor and the rim faced with hand tools as is clearly shown in the cut, which is a reproduction of a photograph of the installation.

Vice-president Lucius Tuttle of the New York, New Haven & Hartford railroad denies the report that the company is contemplating using electricity for motive power instead of steam.

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CORRESPONDENCE relating to electricity, or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

	PAGE.
Electricity at the World's Fair. Illustrated	71
Testing Dynamos. By Foree Bain. Illustrated	72
Convention of Edison Companies	72
The Strowger Automatic Telephone Exchange Apparatus. Illustrated	73
High Tension Transformers in France	73, 74
The Stanley-Kelly Alternating Current Motor. Illustrated	74, 75
American Street Railways	75
Another Trolley Wire Clamp. Illustrated	75
Unique Motor Installation. Illustrated	75
Editorial	76
Model German Alternating Current Station. Illustrated	77
Human Electricity	77, 78, 79
The Laws of Falling Bodies. Illustrated	78, 79
An English Electric Car with Four Motor Armatures. Illustrated	79
A Peculiar Accident	79, So
Experiments with Alternating Currents. By Dr. Louis Duncan, assisted by E. R. Carichoff and R. H. and G. E. Hutton. Illustrated. Discussion (American Institute of Electrical Engineers)	So, S1
The Cushman Dynamo. Illustrated	81
New Automatic Gear Cutting Machine. Illustrated	81
Electricity in Railroad Shops	81
Electrical Inventions and First Commercial Applications	81

DEPARTMENTS.

Correspondence	S1, S2
New Incorporations	83
Electric Lighting	83
Electric Railways	83
Telephone	S3, S4
Telegraph	S4
Miscellaneous	S4
Trade News	84
Business	84
Electrical Patents	84

CANADIAN electrical affairs ought to show marked improvement if gatherings of the most prominent men identified with the industry can stimulate the people. Less than a year ago the National Electric Light Association held a very successful convention at Montreal, at which a most interesting exhibition of modern electrical apparatus of every description was made. The people of that city, and, in fact, the most prominent citizens of the Dominion, showed their appreciation of the compliment by not only visiting the exhibition and attending the convention, but by opening their doors to the delegates and entertaining them in a most hospitable manner. Montreal will long be remembered by electric light men of this country as a beautiful city and its citizens as leaders among the most munificent entertainers. But this was not the only result of the convention. Interest in electrical matters was aroused. Canadian capitalists began to realize the magnitude of the field of operation opened up by the introduction of electricity in commercial life, and an association somewhat similar to the National Electric Light Association was immediately organized for the purpose of fostering and encouraging electrical enterprises. The first convention of the Canadian association was held recently at Hamilton, Ont., and proved both profitable and interesting in its proceedings to those who attended.

Another convention is now to be held at Toronto, that of the Association of Edison Illuminating Companies. Although this organization, as its name implies, is composed of central station companies using apparatus of the Edison type, its meetings are not devoted exclusively to the discussion of that particular system, and it is quite probable that recent developments will tend to still further enlarge its scope. It is quite probable that, in view of the changes in the relation of the parent company to the other great manufacturing corporations, much more publicity will be given to the proceedings. It is hardly possible that the organization will be allowed to wane, but rather it seems much more probable that it will be encouraged and strengthened, as its power for good, if only as a means of educating the people, has already been demonstrated. The proceedings of the Toronto gathering will therefore be watched with unusual interest by the electrical fraternity. Already the secretary has received assurances from members that warrant him in predicting an interesting programme. In the matter of entertainment of visitors there is no doubt. It is enough to say that the matter has been left entirely to the representatives of the local electrical concerns. The convention, therefore, ought, and no doubt will be highly successful from every point of view, and it will have a lasting effect upon the development of electrical matters in the Dominion.

BEFORE another World's Fair shall be organized in this country it ought to be clearly understood that the government shall bear its fair share of the expenses. At present Congress sends out the invitations and interferes with the local management, but leaves the local promotors of the Fair to pay the piper.

The above paragraph from the Philadelphia *Ledger* tells in a few words the story of the present disgraceful delay at Washington in World's Fair matters. The WESTERN ELECTRICIAN does not dabble in politics, but it takes the greatest interest in everything that bears upon the success of the coming exposition. For this reason it wishes to go on record with many others in protesting against the malicious manner in which certain soreheads still continue, both directly and indirectly, to spread broadcast the false impression that the World's Fair is merely a local enterprise. Congress sanctioned the fair and made it a national enterprise; Congress sent out invitations to the nations abroad, and Congress did not hesitate to supervise the local management; and now, when the success of the exposition is assured, there are a handful of men apparently perfectly willing to help in the work of disgracing the nation by proposing, as the Philadelphia paper says, that the local promotors of the Fair be left to pay the piper.

The foreign technical press has many interesting comments to make on the progress of the work for the exposition, although we notice with regret that, with two or three conspicuous exceptions, the class journals that come to us from the other side of the Atlantic appear to take much greater satisfaction in reproducing squibs from the few irresponsible scribblers who are trying to discredit the exhibition in America than in publishing the easily obtainable accounts of the accomplishment up to this time, which is really marvelous, both in quality and quantity. Perhaps the congressional game of cross purposes is responsible for this. Happily the exposition has in *Engineering* of London, a journal that certainly stands unsurpassed in its field, a staunch and untiring friend, but other English technical papers of standing and influence have displayed an opposite tendency. Thus London *Industries*, a journal that usually strives to be accurate and well informed, publishes this in its issue of July 22d:

Judging from the latest reports from the United States, matters at the Chicago Exhibition do not seem to be progressing very smoothly. The *Bulletin of the American Iron and Steel Association* states that "Bankruptcy has at last reached the World's Columbian Commission. Every cent of the appropriation has been exhausted, and Secretary Dickinson has not enough money left to buy a postage stamp unless he draws on his own resources. Director-general Davis has not drawn his salary for several months, and Colonel Dickinson has gone without pay for the same period in order that the clerks in his office could draw their salaries in full. The last postage stamp in Secretary Dickinson's office was put on a letter to Secretary Foster last week informing him of the condition of the National Commissioner's finances. Congressional appropriations which are now available will, however, relieve the situation at once." As a side light to the above quotation, we learn from the *Engineering News*, of New York, that "J. C. Slocum has opened an office in the Grand Pacific Hotel, Chicago, as a consulting mechanical engineer. Mr. Slocum was until recently the mechanical engineer of the World's Columbian Exposition."

Of course the statement that the commission was bankrupt is absurd. The present Congress has made an ample appropriation for it, and salaries and postage bills are promptly paid. The reference to the resignation of Mr. Slocum is totally irrelevant and is not a "side light" at all. This gentleman was not employed by the commission, but by the World's Columbian Exposition company, a local corporation that has thus far received about eight million dollars for the purpose of preparing the grounds, erecting the buildings and maintaining the World's Fair; the commission installs the exhibits and is the representative of the government. Neither did Mr. Slocum resign for financial reasons, as our contemporary seems to imply. These are familiar facts in Chicago, where everybody has unbounded faith in the success of the fair, but perhaps they will enable our English friends to arrive at a more exact conception of the state of affairs at the World's Fair.

While on this subject it will be of interest to refer to the feeling of English electrical manufacturers toward the exposition. All the London electrical papers agree that the list of exhibitors so far assured is not a representative one, and the general opinion seems to be that it would be better to have no English electrical section at all than a poor one. Some twenty thousand feet has been assigned to the United Kingdom in the electricity building at the request of the Royal Commission, but not one half of this has been applied for. As has been repeatedly pointed out, the English themselves will be the greatest sufferers by refusing to exhibit, and we can only hope that they will be brought to see this in the very short time now remaining.

IT is reported from St. Louis that the Missouri Electric Light & Power company does not propose to rest content with the action of Judge Claiborne of St. Louis, in discharging G. A. Tempel, the hardware dealer of that city who is accused of putting a "jumper" on the wires back of his meter, and thus securing his electric lighting free. The judge's action was largely based on legal technicalities, as it appears that the grand jury refused to return an indictment in line with a previous decision of his, but presented a charge of petit larceny. Tempel had formerly been before the judge on this accusation and the case had been dismissed, his honor holding that fraud, and not petit larceny, should be charged. When the grand jury disregarded this opinion and reaffirmed the original charge, the judge refused to try the case, on the ground that the defendant had been before tried for that offense and released. It will thus be seen that the case has not been tried on its merits at all, which is a pity. As our St. Louis correspondent says, "The amount at issue is small, but the principle involved is of vital importance to electric light and power companies, as it seems that no precedent has yet been established." The proceeding alleged is so clearly inequitable that if it cannot be reached and punished by the existing laws of Missouri a statute drafted especially to prevent theft of this character should be enacted. The common sense view of the question undoubtedly is that electricity generated in central stations for commercial use is a manufactured product which can be stolen or unlawfully diverted, the same as any agent supplied under similar conditions—illuminating gas, for instance. Whether the offense comes within the purview of the law is of course a different question, and one not to be determined until carried to the highest courts. We believe that the question has been passed upon by the courts in Pennsylvania, the case in point being whether electric light companies should be taxed as manufacturing corporations, but whether it was ultimately determined by the court of last resort does not appear. The subject is one of grave importance to central station companies, which will eagerly watch the steps in the St. Louis case, should the attorneys of the Missouri Electric Light & Power company succeed in reopening it. Should it prove that the existing statutes in the several states are impotent to protect electric light and power companies in their rights, the National Electric Light association can find no more important duty than that of taking the matter up and beginning an agitation that shall not cease until sufficient laws to prevent the stealing of electricity are on the statute books of every state in the Union. In the meantime we shall be glad to hear from any of the readers of the WESTERN ELECTRICIAN who can throw light on this question. Perhaps the Missouri Electric Light & Power company is not the first central station company that has had an experience of this sort, and if so a recital of the remedy sought or adopted will be of common benefit.

Model German Alternating Current Station.

The illustrations presented herewith represent features of one of the finest municipal electric light stations in Germany—that of the historic city of Cologne. They were taken from the *Elektrotechnische Zeitschrift*, which, in its issue of July 1st, contains an exhaustive and carefully written description of the plant from the pen of F. Uppenborn. The information given below is extracted from Mr. Uppenborn's account.

As will be seen by referring to Fig. 1, which gives a general view of the dynamo room, the fly wheels of the engines are replaced by "magnet wheels," each 14 feet in diameter and having 72 poles, making, at 85 revolutions, 6,120 alternations a minute. These magnet wheels are surrounded by rigid crowns, also carrying 72 magnets each. Every part of the dynamo and engine is easily accessible for repairs, and each coil is provided with a switch, so that, should an electrical defect appear, the offending coil can immediately be cut out and the dynamo made temporarily whole. The electromotive

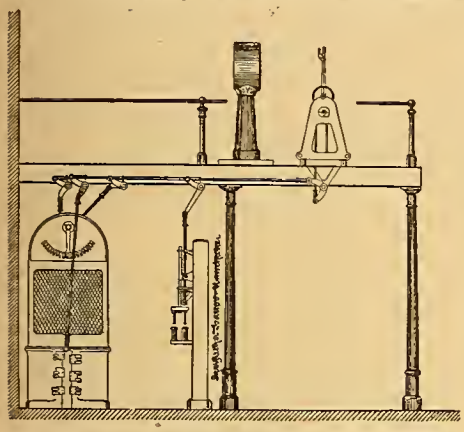


FIG. 4. MODEL GERMAN ALTERNATING CURRENT STATION.

force of these alternating machines ranges from 2,000 to 2 500 volts, and the maximum output is 450,000 watts each.

In Fig. 2 is shown a ground plan of the station. The triangular shaped building adjoining the engine and dynamo room on the right is used as a machine shop. All the switch-board and regulating apparatus is located on a balcony, shown in section in Fig. 4. During the operation of the dynamos no wires carrying the primary current are exposed to possible contact by the dynamo tenders. The switches, rheostats etc., that are operated

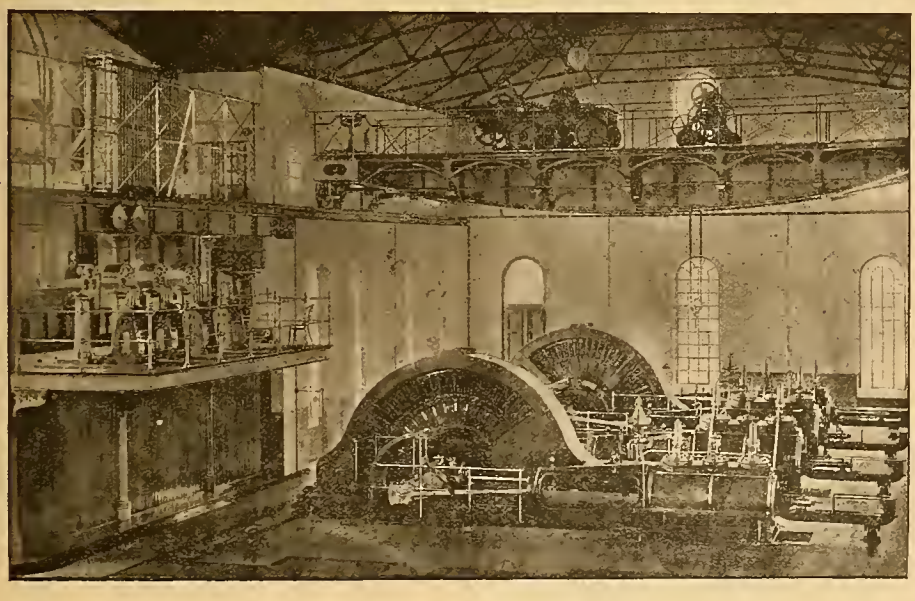


FIG. 1. MODEL GERMAN ALTERNATING CURRENT STATION.

by the levers in the gallery are concealed in the cabinets under and back of the gallery.

For each dynamo there is provided an entire set of instruments enclosed in an upright cabinet, in front of which is the set of levers operating the dynamo to which the instruments belong. In each of these cabinets is an ampere meter for the alternating current and an ampere meter and volt meter for the exciting current. The large circular instruments shown above the regulating gallery are the volt meters for the alternating machine.

Fig. 3 shows a front perspective view of the regulating levers, a side view of the connections being given in Fig. 4. The levers *d* and *c* are for cutting in and regulating the exciting dynamo; the levers *a* and *b* control the alternating machine, while the handwheel *e* cuts in the rheostat when the dynamos are run in parallel.

The operation of this fine station is of course essentially the same as that of any large station of similar

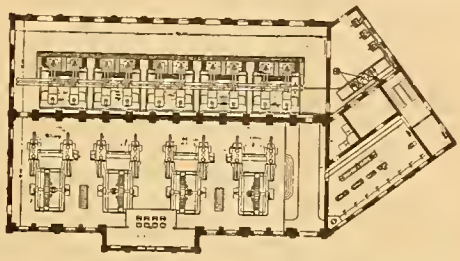


FIG. 2 MODEL GERMAN ALTERNATING CURRENT STATION.

type, the difference being in the unique arrangement of the accessories and the highly ornamental disposition of these auxiliaries.

Human Electricity.[1]

The investigations of physicists make it highly probable that all movements of matter, even those of a molecular character, are linked with electrical phenomena. Friction, even the brushing of the wind over the surfaces of things, the falling of rain-drops from the sky, the action of light and heat, the production of flame, and all the molecular chemical changes that are silently going on in inanimate nature, are associated with changes in the electrical state. It follows that our modern methods of producing electricity, by friction, by induction, by heat, by chemical action, are but specially contrived imitations of processes carried on throughout the ages. Such considerations would naturally lead one to expect that electrical phenomena would also be associated with those finer molecular changes on which life depends, and that it is only a matter of experimental detail to demonstrate the existence of an animal electricity. It seldom, however, happens in science that we see far before us, and even acute minds miss recognizing facts that to their successors are everywhere apparent; the usual procedure rather is that we look backward and find an intellectual satisfaction in tracing the gradual unfolding of any department of knowledge, while we have some difficulty in even imagining a time when such knowledge did not exist.

All this is true of animal electricity. Thus, electrical fishes have been known from early times. The benumbing effects experienced by a fisherman in the Adriatic, when he drew a torpedo from his net, were familiar to Aristotle. An Egyptian inscription, executed about 5,000 years ago, shows figures of the well-known malapterurus, the thunderer fish of the Arabs, a fish having such electrical properties as could not have escaped the attention of the ancient people. It was not till 1773, however, that Walsh first demonstrated that the shocks of the torpedo were truly electrical. Thirteen years after, namely, in 1786, Luigi Galvani, professor of anatomy and physiology in Bologna, noticed that the limbs of recently killed frogs became convulsed when brought near a frictional electrical machine in action. This famous observation marks a new epoch in the history of science. He found that the convulsive twitches occurred only when a spark was emitted from the conductor, and only when some metallic substance was in contact with the nerve. Recognizing the sensitiveness of the frog's nerves to electric shocks, he used them in investigations into the phenomena of atmospheric electricity; and on the 20th of September, 1786, he suspended, by copper hoops, three frogs to the iron trellis-work on the roof of his house, and saw, as the limbs were blown about by the wind, that convulsions occurred when the toes touched the iron railing. This proved that an electrical machine was not required, but while Galvani recognized the fact, he missed the true explanation. We now know that the twitches of the frogs' legs were caused by electrical currents that came, not from the sky, nor from the animal tissues themselves, as Galvani imagined, but from the contact of the copper hooks with the iron railing. About this period the old and ever-recurring question of the nature of life was in an acute stage, and it is not wonderful that the physiologist of Bologna thought, from this and numerous other experiments, that he had detected the "nervous fluid," the something which, if not life itself, was at least inseparable from it. This is now an old story, and all the world knows that the famous controversy between Galvani and his followers and Volta, the professor of natural philosophy in the University of Pava, led to the invention of the voltaic pile in 1799, and still more to the discovery of the production of electric currents by the contact of dissimilar metals, more especially when one of them is acted on chemically by certain fluids. For a long time the brilliancy of the results flowing from the investigations into voltaic electricity threw the discoveries of Galvani into the shade; but by and by, as experimental methods became

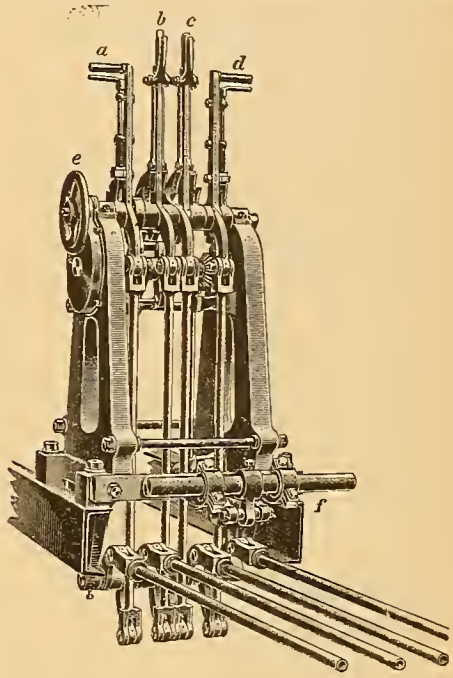


FIG. 3. MODEL GERMAN ALTERNATING CURRENT STATION.

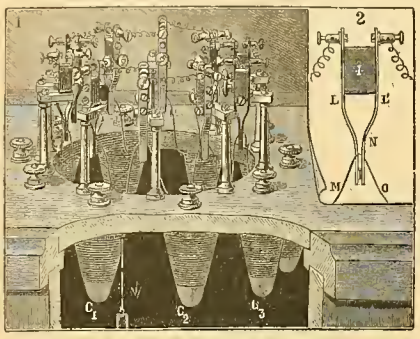
more delicate, it was found that there is in truth an animal electricity, the existence of which was doubted by Volta and his followers.

We know now that in spite of Galvani's primitive experiments the electric currents that caused muscles to contract were undoubtedly produced by the living tissues themselves. It was next to impossible, at that time of day, to prove the fact. The apparatus for the detection of extremely feeble currents had not been invented. The next step was made by Oersted, in 1820, when he discovered the influence of a current of electricity on a magnetic needle, and the construction of a galvanometer thus became possible. Five years later, in 1825, Nobili constructed such an instrument for physiological purposes, and by means of it he demonstrated that a current could be obtained from a frog's muscle. He prepared a frog, introduced its two legs into two glasses of salt water, placed in each vessel a strip of zinc, connected the two strips with the galvanometer, and obtained a deviation of the needle to the extent of 10 degrees to 30 degrees. He showed that Galvani was right in maintaining the existence of an animal electricity, while he was wrong in holding that the contact of two metals with the tissues gave a proof of this. On the other hand, Volta was right in his statement that the twitches of the frog's muscles in Galvani's experiments were independent of an animal electricity, but he was wrong in denying, as he did, that electrical currents existed in the tissues. Matteucci, about 1837, enriched the subject by many beautiful investigations, and by joining the thighs of frogs in a special way, he made a living voltaic pile, which produced effects similar in character to the piles built up by physicists with disks of metals and intervening disks of paper or cloth. Then came Du Bois-Reymond, the present venerable professor of physiology in Berlin, and the successor of Johannes Muller, who was the intellectual godfather of such men as von Helmholtz, DuBois-Reymond, Virchow, Brucke and Reichert. In 1841 du Bois-Reymond, who combines, as his ancestry would lead us to expect, Celtic fervor with Teutonic thoroughness, took up the subject of animal electricity with rare enthusiasm, and since then has labored on it with much success. One feels, after reading any one of his numerous monographs, that he has left little for the gleaners in this field of research. Electro-physiology has attracted many able workers during the fifty years that have elapsed since DuBois-Reymond entered on it,

1. From the *Fortnightly Review*.

and much has been accomplished, more especially in examining the properties of the electrical fishes. It may not be uninteresting now to inquire as to what can really be demonstrated.

In the first place, by using a sensitive galvanometer, or the ingenious capillary electrometer, a kind of electric manometer, invented by Lippmann in 1873, and by connecting tissues with the unpolarizable electrodes of Du-Bois-Reymond (a contrivance by which contact can be made between the galvanometer or electrometer and the tissues without the risk of generating currents by chemical action), it can be shown that all living tissues show differences of potential at different points, or, in other words, that electrical currents pass through the instruments when the tissues are placed on the electrodes. With such sensitive appliances, a bit of skin, a morsel of muscle or nerve, a fragment of such an organ as a gland, an eye, or a heart, show electrical currents. Although a normal muscle, absolutely uninjured, is isoelectric; that is, gives no current, because all points of its surface have the same potential, it is often impossible to place on the electrodes a muscle, or, indeed, any living tissue, so not to show currents by the movement of the needle of the galvanometer. Careful examination, however, proves



FIGS. 1 AND 2. THE LAWS OF FALLING BODIES.

that the strongest currents are manifested when certain surfaces are brought into contact with the electrodes. For example, in the case of muscle, the strongest current is obtained when one electrode touches the center of a transverse section, while the other touches the uninjured surface of what may be called the equator of the muscle, that is, a line encircling it in the middle of its length, and it can be shown that the surface is always positive to the transverse section. The same is true of nerve. If a frog's eye is placed on the electrodes, the center of the cornea is positive to the transverse section of the optic nerve and the internal surface of the retina is positive to its outer or choroidal surface. Again if a small piece is snipped off the apex of the ventricle of a frog's heart, this surface is negative to any other surface, while the heart is at rest and does not make a beat. All of these currents are, of course, due to differences of potential; and as they exist while the tissue or organ is at rest, they may be called resting currents, and they are usually due to the injured surface undergoing molecular changes causing it to become a different potential from that of any part that has not been injured. If living matter has a flesh surface exposed by an incision, the surface begins to die, that is to say, it rapidly undergoes molecular changes, and the dying matter becomes of lower electrical potential than the matter that is not dying, so that if the dying surface is connected with one electrode while the non-dying surface is connected with the other, a current passes through the galvanometer from the non-dying to the dying. Another way of expressing the same fact is to say that any local injury to living matter always disturbs electrical equilibrium, because the injured part becomes very quickly of lower potential. Now, it is evident that chemical action, as occurs in dying tissues, will be greatest on the injured surface. We may suppose that this surface, acting like the zinc, the positive, plate in a Daniell's cell, generates currents which pass through the muscle to its surface, issue from the surface (thus the positive pole) to the galvanometer, and back from the galvanometer to the injured surface, which thus represents the negative pole. Such currents, therefore, are evidently not of much physiological importance, except that they differentiate between different planes of vitality.

But the case is different when the tissue or organ discharges its normal function. This will be readily understood if we examine what occurs in a contracting muscle. The normal function of a muscle is to contract; that is to say, there is a movement of its protoplasm by which it shortens in length while it increases in thickness. Now, suppose a muscle laid on the electrodes so that a "resting" current is manifested by the deflection of the needle of the galvanometer; let the nerve supplying the muscle be irritated so as to cause contraction of the muscle; instantly the needle of the galvanometer moves in the opposite direction, and it may pass even beyond the zero point. This is due to the generation of a new current in the muscle, in a direction opposite to that of the resting current. The proof is this: Let us compensate the resting current before causing contraction of the muscle, by sending a portion of a current from a Daniell's element in the opposite direction, so that the galvanometer is brought to zero, then cause the muscle to contract, and the new current—the action current, as it may be called—sends the galvanometer needle to the opposite side of zero. This phenomenon of a new current in the opposite direction is known technically as the negative variation, and it is of importance physiologically because it is the indication of changes occuring in the muscle that are associated with its contraction. It is a vital phenomenon because it can only occur when the muscle is alive. The action current may be accounted for by supposing that at the nerve terminations in the muscle there is some kind of local change, just as occurs on the cut surface of the muscle. This local action, probably chemical, generates a current which passes through the muscle in the reverse direction of that of the resting current; that is to say, it flows to the cut surface, passes out by it to the galvanometer, and returns from the galvanometer to the point of entry of the nerve. The cut surface therefore, during the action current, becomes the positive pole, while the uninjured surface is the negative pole of the little muscle battery; exactly the reverse state of matters to what obtained while the muscle was at rest.

Early observations seemed to show that this negative variation was a kind of wave of negativity that swept through the muscle, and was over and gone before the muscle contracted; but recent experiments of Burdon Sanderson, in which he simultaneously photographed the movement of the muscle and the movement of the mercury in the capillary electrometer, demonstrate that the negativity extends into the time of the contraction, or, in other words, that the two phenomena go closely together. The electromotive force between the longitudinal and transverse sections of the resting gastrocnemius muscle of a frog is from .03 to .08 volt, and the negative variation may amount to as much as .04 volt.

Similar action currents occur in nerve. A nerve has a resting current, but when the molecular disturbances which, for want of a better term, we call a nerve current, pass along it, there is a negative variation.

Electrical phenomena may also be discovered in the central nervous organs. If we bring the electrodes of the galvanometer into contact with the surface of the brain electrical changes occur when light falls on the eye. Recently Gotch and Horsley have explored the spinal cord with electrodes connected with the capillary electrometer, and they have found electrical variations in the motor strands of the cord when motor centers in the cerebral cortex were irritated. Thus, in a sense, they tapped the wires of the living telegraphic system and got information as to the paths in the cord along which motor, and even sensory impulses travel. It seems to be only a matter of experiment to discover electrical changes in all the cerebral nervous organs. Could we picture to ourselves the changes in the brain when its higher centers are in a state of molecular disturbance, as when one is thinking rapidly in a lecture, now adapting his words to his ideas, now thinking ahead as to what he will say next, now noticing the effects of his words on the audience, now becoming conscious that he is obscure, and again that he is succeeding in making things plain, now watching the clock and noting the inevitable flight of time—could we, in such circumstances of mental turmoil, examine the phenomena of the brain, we would, in all probability, obtain evidence of rapid changes of potential, and of currents flashing in a thousand directions, pursuing paths the intricacies of which are many times greater than if all the telegraphic and telephonic wires of London were concentrated in one vast exchange.

Take another illustration. Place a frog's eye on the electrodes; we at once obtain a resting current, as above indicated. Keep the little eye in the dark and the resting current becomes less and less as the tissues die; but allow

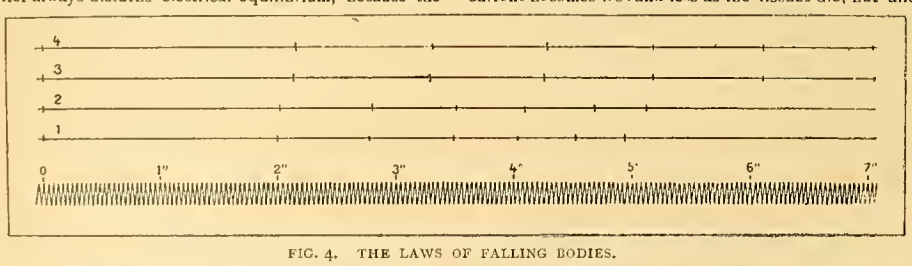


FIG. 4. THE LAWS OF FALLING BODIES.

light to fall upon it—even a flash of light lasting the thousandth of a second, or the light of a vesta at a distance of several yards—and there is usually, first, a positive variation, then a falling off, if the light is allowed to act; and, lastly, if the light is suddenly cut off, there is almost invariably a second (positive) increase, followed by a (negative) diminution of the current (Holmgren, Dewar, and the writer). It is highly probable that similar electrical phenomena are related to the action of stimuli on all the terminal organs of sense.

The skin of all animals shows a current passing from the surface inward. This has been supposed to be due to abrasion of the surface, and the skin current must be distinguished from that due to secreting glands in that organ. Thus the skins of fishes show a true skin current, although they contain no glands. The glands of the skin, however, produce currents, and it can be shown that when the secretory nerves of the glands are irritated there is a positive variation or increase coincident with the secretion of sweat. Such electromotive phenomena connected with secretion have been demonstrated in the pad of the cat's foot, which contains numerous glands, and also in the submaxillary salivary gland. Thus the phenomena of secretion are undoubtedly connected with electrical changes.

One of the most interesting demonstrations of electrical phenomena in living structures is that of the variations connected with the beat of the heart. If the heart of a frog be laid on the electrodes, so that one electrode touches the base while the other touches a cut or injured surface at the apex, the needle of the galvanometer immediately begins to swim backwards and forwards, and it is easy to show that the swings are coincident with the beats. This remarkable phenomena has received much attention. It is almost impossible to trace the direction of the currents while the heart is beating; but if the rhythmic beat is arrested by applying a ligature around the heart at the junction of the sinus venosus with the auricle, as was first shown by Stannius in 1852, it is then possible to bring about a single beat by stimulating the heart either at the base or at the apex. Suppose, now, that the heart was connected with the galvanometer, or, still better, with the capillary electrometer, and that we stimulate at the base; there is contraction, the base becomes negative to the apex, and the next instant the apex becomes negative to the base. This is what occurs with a normal beat. On

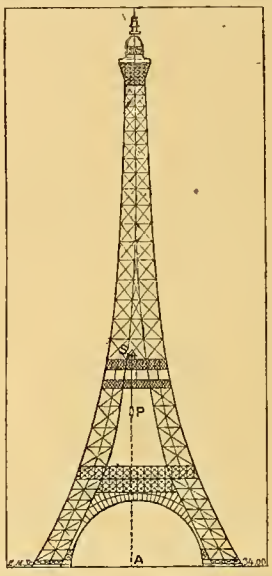


FIG. 3. THE LAWS OF FALLING BODIES

the other hand, if the apex is stimulated, the apex becomes first negative to the base, and then the base negative to the apex. Evidently, then, in a normal beat, the contraction commences at the base and travels to the apex. But the electrical change does not occur in the same phase throughout the heart at one moment; on the contrary, the wave of negativity travels to the apex. An instant afterward, however, the contraction change at the base has disappeared, while it still remains at the apex. At this moment the apex is negative to the base. There are thus two phases with each contraction, and the phenomenon is termed a diphasic variation. Hence the swinging of the needle of the galvanometer. It is driven alternately in opposite directions. Similar phenomena have been noticed in the isolated mammalian heart. By far the most beautiful demonstration of this kind, however, has been recently given by Dr. Augustus Waller, of St. Mary's Hospital, London. Using the capillary electrometer, he has succeeded in showing electrical variations in man, without the necessity of making even an abrasion of the epidermis. Deeply placed as the heart is in the chest, full as it is of blood, and surrounded by the chest walls composed of bone, muscle and skin, yet by placing one electrode, say in the mouth, and the other on the left foot, or even by placing them on opposite sides of the heart on the chest wall, the electrical variations with each beat can be demonstrated. Each beat of the human heart shows different electrical potentials if two points are connected with the capillary electrometer, one on each side of an axis passing, roughly speaking, from the left shoulder obliquely downward to the right side. Thus the body may be divided into two asymmetrical electrical districts, so far as the beat of the heart is concerned, one including the head and right upper extremity, and the other the three remaining extremities.

We have seen that electrical variations occur in connection with muscular contraction, and at once the question arises of whether any such changes can be demonstrated in the human being. Suppose we have a very sensitive galvanometer. Take two shallow vulcanite troughs, and fill them two-thirds full with a three-quarter per cent solution of common salt. Dip a perfectly clean slip of platinum into each trough, and lead wires from the strips to the galvanometer. Connect the two troughs with a strip of clean white blotting paper wet with the salt solution. As a rule, if precautions have been taken to have everything absolutely clean, no current will pass through the galvanometer. Then wash the hands thoroughly and place one in each vulcanite trough. At first there is usually a swing of the galvanometer, but it soon comes to rest. Then contract powerfully the muscles of the right arm. There will be a swing in one direction, say to the right. Next, throw the muscles of the left arm into contraction The needle of the galvanometer will now swing in the opposite direction. By alternately contracting the muscles of the right and left arms the needle of the galvanometer can be caused to swing rythmically. This experiment, first made by Du Boise-Reymond demonstra

ting what he calls the man current, is of great interest Careful examination shows that when the muscles of the right arm are contracted an electrical change passes through the body from the right to the left arm, out from the left arm to the galvanometer, and back from the galvanometer to the right arm. When the muscles of the left arm are contracted the reverse occurs; or, in other words, a current passes through the body from the contracting to the passive arm, and through the galvanometer from the passive to the contracting arm. Some have supposed that this is skin-current, or rather a current due to a change in the cutaneous secretions, and it has been stated that it will not occur if the seretory nerves have first been paralyzed by atrophine. As excitation of secretory nerves gives a positive variation, it is difficult to account in this way for the negativity that occurs in the actively contracting muscles, while the remarkable uniformity in the results that one, by careful experiment, obtains by alternately and rapidly contracting the muscles of the two arms, is in favor of the view that the man-current is due to electrical changes occurring in the muscles themselves.

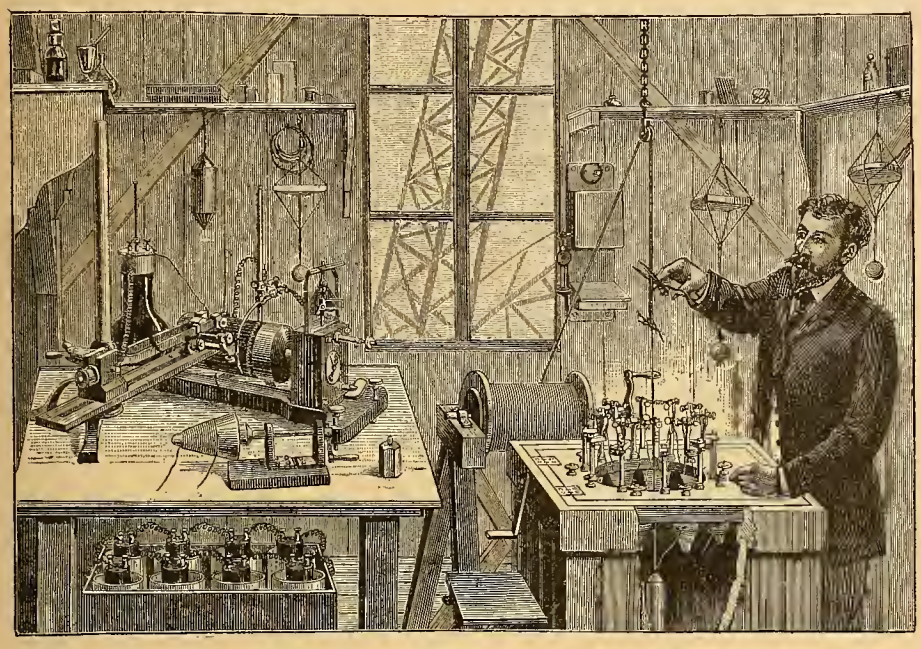


FIG. 5. THE LAWS OF FALLING BODIES.

The Laws of Falling Bodies.

In reading the reports of the physical experiments of French scientists one is struck with the fact that they are predisposed to the employment of electrical devices. The recent series of experiments instituted by MM. Cailletet and Colardeau in studying the air resistance encountered by a falling body is no exception to the rule. The laboratory, Fig. 5, in which their tests are made is located on the second landing of the Eiffel tower, Fig. 3, about 400 feet from the ground. The electrical equipment which forms the essential part of the investigating apparatus is illustrated in Figs. 1 and 2. In studying the fall of a body, it is necessary, first of all, to determine its exact position at each instant of its descent through space, and the electrical device designed by Cailletet and Colardeau was constructed to furnish exact data in this respect.

They attach to the weight which is to be dropped a wire so fine that it will retard only very slightly the fall. The wire is divided into sections of 20 meters each, and each section is coiled successively on the wooden cones, C^1, C^2, C^3, Fig. 1. As the weight falls the wire unwinds from these cones freely. When the wire at the end of the 20 meters leaves a cone it breaks an electric contact, and the means by which this is effected is shown in Fig. 2. The wire in going from one cone to the other passes through the clip shown in section at *M O*, Fig. 2. The clip is insulated at *I* and the ends are provided with platinum contact points. When the wire *M N O* is pulled through the ends it momentarily breaks circuit. The clip is connected electrically with a registering stylus recording on a revolving cylinder on which square periods of time are marked off by means of a tuning fork. When a contact is broken, when each 20 meters of wire is unwound, the pen makes an indication.

Fig. 4 shows the result obtained with the apparatus. No. 1 is the theoretical line represented by a body falling through the air; No. 2 is an experimental record of a wooden body ballasted by a metal weight; No. 3 is the record of a second ballasted body of square form; No. 4 is the record of a ballasted body triangular in form. Below are the beats of time registered by the tuning fork. The four lines above are one-fourth the actual length; the time record is merely representative, it shows the vibrations of the tuning fork to be only 25 per second, instead of perhaps 500. The illustrations are reproduced from *La Nature*.

An English Electric Car with Four Motor Armatures.

Electric cars operated by means of overhead wires are familiar enough on the streets of American cities, but in England they are still a novelty and meet with much opposition from the conservative Briton. The few existing installations are well constructed, however, and the overhead trolley electric railway appears to be growing steadily, if slowly, in public favor even in England. The accompanying illustration shows a car and portion of the track of the Bradford road.

As will be seen the car is "double-decked." It has a seating capacity of thirty-six—eighteen inside and eighteen outside—with plenty of standing room. It has frequently carried forty-eight people up what is said to be the steepest tramway hill in Great Britain. The route was specially selected by the Bradford corporation, the members of the tramway committee feeling sure that if a car could be made to climb such an incline it could ascend any other that would be met with.

The chief feature of novelty in the car, says *Industries* of London, from which the illustration is taken, is the arrangements of motors and gearing. Some of the curves on the route being very sharp, and occurring on the steepest part of the track, it was desirable to lessen the friction as much as possible, and each wheel is therefore separately driven. Two motors are employed, each having two armatures which communicate the power to the car wheels by means of worm gearing. The precise form of worm gearing employed is the result of considerable experimental research. When the motors and gearing were quite new tests were made at the works. One pair of motors were loaded with a weight representing the maximum duty likely to be required when running the car, and started against this dead load, and the combined efficiency of motors and gearing was found to be 65 per cent.

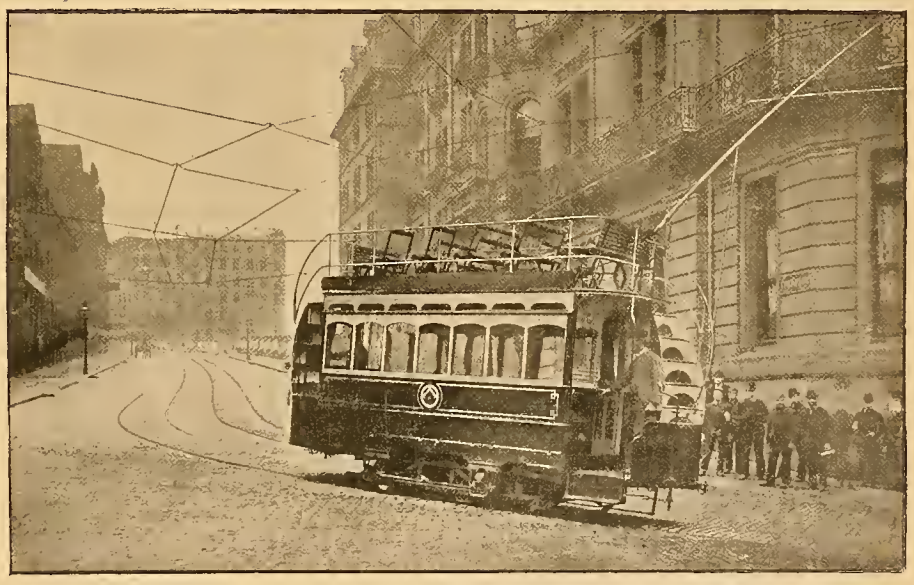
Although the cars have not yet run long enough to give the gearing a perfect working face, the efficiency has much improved, for the readings of the voltmeter and ammeter used upon the car on several of the ascending journeys gave the following results:

	Volts.	Amperes.	Gradient.
Rounding the curve at Cheapside.....	280	60 = 22.52 e. h. p. ...	1 in 13 22
Half way up Cheapside	281	56 = 21.09 " ...	1 in 14.75

The weight of the car with passengers being not less than 7 tons and the speed over 5 miles an hour, allowing the usual coefficient of friction for tramcar traction, this shows an efficiency in motors and gearing of over 80 per cent.

The method adopted has its electrical as well as mechanical advantages, for by an ingenious arrangement of switches the two dual armature motors may be set to work in series, in multiple series or in parallel, thus controlling and economizing the electric power as circumstances require. For instance, when the motors are in multiple series the average speed of the car uphill is 6 miles an hour; when in single parallel the car, though fully loaded, rushes round the curve and up the hill at a speed of 11 miles an hour.

Another valuable result of this arrangement is the facility with which the motors may be set to act as dynamos when the car is running down-hill by gravitation alone, and made to generate a current that tends to drive them in a reverse direction and so stops the car, for on steep gradients like those in Bradford, the question of absolute control of the car when running down-hill is of great importance. The electric brake is only used under special circumstances, the car being usually controlled by powerful duplicate hand brakes, so that, if one failed, there would be another available. The practice is to operate both the hand brakes at certain portions of the line, because doing so involves less muscular exertion on the part of the driver and ensures both brakes being always kept in working order.



ENGLISH ELECTRIC CAR WITH FOUR MOTOR ARMATURES.

A Peculiar Accident.

On July 23d Superintendent Harry Hosking of the Peninsula Electric Light & Power company, with a small force of linemen, was making some repairs to an overhead electrical line between Lake Linden and Calumet, Mich., when a severe thunder storm came up. At the time, most of the men were at work on the poles. A shock of lightning struck the wires, and all the men, with the exception of Daniel Devierge, fell to the ground unconscious. Devierge hung up among the wires dead. He was in the act of tying the line to an insulator and received the full force of the shock. The dead man was lowered by a rope. The superintendent and two linemen were considerably injured, but not seriously. A careful examination of the

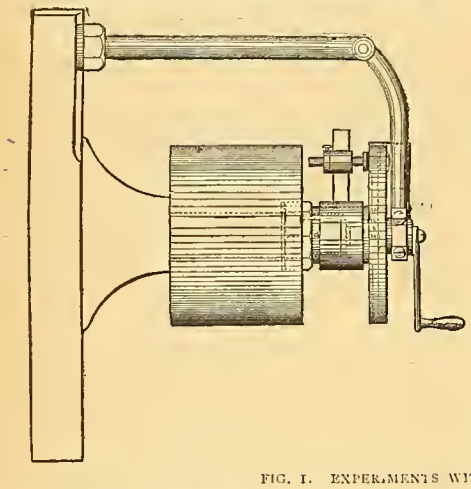
body of Devierge revealed no marks except a trifling burn on the right ear. The accident is an unusual one, as casualties to linemen from lighting while working on overhead wires are rare.

Experiments With Alternating Currents.[1]

By Dr. Louis Duncan.[2]

The first real representation of an alternating current curve was made by Joubert, who employed a contact piece rotating with the armature of a dynamo, touching a fixed brush at a point of the revolution determined by the position of the brush with relation to the dynamo poles. He obtained a curve for current which was approximately a sine curve. Later, in 1888, Messrs. Wilkes and Hutchinson and myself modified the method to obtain the curves for electromotive force and current in the primaries and secondaries of induction coils. This modification was used afterward at Cornell, where Professor Ryan and others made valuable experiments, and it has been more or less generally employed. The principal difficulties lie in the fact that with a single commutating arrangement but one curve can be taken at a time, and as an experiment involving four curves takes something like 45 minutes, the condition may seriously change; while the whole voltage of the dynamo is at times on the commutator. It is at best rather a tedious method. In our work and in the work at Cornell, electromotive forces were measured by an electrometer, and currents were obtained by getting potential differences at the terminals of a non inductive resistance through which the current passed. Lately, in France, two commutating arrangements have been used to give two curves at once, with a condenser charged through the contact and discharged through a d'Arsonval galvanometer.

By the method which I described last fall, any number of curves may be obtained simultaneously, with only a few volts on the commutator and with a rapidity and accuracy much greater than by the other methods. Briefly, a number of dynamometers are used, equal to the number of simultaneous curves to be obtained. The first ones used



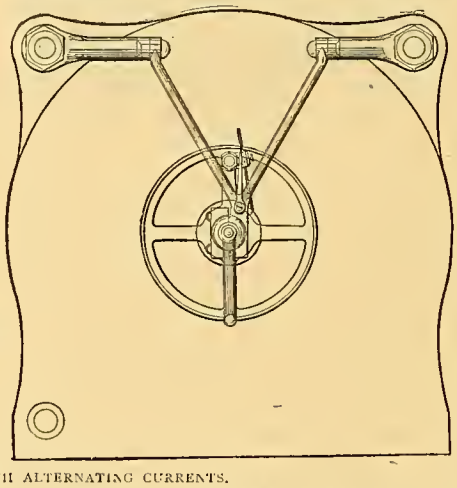
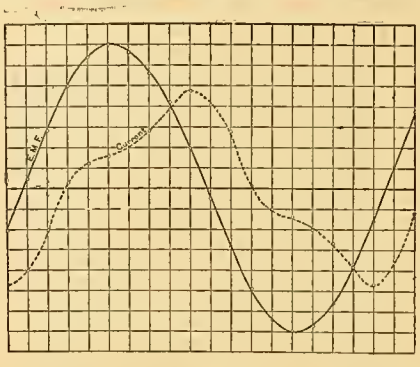


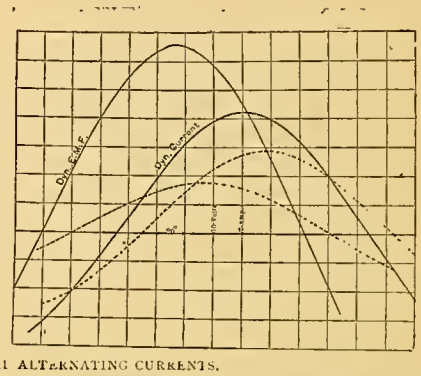
FIG. 1. EXPERIMENTS WITH ALTERNATING CURRENTS.

were made by Mr. Carichoff and myself, and were quite satisfactory, but experience having suggested some improvement, and our time being fully occupied, E. S. Ritchie & Sons made four of them, such as are shown in Fig 1.

The four dynamometers have their stationary coils wound for, say, primary current, primary electromotive forces, secondary current and secondary electromotive forces. The movable coils are wound with fine wire and are all connected in series. The electromotive force instruments are made exceedingly sensitive so their self-induction may be made a minimum, and in series with them is placed a large non-inductive resistance, the relation of the self-induction and resistance being made such that the former may be neglected. The circuit of the movable coils is through a battery of a few storage cells to a brush which may be moved by hand through the arc of a circle, and which touches a contact piece on the dynamo shaft once every revolution. The other end of the circuit being joined by a sliding connection with the contact piece, the circuit is closed through the cells and coils for a short period once every revolution. The instant of closing this circuit is determined by the position of the movable brush with respect to the dynamo poles. Now suppose an alternating current is sent through the stationary coil of one of the dynamometers. If an instantaneous current be sent through the movable coil, an impulse will be given it dependent on the value of its current and on the instantaneous value of the current in the stationary coil; as the period of the coil is great compared with the period of the dynamo, we will get a steady deflection dependent on this product. If now we move our contact brush, the instantaneous current will pass at some other point on the alternating current wave, and our deflection will be proportional to the value of the current at this point; by moving the brush through an angle corresponding to a complete wave we can plot the wave exactly, providing we have properly calibrated our dynamometer.

It is apparent that in order to attain accuracy our instantaneous current must be very brief and very steady, and its value must be the same in actual work as in calibrating. A d'Arsonval galvanometer in the circuit allows us to judge the two last points, and we found that when a high resistance was used in the circuit so that any variation in the contact resistance was eliminated, almost absolute steadiness was obtained. It was also assured by using a condenser charged during part of the revolution and then discharged by the contact brush through the circuit. To give an idea of the current in this circuit, an ordinary arrangement, when the condenser was not used, was 12 volts through 1000 ohms, and it must be remembered





FIGS. 2 AND 3. EXPERIMENTS WITH ALTERNATING CURRENTS.

that this current only passes an exceedingly small part of the time.

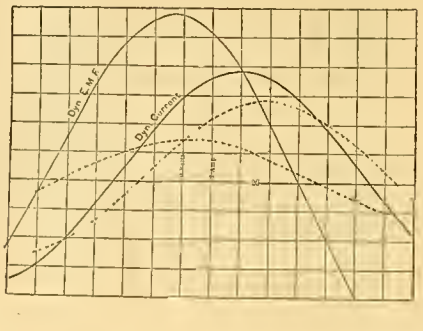
The dynamometers were made of wood, mounted on a revolving base, so they could be adjusted with respect to the meridian. It will be seen on looking at the picture that one side is made removable to facilitate adjustments. The fixed coils are wound in two cylinders which move in and out through holes in the sides, and whose distance apart is adjusted when the instrument is calibrated, so the scale divisions read directly in volts or amperes, or fractions of them. The movable coil is suspended by a silk fibre, which gives it no directive force but which sustains it. Directive force is given the coil and current is introduced to it through two palladium hair springs which are fastened to stiff brass wires, which serve as the axis of the coil. A vane in a beaker filled with glycerine damps the swinging and makes the instrument absolutely aperiodic. I have rarely used instruments which give more satisfactory results, the zero is invariable, readings may be taken with great ease and rapidity, while a reversal of the current gives equal readings on the two sides of the zero. To show the rapidity of the readings, six curves, representing different quantities in a step-up-and-down transmission were taken in a little over five minutes, and in this case two instruments were used for four curves—those at the sending and receiving ends of the plant,—and therefore had to be switched from one side to the other at every reading. Twenty points were usually taken for each wave. The curves could of course be photographed instead of observed, but the latter is so much simpler and more satisfactory that—especially in a laboratory where there are plenty of observers—I much prefer it.

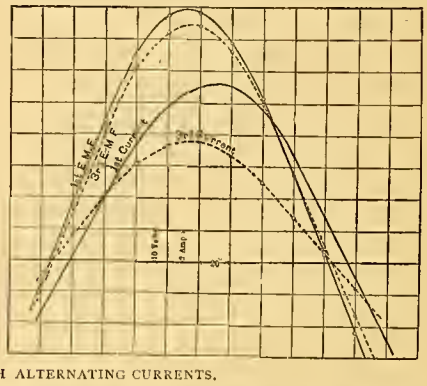
The contact arrrangement is shown in Fig. 2. As it comes outside of the belt, and as it was often necessary to remove the latter, the swinging arrangement shown was designed and constructed by the Messrs. Hutton. On the shaft was a hard rubber cylinder with the brass contact almost flush with its surface. The whole arrangement worked admirably. The results of our work will have to be another story. I will simply give a few to illustrate the method.

We have a small Tesla fan motor intended to work on an ordinary incandescent circuit. There are eight poles, the alternate ones having their windings in different circuits, one set of poles having a few turns of coarse wire, the others having a greater number of fine wire turns. The curves in Fig. 3 show the condition of affairs when the motor was working; in Fig. 4 where the the armature was held. In the second case the energy represented corresponds, of course, only to the losses. It seems to be the general impression, by the way, that a rotating field motor starts up with the same torque as a corresponding continuous current machine. I have shown, however, that a two phase motor corresponds exactly to a converter, or rather two converters, in which the secondary has an outside resistance of $\frac{p^1}{p-p^1}$, where p^1 is the angular velocity of the armature and p that of the field. When p^1 is 0—that is, when the motor is at rest—it will be seen that the current is in the worst possible condition for starting and the torque for a given current is small. It is like starting a continuous current motor, with the brushes almost ninety degrees from the proper position.

But most of our work has been with circuits in which both self-induction and capacity have been introduced. It is a well known fact that circuits carrying alternating currents may be given the same period of vibration as the current; or, to put it another way, circuits may be so arranged that, with currents of a given period, the sum of the energies stored up in the circuit and given out by it is zero. With a condenser and self-induction properly adjusted, if energy from the current is being stored up in the condenser, an equal quantity is being given to the current by virtue of the self-induction—that is, we can neutralize our self-induction by a capacity. I can hardly think of any fact more likely to play an important part in the future of alternating current work. For instance, if a circuit has in it a periodic current consisting of a number of sine curves of different periods—one third, one-fifth, one-seventh, etc., the period of the fundamental wave—then if we put in inductive relation to this circuit another circuit whose period is, say, one-third that of the fundameotal wave, this current will pick out the one-third period waves in the primary.

An ordinary sine curve electromotive force may be made to give a periodic current wave with these higher harmonics in several ways—by having in the circuit a self-induction coil whose iron core is saturated when the current nears a maximum, or by using the same coil with a capacity which neutralizes one of the value of the vary-





FIGS. 4 AND 5. EXPERIMENTS WITH ALTERNATING CURRENTS.

ing self-induction; so we can produce these higher harmonics and we can pick them out. But it is a complex subject not to be treated here. In all such experiments, however, there are several points which must be carefully attended to, or there will be very unsatisfactory results. If the iron core of the induction coil—provided such a core is used—is not properly laminated and annealed, or if there are considerable losses in the condenser, the results will be disappointing. Take the case for example where there are eddy currents in the core, and there is loss in the condenser. The first effect

1. Read at the general meeting of the American Institute of Electrical Engineers, Chicago, June 6, 1892.

2. Assisted by E. R. Carichoff and R. H. and G. E. Hutton.

corresponds to a short-circuited secondary near the coil; the loss in the dielectric of the condenser means that energy is taken from the current, and this energy must be represented by the product of the current into the electromotive force corresponding to the transfer of energy, or it is $e.i.$ The value of e is a maximum when the displacement is greatest, that is when the current is greatest, and for a given current and dielectric varies as $\frac{1}{c}$.

The result is that the relation between $R.I.$ and $E.$ instead of being 1 to 1 as would be the case were there no disturbing causes, is 1 to 1+. That is for a given electromotive force the current is less than it should be, and a glance at the figure will show that it is thrown ahead of the electromotive force. No possible change in our self-induction and capacity can remedy this decrease in the current, although we may, of course, make the phase angle zero if we wish.

An excellent way to make an iron core, by the way, is to shellac fine, well annealed wires, spread them along a piece of thin paper, brush them over with shellac and then roll the mat so formed into a cylinder. The losses in a condenser are usually small. They are discussed in a paper of Messrs. Huttin and Leblanc, published last spring in *La Lumiere Electrique*. We find however that if the condenser is made of very thin tinfoil and has a large area, then for heavy currents it may considerably decrease in capacity and offer a definite resistance to the current.

The curves given have been selected almost at random from a mass of data. We have not the time to discuss the results which are hardly within the scope of this paper. Fig. 4 gives the curves at the two ends of a transmission plant where the voltage was raised from 50 to 1,000 volts and reduced again.

Fig. 5 gives the curves obtained in the circuit of a Siemen's dynamo connected to a transformer whose secondary circuit was open.

DISCUSSION.

PROF. HENRY S. CARHART: I wish to say a word, not at all in criticism of Dr. Duncan's paper, but rather to give some of my own experience in this matter. We have succeeded, by a very simple means, in getting these curves with only two observers, taking 20 points in five minutes. I have written off a few of the curves, but they are on a small scale. The apparatus is in general similar to that used in the older method, connected to the end of the shaft of the armature, with sliding contact. The instrument is well made and has worked perfectly from the start. The shunt is taken off from a single lamp of non-inductive resistance, 24 lamps across the primary. The current was 10,000 volts. I am not certain yet whether the lag between the current and the electromotive force comes out properly or not. In that case we use a galvanometer. In another instance the same apparatus is used, except that we use an electrometer. They came out better and faster and are very satisfactory. The calibration was what I was about to speak of. An instrument made under precisely the same conditions with saturated paper, was put in place of the shunt around the lamp, and then run through the machine in exactly the same way, and through a commutating arrangement on the machine. We ran this with precisely the same apparatus. Dr. Duncan's method very likely worked more rapidly, but this certainly answers very well for ordinary purposes. Our apparatus was provided with two disks, but we could just as well have put on four, and got three of four contacts at the same time, and measured three or four curves at the same time.

Dr. EDWARD L. NICHOLS: I should like to say that it seems to me that the paper, together with other work which we know of that is going on at the present time along these lines, goes to show what progress has been made in this kind of measurements within the last few years. We can all remember the time when to get such curves at all was regarded as an achievement, a little later on it took an hour, then forty-five minutes was boasted of as something wonderful. Now we have the statement that these simultaneous curves were obtained in five minutes. Prof. Carhart tells us that he has taken them by the old method in five minutes. The world has seen great development in alternating current measurements. It seems to me that Dr. Duncan's paper is chiefly important therefore, not on the question of rapidity, but in the fact of getting absolutely simultaneous values for two curves, so that no change can take place between the taking of the electromotive force curve and of the current curve. There is no lapse of time during which some change of condition might occur to vitiate the result.

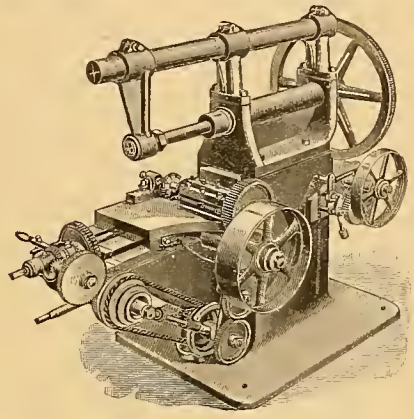
Electricity in Railroad Shops.

A paper bearing the above title was read by C. A. Seeley recently before the Northwest Railroad club. Among other things Mr. Seeley said: "One difficulty to be overcome in the use of small motors is their speed as compared with all machines used in iron working. One convenient way of overcoming this would be to mount the motor on a plate, on which standards would carry a shaft and pulley so arranged that the pulley would be in frictional contact with the pulley on the armature. This counter pulley could be ten or more times the diameter of the other and have a grooved cone on one side, from which a round belt could be run to a grooved pulley on the machine to be driven. By a system of idlers, tension and direction could be given to the belt. The motor having a constant speed, the cone would permit changes of speed at the tool. Many forms of special tools could be devised in this connection.

"In the Crewe shops in England portable drills capable of drilling one inch holes in steel are in use which are electrically driven. The drill spindle is the arbor of a worm wheel, and a dynamo armature is on the shaft of the screw which works the wheel, and the whole apparatus—dynamo and all—weigh sixty-five pounds. Another application used in the same shop is a saw for cutting tubes out of locomotives. The saw arbor is also the arbor of the dynamo armature; and the saw is just large enough to enter the tube; the frame work carrying this is held up against the tube sheet by hand, an eccentric motion forces the saw through the tube on one side, and then by another motion the saw is carried around, completely severing the tube. The saw is then returned to the center and withdrawn, and the tube can then drop down. The beauty of this operation lies in its celerity of cutting, and in the fact that the tube end is neatly cut off square and ready at once for scarfing for a new safe end."

New Automatic Gear Cutting Machine.

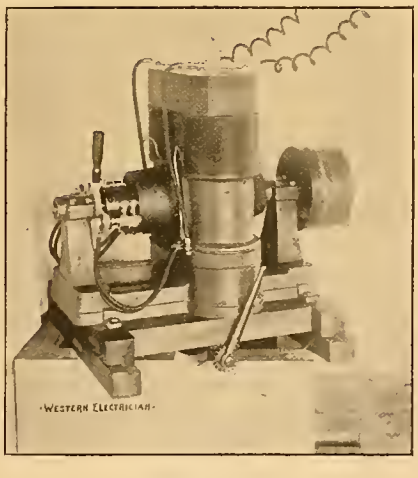
The Superior Machine Works, Cleveland, Ohio, are manufacturing the new gear cutter shown in the accompanying illustration. This machine has a number of valuable features. Gears of from 24 to 61 teeth are cut on



NEW AUTOMATIC GEAR CUTTING MACHINE.

this machine through the use of change gears having the exact number of teeth required to be cut. The mechanism for the feed and return of the carriage is a very simple device, reducing the cost of repairs to a minimum. The machine is driven by a four inch belt, the "take up" being on a countershaft overhead, a new feature that will be appreciated. The principal advantages claimed for this cutter are simplicity, accuracy of operation and increased capacity.

The inventor of the cutter is John Sherman, who is arranging to place on the market a new motor gear made by this machine. The new gear is cast solid and is afterward sawed in two, the improvement consisting of a beveled clamp to hold the gear in position. The clamp, it is stated, does away with the necessity for machine work



CUSHMAN DYNAMO.

and bolts as usual on the ordinary gear, reducing the cost, it is claimed, one-third. The Superior Machine Works are arranging to manufacture the gear on a large scale.

The Cushman Dynamo.

The dynamo herewith illustrated has lately been invented by Abel L. Cushman and is being manufactured by Bartlett & Marsh, of Concord, N. H. Both dynamos and motors are made on the same general plan, and the motors are particularly adapted, it is claimed, for use in street railway work. The machine is convenient in form, and highly efficient. It is made in several sizes.

Electrical Inventions and First Commercial Applications.

The census bureau is desirous of securing authentic information concerning the invention and first commercial application in this country of electric lighting and power machinery and devices. Allen R. Foote, special agent for the electrical division of the census bureau, invites persons having knowledge of the subjects to furnish the department the full name and date of who first invented or used commercially in America continuous current, constant voltage and variable ampereage dynamos, lamps and motors; continuous current, variable voltage and constant ampereage dynamos, lamps and motors; alternating current constant voltage and variable ampereage dynamos, lamps and motors; and alternating current, variable voltage and constant ampereage dynamos, lamps and motors; also trolley contacts, single or double.

In addition to this information, similar credit and dates for the following engineering methods would be of great present interest and of increasing value.

Incandescent lamps: Operated by continuous currents, by alternating currents; wired in multiple, in series; wired to converters, to accumulators; wired on arc lamps circuits, on power circuits.

Arc lamps, single or double carbon; stationary motors and electric locomotives: Operated by continuous currents, by alternating currents; wired in multiple, in series; wired to converters, to accumulators; wired on incandescent lamp circuits, on power circuits.

Converters and accumulators: Used for incandescent lighting, for arc lighting, used for stationary power, for locomotive power.

CORRESPONDENCE.

New York Notes.

NEW YORK, July 30.—The Manhattan islanders are much excited, and they have reason to be. An old fogy city too narrow minded to be cognizant of its own defects, may hold out against modern improvements for a long time, but eventually the "conservative element," or more correctly, the "mossbacks," have to bow their heads and take a medicine that, as time goes on, they are surprised to discover does them a world of good. It looks in the present instance as though the physic that will have to be taken will be the much abused trolley system. The Crimmins' syndicate is perhaps the most threatening just now. It already controls nearly a dozen lines, and has plans under way for as many more connections and extensions. Canvassers, it is understood, are at work endeavoring to secure property owners' consents to a change of traction power on certain lines, and the wail of the New York dailies is that it is noteworthy that the blank forms of consent exclude steam power only. If the necessary proportion of consents to a change can be secured, and the syndicate is able to handle the State Railroad commissioners, the New Yorkers will ride like the residents of Boston and many other cities where advanced ideas obtain.

There has also been considerable talk as to the possible introduction of the electric system by the new Fiftieth street, Astoria Ferry and Central Park Railway company, in the event of its securing the necessary permission to lay out its proposed crosstown routes. That this was to be done, however, has been denied by Frederick A. Bartlett, the secretary and treasurer of the company.

There is still another possible friend of the trolley in the field beside the Crimmins syndicate, in the shape of a newly organized surface railroad company, known as the East & West Railroad company. This corporation presented its petition for permission to gridiron the upper end of Manhattan island at last Tuesday's meeting of the board of aldermen. The company's proposed route is as follows: One Hundred and Twenty-ninth street and Second avenue, One Hundred and Twenty-ninth street and Fifth avenue, Fifth avenue to One Hundred and Thirty-fifth street, One Hundred and Thirty-fifth street to Edgecombe avenue, or the first new avenue west of Eighth avenue, Edgecombe avenue to One Hundred and Forty-second street, Bradhurst avenue, or first new avenue west of Eighth avenue to One Hundred and Fifty-fifth street, One Hundred and Fifty-fifth street to Harlem river, also from Eighth avenue and One Hundred and Fifty-fifth street via Eighth avenue to the Harlem river.

It will be observed that this route includes a piece of Fifth avenue, between One Hundred and Twenty-Ninth and One Hundred and Thirty-fifth streets, which is by law closed to any form of surface or elevated roads. The progressive minds, who are looking for "niggars" in wood piles and petitions, think that the most suspicious feature of the company's written request for permission, is the clause providing that the road may be operated "by horse power or some power which may lawfully be used other than steam locomotive power." On August 24th the rail-

road committee of the board of aldermen will meet for final action on the petition.

There will be a sale of storage battery equipment at the New York Exchange salesroom on August 22d, when the remains of the old Julien Electric Traction company are to be disposed of. The property consists of sixteen cars and trucks now at Marion, N J., and the electric plant at Eighty-fifth street and Madison avenue in New York city. The cars have been standing out in the open air for a long time and rather than let them go to ruin the Mercantile Trust company which, under virtue of a mortgage, owns the stock and fixtures of the old Julien Electric company, has foreclosed and will dispose of everything to the highest bidder. At the office of the attorneys for the Mercantile Trust company, Alexander & Green, it was said that this was the last act in the existence of the Julien company. The mortgage having been foreclosed, the trust company had determined to realize what it could on the property rather than let it fall to pieces from neglect and ruin. The Julien company, it will be remembered, ran two electric cars on the Fourth avenue railroad until stopped by an injunction granted by Judge Cox. The stock was owned chiefly by the New York Central people.

It will be remembered that mention was made in a recent letter of the death of an electric workman who "was in the habit of tasting wires." It is understood now, however, that the deceased's relatives are suspicious of poisoning, and the man's father intends to take steps to have the matter investigated in the courts.

The directors of the American District Telegraph company on Thursday declared a quarterly dividend of 1 1-4 per cent. This is the first dividend declared since the old American District and the Mutual District companies were consolidated last January, and is 1-4 per cent. above the rate of the old District company.

The electric light plant of the Erie Railroad at Jersey City is to removed from the ferry house to dock No. 4, where a new power house has just been completed. New cables are being laid in he passenger shed preparatory to making the change.

Last Monday the building known as "Tube Works No. 11" of the Edison General Electric company's factory at Schenectady, N. Y., was destroyed by fire. The fire was discovered about 7 A. M., and in a short time the entire building with its contents, much valuable machinery and a large quantity of stock wire entirely consumed. It is supposed that the fire was due to spontaneous combustion. The loss is estimated at about $100,000. The building is fully covered by insurance, however, and the company states that it will be manufacturing the tubes in temporary quarters within forty-eight hours after the adjusters have finished their work.

At a recent meeting of the board of managers of the Electric club the following named gentlemen were elected members: J. F. Hughes, Edward Peck, D. A. Patton, Leonard F. Requa, Alex. H. Bauer, J. H. Long, H. J. Stanbaugh, George E. Kent, J. H. Enholm, A. G. Greenburg, Harry S. Marlor, F. H. Leonard, Jr., W. S. Hine, E. W. Seymour. W. F. O.

Kansas City, Mo.

KANSAS CITY, July 30.—The Consolidated Interstate Rapid Transit Railway company is equipping its Eighth street line from the Union depot to Delaware street with the overhead electric system. The poles are placed between the tracks. The road was formerly operated by cable power, which was unsatisfactory inasmuch as all the rest of the company's lines (about 10 miles) are operated by steam power. This portion of the system is elevated and the company intends to equip the entire system, elevated and surface, with electric power.

On July 25th both houses of the council of Kansas City passed an ordinance creating the office of electrical inspector and regulating the installation of electric light, heat or power wires. The officer is to act in conjunction with the fire department, and is to be appointed by the chief of that department to hold office at the pleasure of the chief. It shall be his duty to enforce all ordinances respecting the installation of wires and inspect and approve all electrical apparatus, wires, etc., before they are put in use.

All wires shall be so placed that they shall still be practically insulated should the insulative covering be removed in any way and the "Rules for Safe Wiring" adopted by the National Electric Light Association in 1891 and revised in 1892 shall be strictly followed. No change shall be made in any wire or apparatus without the knowledge and approval of the inspector. Concealed wires must be inspected before they are put in use. Fees for inspection shall be based upon the following schedule:

Arc lamps, $1 each; motors, large or small, $1 each; from 1 to 10 incandescent lamps, $1; 11 to 25 incandescent lamps, $1.50; 26 to 50 incandescent lamps, $2; 50 to 100 incandescent lamps, $3; for each additional 100 or fraction thereof, $3. The same rates shall be charged for inspecting wires for furnishing such lamps or motors, in which case no charge shall be made for inspecting lamps or motors.

An appeal from the decision of the inspector shall go to the chief of the fire department, superintendent of buildings and city engineer, whose decision shall be final.

The inspector shall retain $1,000 of his collections, the remainder to go to the city. It is also provided that the inspector shall be permitted to accept such additional remuneration as the board of fire underwriters may give him. He shall give a $5,000 bond to the city for the faithful performance of duty.

An ordinance of this sort has long been before the council. It is passed at the request of the fire underwriters and fire department.

There is an ordinance pending before the public improvements committee of the upper house of the council, to grant the Missouri & Kansas Telephone company a franchise for thirty years to place its telephone wires in underground conduits. According to the ordinance, as drawn by the company's attorneys, the right is not to be exclusive. All plans for work are to be approved by the city engineer and one mile of conduit is to be laid and in use one year after the ordinance becomes a law. The company proposes to begin building the conduits at its general office building at Sixth and Delaware streets, extending the system as fast as possible. One duct 2½ inches square is to be reserved in every conduit for the use of the city and this is the only compensation offered the city. Sewers or railway conduits previously laid are not to be interfered with, but the telephone conduits shall not be disturbed after they are laid unless through public necessity. If a change in the grade of streets is made, or new sewers built by the city, the conduits shall be changed at the company's expense. The company is to give the city a $10,000 bond conditional so that the city shall be protected from all damage suits occasioned by the negligence of the company and to insure proper repair and replacement of all pavements disturbed in laying conduits. If at any time the telephone company fails to comply with any provisions of the ordinance, thirty days notice shall be given it by the city to comply, and if the company still fails to do so, the franchise shall be forfeited provided a forfeiture shall be declared by the city in six months.

This is the substance of the ordinance now pending. An ordinance similar in nearly every detail was introduced in the council last September and it passed both houses, but was vetoed by the mayor because the company refused any compensation to the city for the rights granted and because the company refused to permit any regulation of telephone rates by the city. A remonstrance signed by the majority of the local telephone subscribers was presented at that time and public sentiment was very much against granting the franchise. Within a year the council of Kansas City has taken a stand against granting franchises of value unless the city is given compensation for the privileges granted, or is permitted to share in the profit of the company. The patents and privileges now held by the Missouri & Kansas company in Kansas City will soon expire. It is thought that the city should be assured that telephone rates will be materially reduced in the near future before granting any long time franchises. It is admitted by the officers of the telephone company that the ordinance will not pass in its present form, and it is safe to say it will never pass unless one of these provisions is given the city: A right to regulate prices of telephone service, compensation for the franchise given, or a share in the profits of the company.

By the new charter of Kansas City telephone wires and all electric wires are to be placed under ground as soon as practicable.

The Thomson-Houston Electric company and the Missouri & Kansas & Texas company of Kansas City will ask for a franchise for an electric railway on Wyandotte street from Second street to Westport avenue, a distance of about seven miles. There is much opposition to the scheme already from property owners on Wyandotte street which is the only unobstructed thoroughfare of any account on the west side of the city. It is paved mostly with asphalt.

The council of Westport, a suburban city, has been asked by B. T. Whipple and others for a franchise for an electric railway on Summit street, from Thirty-First street to Westport avenue, a distance of about five miles. The road will connect at the north end with the Kansas City Cable Railway Company's tracks. R. E. T.

Louisville, Ky.

LOUISVILLE, July 30.—The semi-annual report of Gas Inspector Breeder has been completed. It shows that the cost of lighting Louisville for the first six months of the present year was as follows: January, $5,482.43; February, $4,837.85; March, $5,214.95; April, $4,874.54; May, $5,179.54; June, $5,057.35. The cost of lights for the corresponding six months of last year follows; $5 916,-82, $5.351.05, $5,958.40, $5.771.51, $5 962.95, $5,768 93.

A comparison of these figures shows that the saving to the city by the introduction of electric lights during the first six months of the present year was $4,083. The gain comes entirely from the electric light district, as the costs of the gas lamps have always shown an increase from year to year. It is thought by Inspector Breeder that when the electric lights are placed all over the city the latter will save about $10,000 every year.

The Louisville Railway company now expects to put the Second and Sixth street electric line in operation between August 1st and 15th. Everything in connection with the line is complete, with the exception of some of the cars. The delay, in fact, in starting the road is due to the inability of the company to secure a sufficient number of motors. When this road gets in running order, Louisville will have something over sixty miles of electric street railway.

The Ohio Valley Telephone company has begun work on a conduit which will place a great many of its wires under ground. The conduit will hold a cable of 4,000 wires. When completed it will extend from Baxter avenue down Green street to Eighteenth, a distance of four miles. The wires on Preston street and Shelley street will first be put in the cable. Those on the Tenth street route and the Twelfth street route will also be placed in the cable as soon as the conduit is completed. This will remove wires from Grayson and other streets. The intention is, as soon as possible, to extend the conduit from Tenth to High street, and out Eighteenth to Portland avenue, a distance of nearly three miles. Within a year work will probably be begun on a conduit out Center street to Broadway, and thence out Fifth street to the southern part of the city. Work was begun on the Green street conduit this month, and it will probably be completed by fall. A manhole will be left in the conduit at every street corner, so that pipes can be extended from it through the cross streets.

Capt. Gifford, the manager of the telephone company, said yesterday that fully two-thirds of the telephone wires are now under ground. C. C. Y.

Denver, Colo.

DENVER, July 30.—Chicago capitalists have been negotiating for the purchase of the property and franchise of the Trinidad Street Railway company, and it is believed that the deal will soon be closed. It is understood that the Patton motor will be used.

It is expected that the Denver Tramway company's new plant at Thirty-first and Blake streets will be in running order before the Knights Templar conclave in August.

The City Cable company is to erect a large car house in West Deover, although the location has not yet been determined.

Prof. H. Howe of the Denver University has just concluded an interesting course of lectures to the Denver Electric society.

Articles of incorporation of the Baker Coal Mining & Land company have been filed with the secretary of state. The incorporators are: E. B Light of the Denver Manufacturing company, C. H. Mayhem of the Westminster Land company and Isaac Berlin, a Denver capitalist. The corporation on the start will be capitalized at $300,000, fully paid in. An electric line eighty miles long, to extend into the country west and north of Denver, is one of the company's projects. The route as mapped out starts somewhere near the North Denver "loop," runs to Westminister, thence to Dry Gulch, where Col. Dodge of the Rio Grande Western, ex-Gov. Cooker, D. C. Brown of Aspen, and other capitalists, are preparing to develop the gas, oil and coal properties, and are laying out a town site. Coal Park, another town site, is the next point reached, and there it is proposed to erect the company's power house. From Coal Park the road will run to Boulder, Longmont, and thence to Greeley. E. C. D.

The correspondent of a London electrical journal reports that Thomson-Houston electrical machinery, Babcock & Wilcox boilers and Okonite cable will be used in the new municipal electric light plant of Melbourne, Australia. This is a gratifying indication of the esteem in which American electric products are held abroad.

PERSONAL.

W. R. Mason left for Buffalo and the East Monday night, expecting to be gone a week or ten days.

George K. Wheeler of the western railway department of the General Electric company left for the East on Monday.

Geo. D. Shepardson of the department of electrical engineering, University of Minnesota, Minneapolis, Minn, was in Chicago last week.

T. C. Rafferty, assistant-general manager of the Great Western Electrical Supply company, Chicago, returned last week from a short vacation at Bar Harbor, Mich , and other Eastern points.

Frank W. Harrington of New York, connected with the New York Insulated Wire company, was in Chicago on Friday of last week. Mr. Harrington has just returned from a western trip.

Charles E. Brown of the Central Electric company, Chicago, met with a very painful accident last week. While adjusting a fan motor the blade of the fan struck Mr. Brown on the back of the hand, cutting a gash almost into the bone about an inch wide. Dr. John McKinlock promptly dressed the wound, however, and there should, therefore, be no occasion for serious results.

NEW INCORPORATIONS.

C. J. A. W. Electric company, Louisville, Ky.; capital stock, $10,000; selling electric machines, etc.

Garvin Falls Power company, Concord, N. H., capital stock, $100,000; generating electric power; H. F. Lowell, Concord, N. H.

Lowell Water & Light company, Lowell, Mich.: capital stock, $200,000; to furnish electricity for light and power; C. A. Church, Lowell, Mich.

Central Electric company, Peoria, Ill.; capital stock, $5,000; to manufacture, buy and sell all kinds of electric machinery, appliances and supplies; H. W. Wells, Peoria, Ill.

Citizens' Electric Light company, Logan, O.; capital stock, $15,000, manufacturing, selling and furnishing electric light in the village of Logan, O.; L. D. Vickers, Logan, O.

Silver Plume Electric Light & Power company, Silver Plume, Col.; capital stock, $25,000; to supply electric light and power to the city of Silver Plume, Clear Creek county, Col.

Lemont electric Light & Power company, Lemont, Ill.; capital stock, $20,000; to furnish electric light and power for the village and citizens of Lemont, Ill.; J. G. Bodenshatz, Lemont, Ill.

Blanks Ice, Water & Power company, Yoakum, Tex.; capital stock, $60,000; supplying city of Yoakum and Lavaca & Dewitt counties with water, ice and electric light; James Blanks, Yoakum, Tex.

Menominee Electric & Mechanical company, Menominee, Mich.; capital stock, $20,000; to manufacture electric appliances and general mercantile business; Jno. M. Opsahl, Menominee, Mich.

New York Electric Incandescent Lamp company, 396 Congress street, Portland, Me.; capital stock, $2,000,000; manufacturing and selling electrical machinery of all kinds; Seth L. Larrabee, Portland, Me.

Lake Washington Canal & Improvement company, Seattle, Wash.; capital stock, $5,000,000; to build and operate gas and electric light plants; F. H. Whitworth, 24 and 25 Olympic block, Seattle, Wash.

Sandusky, Milan & Huron Electric Railway company, Sandusky, O ; capital stock, $100,000; building, equipping and maintaining street railroads to be operated by electric, horse, or other motive power; A. W. Prout, Sandusky, O.

Burlington & Mt. Holly Connecting company, Burlington, N. J.; capital stock, $100,000; to transport goods, merchandise or passengers between Burlington and Mt. Holly by means of steam, electric or pneumatic system; W. H. Clough, 45 Broadway, New York, N. Y.

ELECTRIC LIGHTING.

The Fort Smith Electric Light company has ordered a new Westinghouse dynamo.

The Fort Wayne company is seeking a franchise from the Jackson, Mich , city Council.

The streets of Cairo, Ill., are to be lighted by arc lamps supplied by the Cairo Electric Light & Power company.

A Janesville, Wis., paper reports that insects gathered so thickly about an arc lamp in that city recently as to practically extinguish the light.

The Hot Springs Electric Light company is moving its plant from its present location on Central avenue to the gas plant property on Malvero avenue.

A Russian physician now asserts that the pain of neuralgia, if superficial, can be relieved at once by throwing a beam of light from a strong arc lamp upon the affected part.

M. Fleming, representing the Reliance Electric Light company, has purchased the 17 transformers seized from the Citizen's company of Windsor, Ont., for debt. The Edison company bought the remainder of the plant and, together with the Reliance company, will operate it. The station will be put in a first-class condition at once.

The electric street lights of Rochester, N. Y., have been placed in charge of City Electrician, Chas. R. Barnes, whose department formerly included only the fire alarm telegraph.

Indianapolis will soon be supplied with 750 additional arc lamps for street lighting. The lights will be about equally divided between the northern and southern sections of the city.

The city council of Fort Madison, Iowa, has advertised for proposals for public lighting, which will be received until August 15th at 7:30 p. m. From 75 to 100 arc lights will be needed.

S. Lenox Tredwell has begun suit in the Supreme court at Yonkers, N. Y., against Hugh R. Garden and Henry C. Davis, whom he charges with dishonesty in the management of the Consolidated Electric Light company.

The boiler of the Grand Ridge, Ill., electric plant exploded a short time ago. The explosion set fire to the debris and the entire electric plant and other buildings were destroyed.

The Cicero Light, Heat & Power company of Cicero, Ill., a suburb of Chicago, has purchased a block of land on Lombard avenue, south of and fronting the Wisconsin Central railroad, and will immediately commence the erection of its plant. Poles have been strung for the lighting of the streets in Austin and the south end of Cicero, and arc lamps of 1,200 candle power will be used.

The main plant of the Toledo, O., Electric Light company on St. Clair street was destroyed by fire shortly after 5 o'clock on the morning of July 30th. The building is a total wreck and the loss will be about $6,500, which is fully covered by insurance. The loss on machinery and fixtures is $68,500, with $55,000 insurance. Over one half of the city was lighted by this plant. It is not known whether the company will rebuild on the old site as it has been negotiating for a site for a new establishment in another locality. The fire was caused by the crude petroleum fire under one of the boilers.

A dispatch from New Orleans, dated July 25th, says: It was learned to-day that numbers of stockholders of the Edison Electric Light company have been approached by officers of the Fort Wayne, Ind., Electric company and made offers for the transfer of their stock, and some of them have accepted. The deal is generally accepted as part of the scheme by which the large electric company expects to secure control of the street railways and lighting plants of the city and consolidate them under one management with an immense central plant to supply the power for the entire system.

It is proposed to have a brilliant electrical illumination on Pennsylvania avenue, in Washington, on the occasion of the next national encampment of the Grand Army of the Republic. To do this it was necessary to have introduced in Congress a joint resolution by which the Commissioners of the District of Columbia were authorized to permit the committee on illumination of the citizens executive committee to stretch suitable conductors, with sufficient supports, wherever necessary for the purpose of effecting the illumination. The Senate has already agreed to the resolution. A provision was added requiring that the conductors and other apparatus should not be used after the 27th of September, and that they must be removed by the 1st of November. No part of the expense is to be borne by the District government, and the pavements are to be restored to their former condition to the satisfaction of the commissioners.

The Citizens' Electric Light & Power company's troubles have at last been ended by a change of name says the Louisville, Ky , *Commercial* of July 22d. It has been made a part of the General Electric company, of New York. The name assumed is the Citizens' General Electric company. Under the agreement reached, new directors were elected for the company under its changed name as follows: W. F. Grant, A. M. Worthington, John G. Roach, J. J. Harbison, Leon H Cooper, Paul T. Bradley and R. E. Drake. The old officers will remain. Under the amended articles of incorporation the company will issue stock to the amount of $600,000. Four hundred thousand dollars of this stock is to be taken by the parent company. The remaining $200,000 of the stock is to remain in the possession of the local stockholders. The original stock of the company was $114,000, which is to be replaced by the new issue. The new company will build a large plant between Fourth and Fifth streets on the river front, to which place its machinery will be removed. Work on the plant will be begun at once and pushed to completion at an early date. The General Electric company will take the entire issue of bonds, and over $150,000 will be expended on the new plant.

ELECTRIC RAILWAYS.

The Baltimore Traction company has decided to equip its Carey street line with electricity.

The Washington, Alexandria & Mount Vernon Electric Railway company of Alexandria, Va., which has awarded contracts for its road, will use the Thomson-Houston system.

The city council of Greenville, S. C., has granted a franchise to the Thomson-Houston company for the construction of an electric railroad. Work is to be commenced within six months.

The Oakland, San Leandro and Haywards Electric road of Oakland, Cal., will soon be extended farther toward Fruitvale. The company has bought up the horse car line on Twenty-third avenue, and is converting it into an electric road. The company has also applied for permission to lay a double track on its main line.

At a recent meeting of the stockholders of the Marinette, Mich., Gas, Electric Light and Street Railway company, it was decided to bond the road for $5,000 to build extensions. The bay shore route has been abandoned and the track will be laid on Pierce avenue.

The Huntington, W. Va., Electric Light & Street Railway company, Huntington Gas company and the Belt Line Street Railway company, have consolidated under the name of the Consolidated Light & Railway company, with J. L. Caldwell as president. The new company owns about seven and a half miles of street railway, partly electric and partly animal power. Extensions and improvements will be made, including the equipment of the entire road with electricity. The capital stock is $100,000.

Mayor Washburne has vetoed the Chicago & North Shore electric railroad ordinance. In speaking of the matter J. L. Cochran, who is connected with the company, said : "The ordinance as amended was of absolutely no use to us, and we never would have accepted it. We could not afford to build the road and then spend more than the cost of building to put our wires underground. We still have our original franchise from Graceland avenue north, but we will not build until we can make the desired connection with the cable. Many property owners who opposed the southern extension are beginning to see their mistake, and we will not relax our efforts to arrange the matter, although we can do nothing more with the ordinance until September." The ordinance was referred, after the veto, to the committee on streets and alleys north.

Early on the morning of July 27th the south half of the roof of the power house of the street railway company on Hill street St. Paul, Minn., collapsed. The roof was made with a slight slant to the south to drain the water. At the south side the wall extends up on a level with the back wall, forming a large reservoir. This was drained by water spouts, which were inadequate to carry off the rain of the 26th, and the roof was soon covered by several feet of water, the weight of which precipitated part of the roof into the dynamo room below. Six generators were under the part which fell, and these and other electrical apparatus were damaged by the roof and water.

The bill which passed the United States Senate providing for the abolishment of "one-horse" cars in the District of Columbia was recently called up in the House by Mr. Heard and sent to conference. The bill originated in the House, and at the instance of Mr. Washington a provision was attached providing that the trolley system could be used by any company operating outside limits of the city. This provision the Senate eliminated. Mr. Washinton was not in his seat when the bill was presented, but he said afterward that he would not insist on his amendment, for he had looked into the matter and found that both branches of Congress permitted this system on all roads outside the corporation. The Senate objected to this amendment because it was in the nature of general legislation on a special bill and was not necessary.

Henry Pierce of Albany, N. Y., has invented an ingenious device for automatically indicating when electric cars are about to pass cross streets and public buildings on the line. The apparatus is enclosed in a receptacle about one foot square, which is placed over the doorway on the inside of the car and at a point opposite the usual location of the passenger indicator. At the top and bottom of this box are apertures. On the span wire which supports the main or overhead wires is placed a check or projection near the main wire, and from the trolley wheel a small arm projects in the direction of this projection. When the wheel passes by this point it touches the projection with sufficient force to make an electrical contact, which rings a bell. Immediately the name of the cross street next to be approached with the nearest number thereon to the main street, or the name of a public building, is shown in the box, and, as the car approaches the next street or public building, it again rings the bell, and the names of the street or building first registered drops automatically to the bottom, and the one approaching occupies the top, and so on to the end of the line. The convenience of this device will be appreciated by strangers in particular, as by watching the indicator they are warned as they approach their destination.

TELEPHONE.

Steps have been taken in Montreal to establish a new telephone company. Provisional directors have been chosen, and it has been decided to call it the Merchants' Telephone company. The rates proposed to be charged subscribers are not over $25 a year.

The new telephone company in London is receiving substantial support. It has already obtained 2,500 subscribers to its service, and proposes to start operations immediately with underground metallic circuits, promising satisfactory service to all customers.

It is said that a paying occupation for the blind can be found in operating switch-boards in telephone exchanges. The Philadelphia and St. Louis exchanges have blind operators on their forces, and they work as rapidly and skillfully as though their sight were perfect.

There is a likelihood of a legal battle between the Sunset Telephone & Telegraph company of San Francisco and the Oakland, San Leandro and Haywards Electric Railway company. When the new electric road was put into operation the telephone company found it necessary

to put in new poles and raise its wires, as the electric wires were too near. This work put the telephone people to considerable expense, and they want the railway company to stand a portion of it. The corporations have been unable to come to terms, and it is very probable that the matter will be taken into court for settlement.

At a meeting of the stockholders of the Bell Telephone company of Philadelphia on July 26th it was decided to increase the capital from $560,000 to $1,000,000. A greater portion of the extra sum is to be expended in laying wires underground and making other improvements.

Fire Marshall Swenie of Chicago, has advertised for bids for furnishing the city of Chicago with four and one-half miles of three conductor telephone cable in accordance with specifications on file at the office of the superintendent of city telegraph. Proposals will be received at the office of the fire marshall until noon of August 10th.

The telephone company at Little Rock, Ark., has replaced the old lines with new fifty-five foot poles, and contemplates extending the system to Fort Smith on the north and Pine Bluff on the south, with new long distance lines to Hot Springs, tapping intermediate towns. The company has one of the best equipped systems in the country, and Manager Adams deserves great credit for the efficient manner in which he has handled the business.

The great increase in the use of the telephone in England is giving much concern to the government, which is fearful that the spread of telephony may interfere with its telegraph business. That there is considerable ground for alarm is certain, as last year the telephone companies in Great Britain distributed 160,000,000 messages, against a total of 66,000 000 by the postoffice. The government has already a cheap and efficient telegraph service, and if the people find that even with such a service at their disposal the telephone is better suited to their needs, they will talk their messages instead of writing them.

TELEGRAPH.

Dynamos have just been introduced in the New Haven, Conn., office of the Western Union company, to supersede batteries.

The government of New Zealand is considering the question of laying a cable to Australia at an estimated cost of £150,000.

A clever piece of work was recently done by the telegraph battalion of an English regiment in the course of some night experiments. A cable was rapidly laid over the roughest possible ground, and that, too, without the slightest assistance from searchlights, and the general in command was thus enabled not only to find a lost brigade, but to control the simultaneous advance and attack of three separate brigades on an earthwork at midnight. The telegraph, in fact, rendered a most difficult and doubtful operation comparatively easy and certain. With large scale maps, a balloon and increased observing staff, it is likely to be made a most important aid to the strategist and the tactician.

MISCELLANEOUS.

An electrical fountain is to be built at a cost of $2,500 in the city of Lynn, Mass., the money being provided by the will of a late resident of that place.

The Westinghouse Electric & Manufacturing company is said to have received since March 1st orders aggregating $3,000,000, including its World's Fair contract.

The latest thing in night clocks has an incandescent lamp over it and a yard or so of insulated wire which runs to the bed of the person who wishes to know what time it is in the dark.

The city council of Boise City, Idaho, has awarded the contract for a complete fire alarm telegraph system to the Gamewell company. There will be ten boxes, and the cost will be $2,600.

The *Daily Financial News* of Pittsburg says that the Mather Electric company has asked the United States court at Boston for an injunction under the anti-trust statute against the General Electric company, the Edison General Electric company and the Thomson-Houston Electric company, restraining them from representing that the plaintiff is infringing upon certain of their patents.

TRADE NEWS.

The Gate City Electric company, the Kansas City branch of the Central Electric company, Chicago, has sold to Armour Brothers ten miles of Okonite and ten to twenty miles of weatherproof wire, besides other supplies for the new Armour buildings. The order was secured by W. D. Green, the manager at Kansas City. The company is to be congratulated upon having such a capable man in charge of its Kansas City house.

W. S. Love, for a number of years secretary of the Pond Engineering company, and well known through his prominent connection with the home office of his company, at 709 Market street, St. Louis, has been elected vice president of the company, with headquarters at room 8, Rookery, Chicago. Mr. Love will have charge of the sale of the Armington & Sims engines for the Pond company in Chicago and vicinity, and do the contracting for the installation of steam plants, etc.

Frank Hoffman & Co., a new corporation, have secured the agency for Chicago and immediate vicinity for the Mayo generators and motors, manufactured by the Rockford Electric Manufacturing company, Rockford, Ill. The Rockford company has some large motor installations in this city—notable among which is the *Inter Ocean* plant 125 horse power. Its apparatus is well known in Chicago, making the outlook for a fine business most flattering. The new company will do a general contract business, incandescent wiring, bell hanging, etc., in connection with the sale of the Rockford apparatus.

The Enterprise Electric company, Chicago, has secured the general western agency for the wire manufactured by the National India Rubber company of Bristol, R. I., and will push its sales throughout the territory tributary to this city. The wire has both a tape and braid insulation, making it, as it would appear, entirely seamless. The compound used in covering the wires, it is claimed, possesses very high insulating qualities, and is not effected by heat, cold or moisture. The Enterprise company is to be congratulated on having secured this agency, and there can be no doubt that the confidence placed in it will be well sustained. This company commenced operations on May 1st, but in the three months passed a very fine business has been built up, the last month showing an increase in sales over the first of 50 per cent., and the sales for the first month aggregating a good round sum. Mr. McKinlock and his associates have commenced on a good, solid foundation, and there can be no doubt as to the results.

BUSINESS.

The Electric Gas Lighting company has been selling from its western office, 20 Lakeside building, Chicago, many Porter motor fan outfits during the recent hot weather. The company has made quite a hit with a primary battery outfit, which gives 35 hours work from one charging, and is also selling a number of storage battery outfits, which, in connection with gravity batteries for recharging, make a complete and convenient plant for office or sick room fans.

During the month of July the Pond Engineering company sold, through W. S. Love, its Chicago agent, one compound Armington & Sims 250 horse power engine to the Hyde Park Thomson-Houston Light company, and one compound Armington & Sims 175 horse power engine, boilers and heaters, complete, to the Calumet Electric Street Railway company of South Chicago. These installations are both very handsome ones. The Pond Engineering company is doing a very fine mid summer business.

A postal card to the Link Belt Machinery company, Chicago, will bring a neat and tasteful little catalogue on "Manila Rope Power Transmission." This company is prepared to make plans and estimates for furnishing and erecting machinery to transmit any required power, or, if preferred, will supply a skilled superintendent and working drawings for the installation of its machinery. Where the power to be transmitted is considerable, or the location of the plant difficult, the Link Belt Machinery company will send one of its engineers to look over the ground and take the necessary measurements.

The Electrical Supply company, Chicago, reports having received a much larger number of orders than it anticipated for Crocker-Wheeler motors during the first week it has acted as Crocker-Wheeler agent. Not only were the sales large for fan motors, on account of the weather, but the company received also several orders for large motors. The Electrical Supply company attributes its success at the start to the fact that the Crocker-Wheeler motor is well known and is recognized as the very best of its class. Doubtless the sales in this department will be pushed with the same energy that has been shown in other departments of the company's business, for the start has been made with the motor department organized with experienced men.

A distinct step forward in the application of electricity has just been made in Denver, Colo., in the Sheridan building, owned by J. H. Ernest Waters and erected by him exclusively for light manufacturers. This building is constructed after the plans of Baerresen Bros., architects of Denver, is designed for the use of light manufacturers, such as watch case makers, brass finishers, etc., and contains some twenty odd rooms above the ground or store floor adapted to the above uses. In this building there is installed a plant for the distribution of power to the tenants by wire exclusively instead of after the usual practice by belting and shafting. The power plant, located in the basement of the building, consists of two 60 inch return tubular boilers, one 165 horse power Fraser & Chalmers Corliss engine and one 40 horse power straight line engine. Belted through a countershaft to the Corliss engine is an 80 kilowatt C. & C. dynamo, wound for a pressure of 120 volts, and to the 40 horse power straight line engine is belted direct a 20 kilowatt C. & C. dynamo wound for the same pressure. The switch-board in the engine room is built of Vermont marble and is 16 feet long. On this board are located the terminals of a distributing circuit for each tenant in the building. In each circuit is an ampere meter, to show the amount of power used by each tenant and thus keep the supply of power constantly under the supervision of the engineer. The large engine and dynamo supplies the light and power during the day, and the 40 horse power plant furnishes such light and power as may be required after 6 P. M., the circuits being so connected at the switch-board that either or both of the dynamos may be connected to the supply circuits of the building. The steam plant was designed and erected by Fraser & Chalmers, Chicago, and the electrical plant by the C. & C. Electric Motor company of New York.

ELECTRICAL PATENTS.

Issued July 26, 1892.

479,379. Cord Carrier for Underground Conduits. Stephen R. Bradley, Nyack, N. Y.

The device consists of an electro-magnet, the armature whereof by reason of the intermittent electric flow, actuates devices which engage with the walls of the conduits to propel the carrier.

479,410. Electric Belt. Andrew M. Eklund, Minneapolis, Minn.

479,469. Motor Frame for Electric Motors. Sidney H. Short, Cleveland, Ohio.

The motor frame is composed of two parts, one insulated from the other, thus preventing leakage of current to ground.

479,493. Electric Railway. Mark W. Dewey, Syracuse, N. Y.

A line is connected with a source of non-continuous currents and to an electric condenser extending along the railway; a motor is carried upon the vehicle and connected to an electric condenser carried upon the vehicle in inductive proximity to the former condenser.

479,509. Cord Adjuster for Electric Lamps. John W. Heaphy, Jr., Rochester, N. Y.

Separate clutches are provided for the electrode and independently movable to positions parallel or inclined to each other by means of a thermo-expansive electric conductor.

479,510. Electric Arc Lamp. William E. Irish, Cleveland, Ohio.

479,520. Electric Self Winding Clock. Malcolm MacKellar and George D. Weaver, Reading, Pa.

Means are provided for automically making and breaking a circuit to actuate an electro-magnet armature which acts upon the clock train through a pawl and ratchet.

479,525. Electric Conductor. Frederic A. C. Perrine, Trenton, N. J.

A flat conductor is twisted into a spiral form and provided with a covering supported only on the exterior lines formed by the spirals.

479,540. Electric Signalling Device for Fire Hose. John C. Wharton and James W. Braid, Nashville, Tenn.

Conductors are provided in each section of hose, the respective conductors of the different sections being connected by coupling the hose. A key is provided at the nozzle and signaling device at the engine end of the hose.

479,541. Sealed Battery Cell or Similar Articles. Charles Willms, Baltimore, Md.

479,557. Electroplating Toy Apparatus. Edward A. Clark, Boston, Mass.

479,596. Thermo-electric Element. Charles W. Iden, New York, N. Y.

A compound of zinc and antimony is cast in an iron box and pole pieces made of another metal are cast in said compound.

479,608. Trolley. Frederick F. Poole, Newark, N. J.

A spring clasp attached to the trolley wheel is adapted to engage with the wire and hold the trolley wheel in place.

479,659. Electric Arc Lamp. Jonathan A. Pierce, Austin, Minn.

The carbon is placed between spring-pressed rollers to uniformly feed the same; one of the rollers being held between friction washers. A spring is adapted to regulate the frictional contact between the roller and washers.

479,666. Switch and Signal Apparatus. Jens G. L. Schreuder, Edgewood, Pa.

479,673. Apparatus for Producing Variegated Lights. Frank L. M. Smith and William J. Bryan, Chicago, Ill.

A series of different colored lights are contained in a single chamber provided with semi-transparent material on one or more sides, and by bringing the lights into action in combination, the material will transmit solid colors differing from any of the lights in the combination.

479,675. Alternating Current Motor. William Stanley, Jr., Pittsfield, Mass., and John F. Kelly, New York, N. Y.

A rotating armature is combined with stationary coils closed upon themselves adapted to produce an effect equal but opposite to that of the armature coils whereby the self induction and consequent retardation in the armature will be neutralized or overcome.

479,676. Alternating Current Motor. William Stanley, Jr., and John F. Kelley, Pittsfield, Mass.

A polarization cell is placed in an alternating circuit in series with the transmitting devices and adapted to yield an electromotive force opposite to that of the self-induction.

479,709. Fire Alarm Apparatus. Albert Goldstein, Baltimore, Md.

479,715. Key Controller and Signal Transmitter. Morris Martin, Malden, Mass.

479,726. Acoustic Telephone. Alfred L. Simpson, New York, N. Y.

479,727. Alternating Current Motor. William Stanley, Jr., and John F. Kelley, Pittsfield, Mass.

A polarization cell is included in one circuit of an alternating current motor having independent energizing circuits and the cell is adapted by its electromotive force to advance the phase of the current in its circuit relatively to that in the other circuit.

479,746. Electro Magnetic Motor. John F. Kelley, New York, N. Y., and William Stanley, Jr., Pittsfield, Mass.

The invention embodies an alternating dynamo and a motor, both of the elements of which are energized by the directly impressed electromotive force of the generator and a condenser in series with such motor and adapted to neutralize its self-induction.

479,753. Secondary Battery. Arthur E. Colgate, New York, N. Y.

479,761. Temperature Regulator. Washington H. Kilbourn, Greenfield, Mass.

479,772. Matrix Making Machine. George A. Goodson and Alexander S. Capehart, Minneapolis, Minn.

479,773. Matrix Making Machine. George A. Goodson, Minneapolis, Minn.

WANTED!

Agents to sell our

Niagara Electric Motors and Dynamos

In cities where we are not already represented. Liberal discounts and exclusive territory to responsible dealers in electrical apparatus.

LOVELL MFG. CO., Ltd., Erie, Pa.

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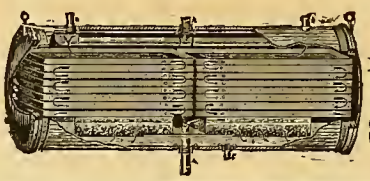

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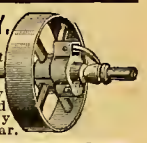

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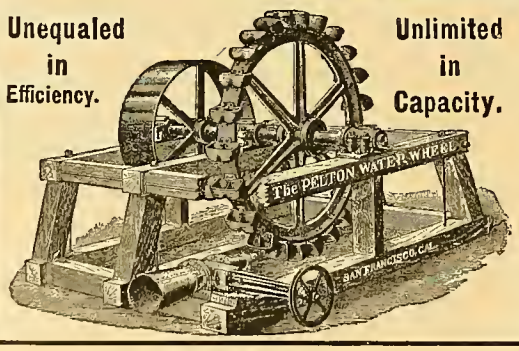

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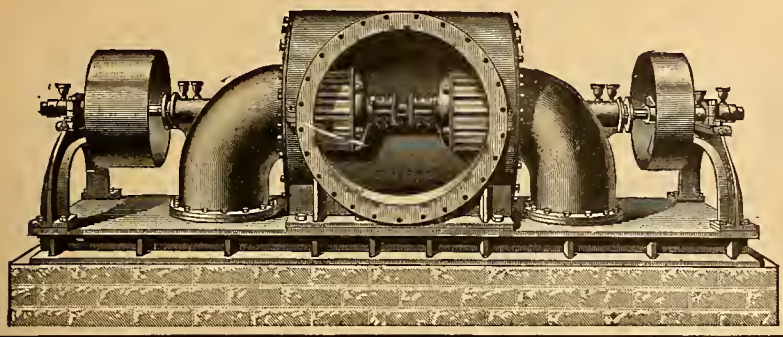

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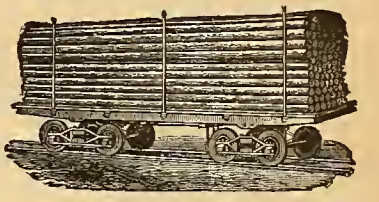

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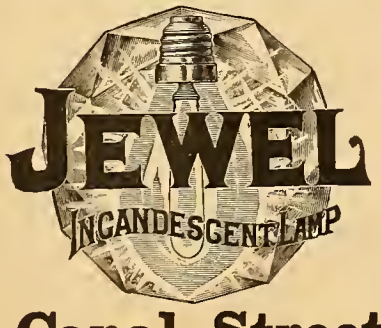

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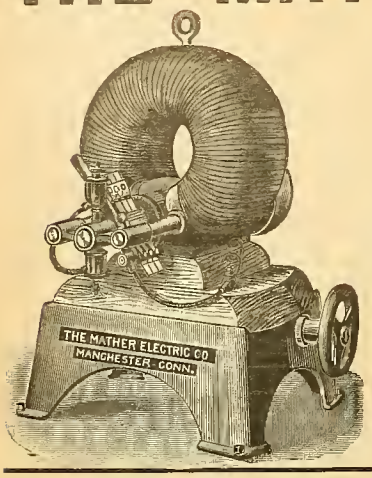

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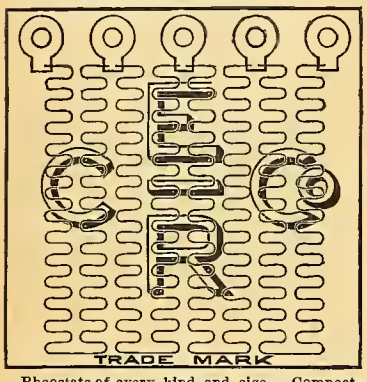

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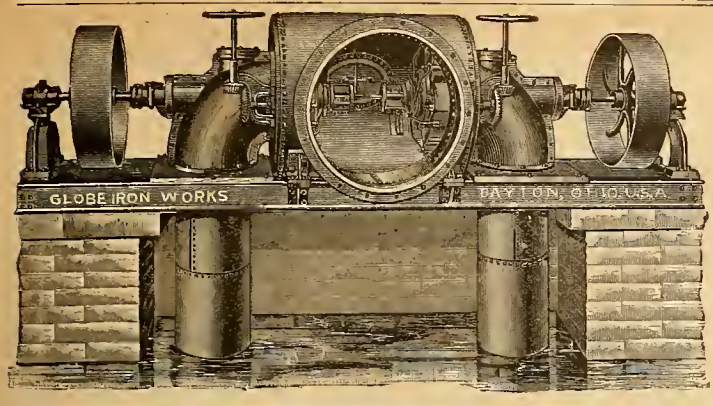

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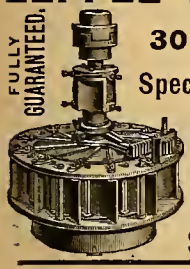

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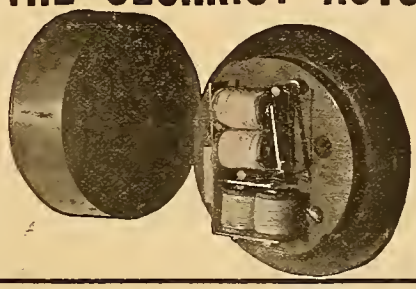

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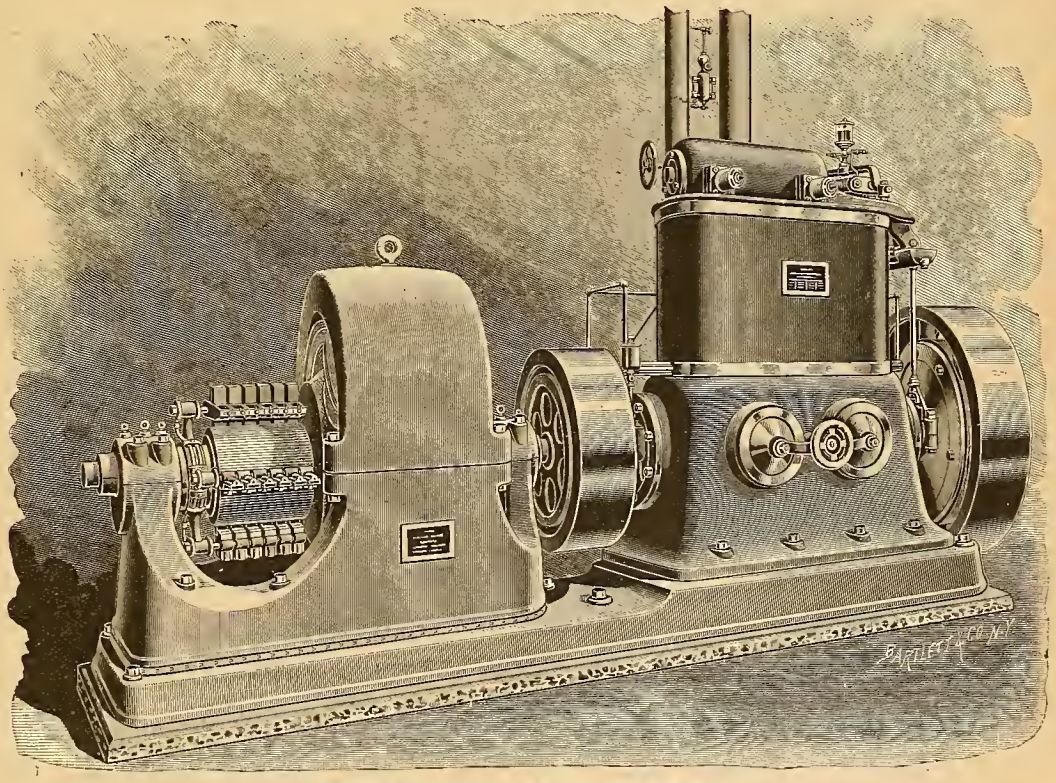

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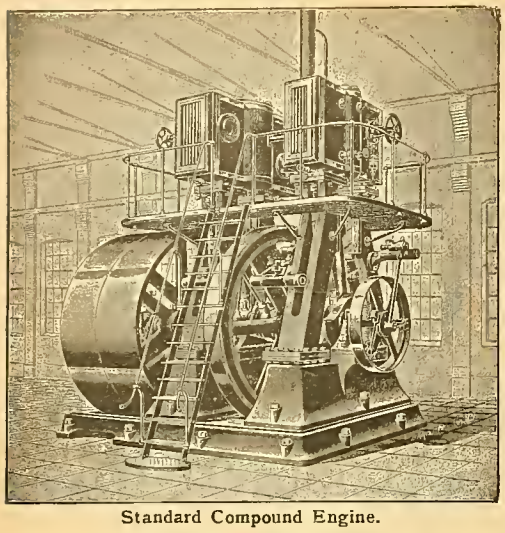

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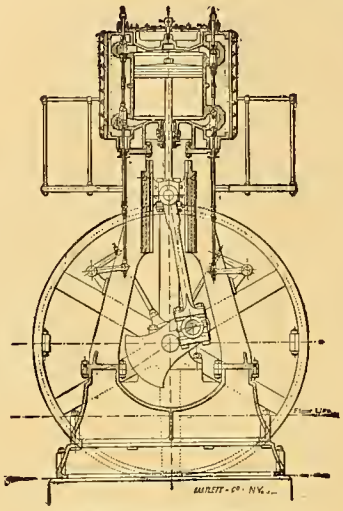

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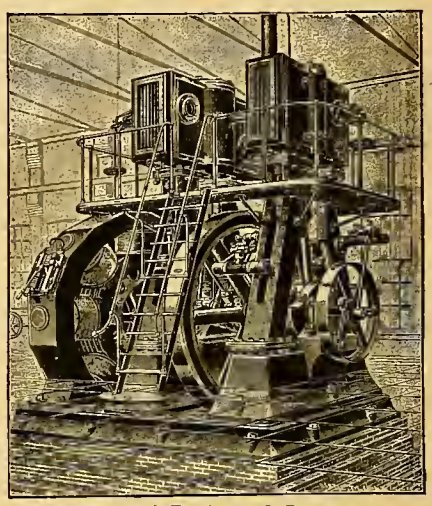

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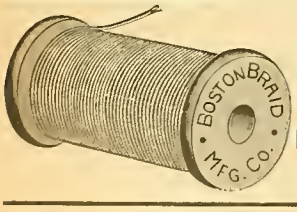

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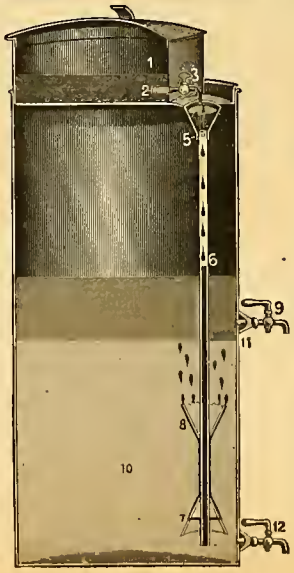

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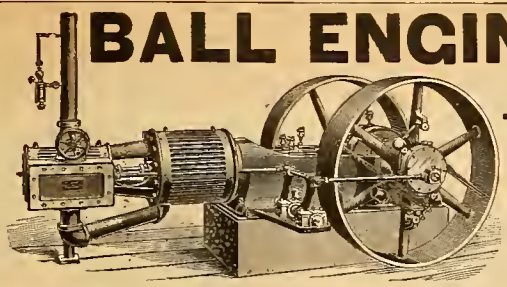

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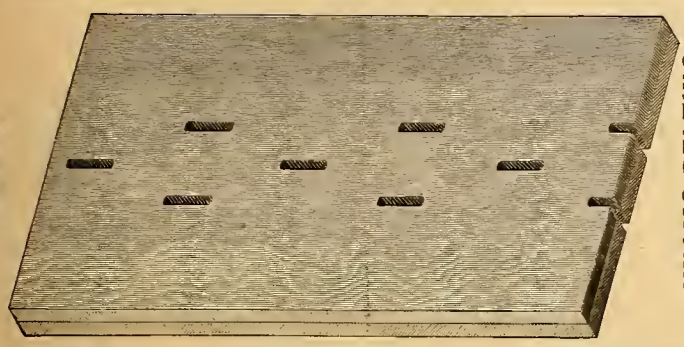

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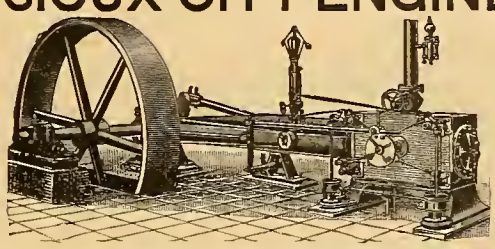

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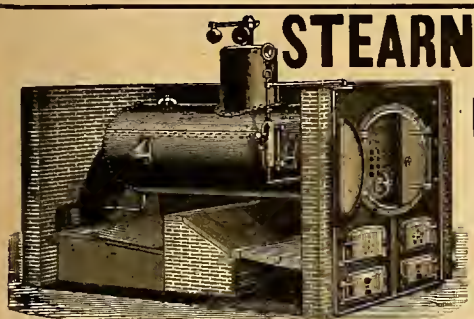

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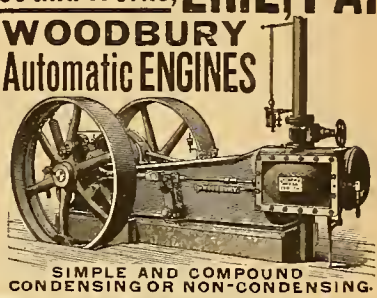

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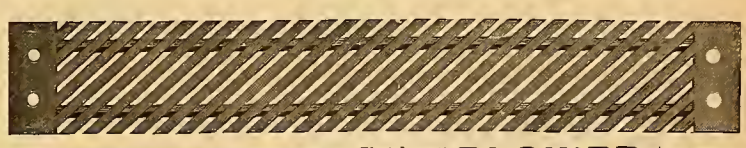

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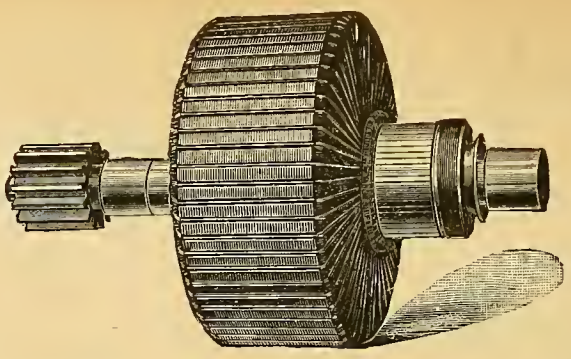

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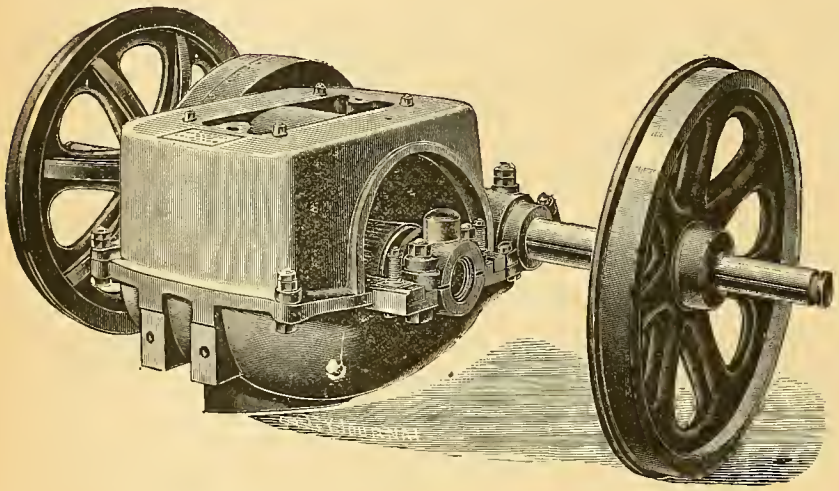

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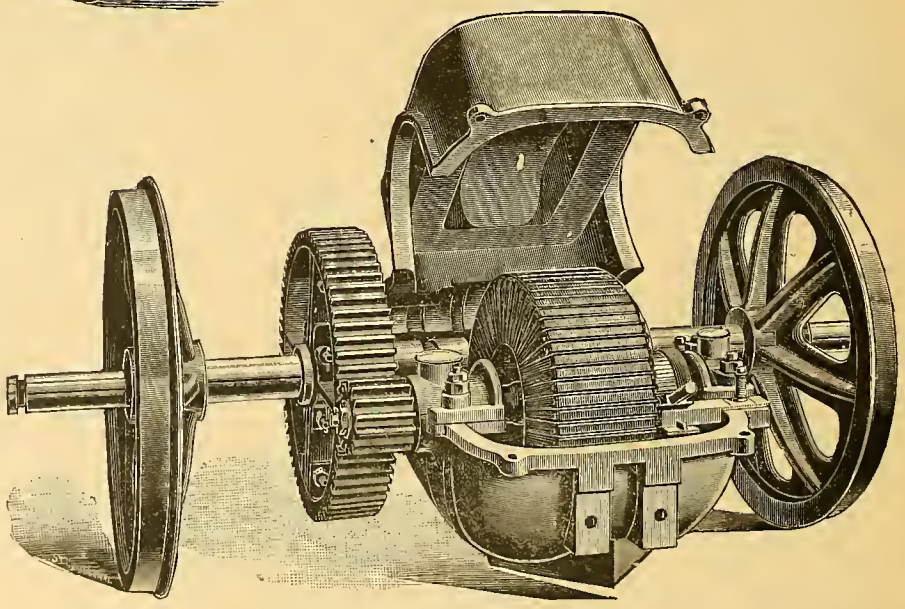

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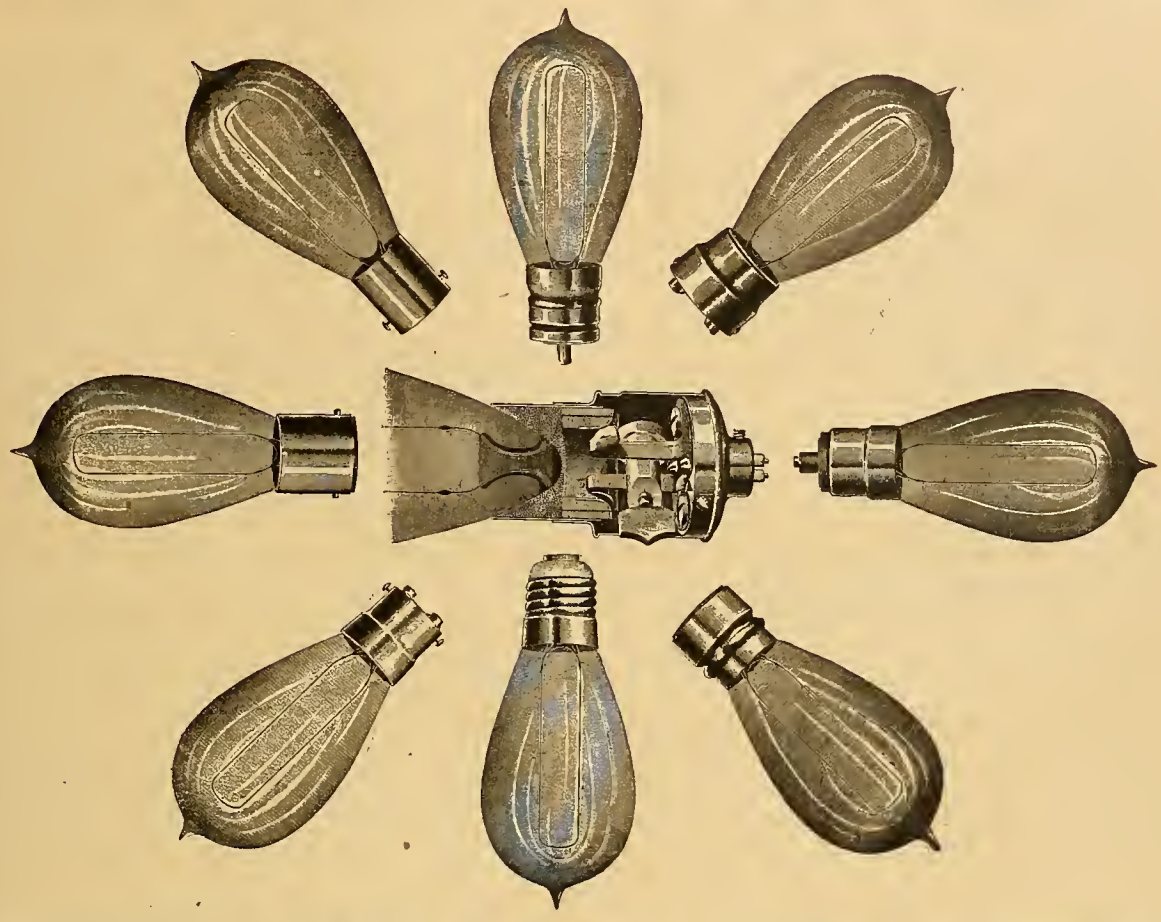

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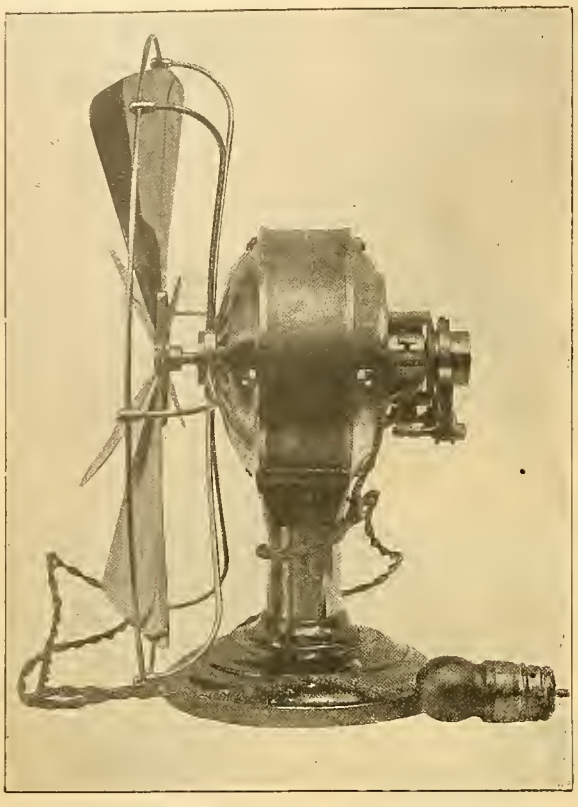

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"Turruble, Daddy, turruble. Hotter'n hoein' corn." And both of them mopped their faces with a large bandana.

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"Great ditches! Daddy, lookee!"

"Sufferin' Mariah!"

"Bigger'n Bob Finter's hay stack, aint she Dad?" 'Daddy' was lost in wonder; they stopped and counted the stories, counted them up and then counted them down.

"Aint she a high 'un, Daddy?" They walked on until they reached Michigan avenue. Daddy chewed an apple core reflectively. Nate looked out over the lake. Suddenly he cried "Dad!" and shot across the street like a frightened squirrel. Daddy followed as quick, nearly, and both stood with their noses pressed flat against the window for a full minute.

"Great shucks, Daddy! Don't they whiz?"

"Um huh!"

"Wouldn't they everlastin' make *butter?*"

"*Wouldn't* they keep the flies off'en old Brindle a-milkin'?"

"Wonder what they call the tarn nation buzzers?"

"Dast ye go in, Dad?"

"Yep." Nathan disappeared through the door and presently came back and handed Daddy a small card—

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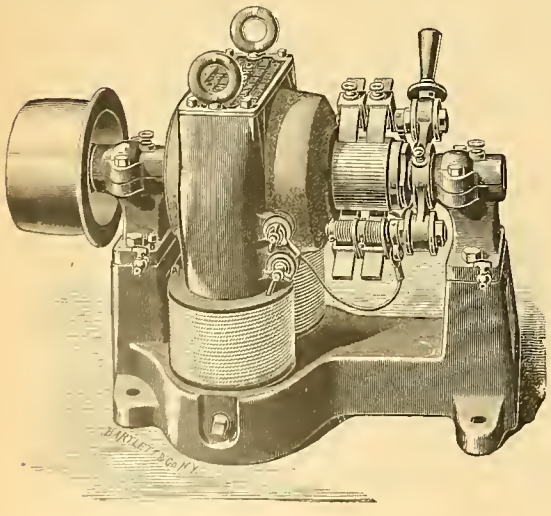

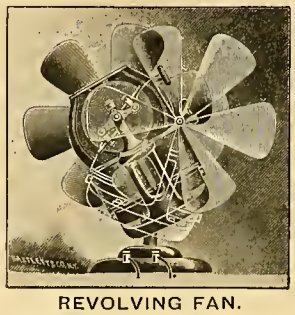

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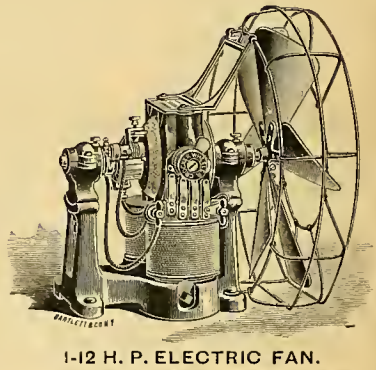

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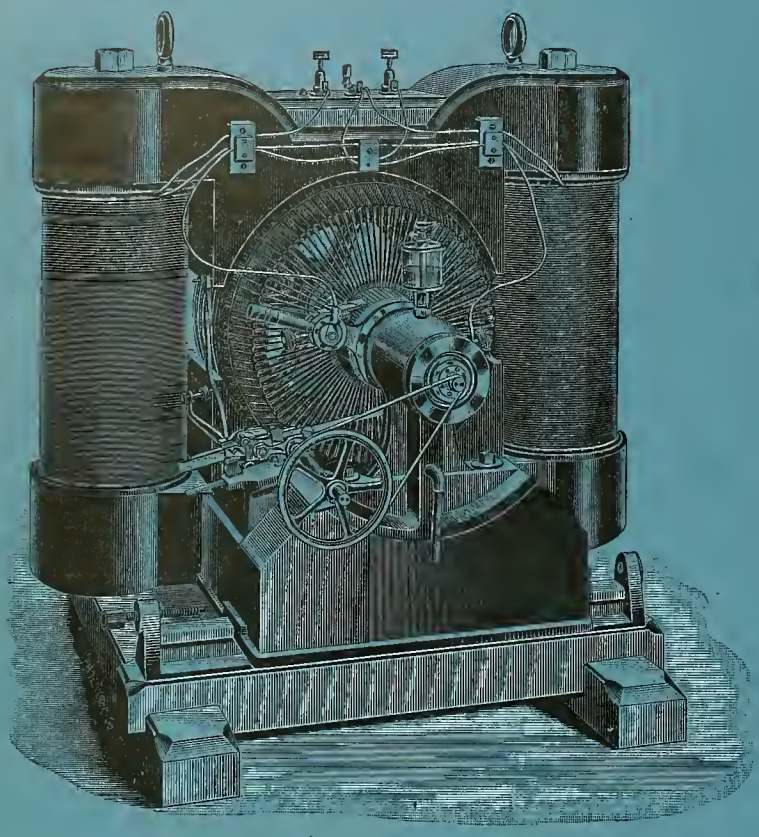

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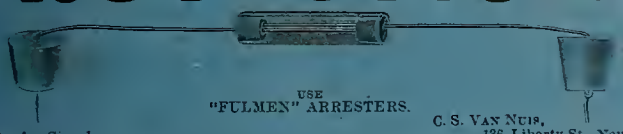

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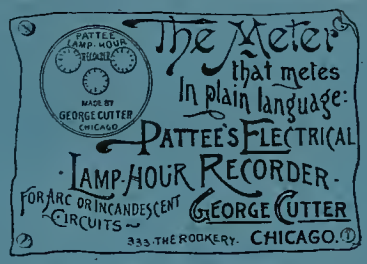

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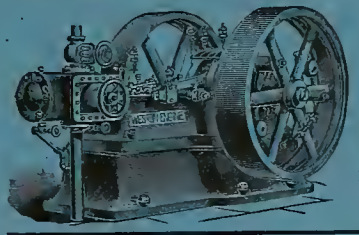

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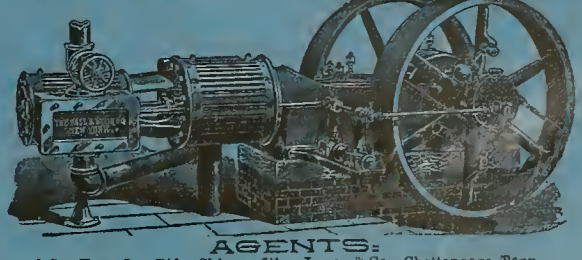

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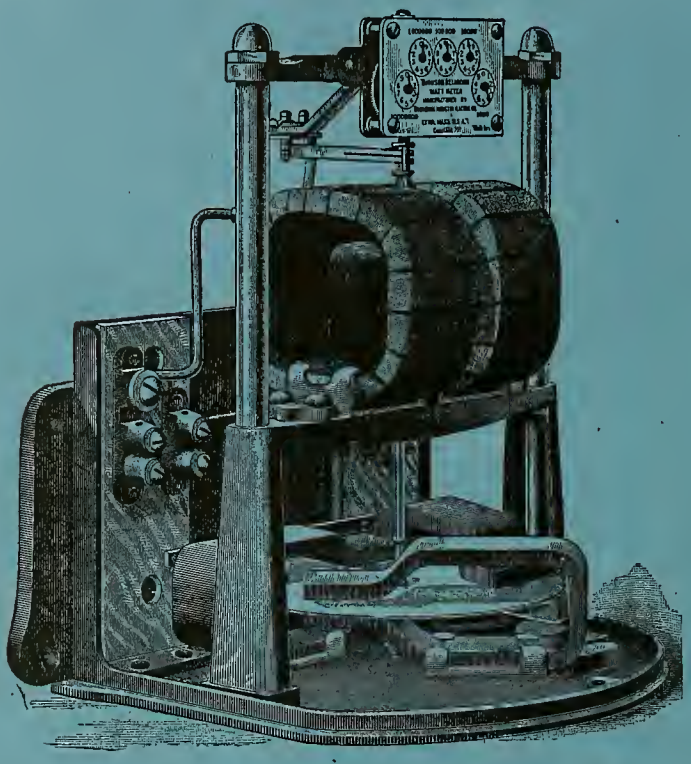

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GERMANTOWN, PA., April 29, 1892.

Thomson-Houston Electric Co.

GENTLEMEN:—Replying to your inquiry of the 21st I am pleased to say the THOMSON RECORDING WATT METERS in use by us are giving us no trouble in any way. Repairs are so insignificant as not to need mentioning. We are using a great many, both on Direct and Alternating Currents, to our great satisfaction. Yours truly,

GERMANTOWN ELECTRIC LIGHT CO.,

(Signed) Chas. M. Allen, Supt.

LANSING, MICH., April 6, 1892.

Thomson-Houston Electric Co.,
BOSTON, MASS.

GENTLEMEN:—Answering yours of the 31st regarding the THOMSON-HOUSTON RECORDING WATT METERS, would say that we are well pleased with them so far, and consider them better than anything else we have tried.

Yours truly,

LANSING ELECTRIC LIGHT & POWER CO.,

(Signed) E. F. Cooley, Supt.

Thomson-Houston Electric Co.,

PRINCIPAL OFFICE,
620 Atlantic Ave., Boston, Mass.

WESTERN OFFICE,
173 Adams Street, Chicago, Ill.

INDEX AND CLASSIFICATION OF ADVERTISEMENTS.

ALPHABETICAL LIST.

American Battery Co..... ix
American Desk & Seating Co.. xiv
American Engine Co..... xii
Andrae, Julius.....—
Andrews & Co., A. H..... ...—
Babcock & Wilcox Co., The.... i
Baggot, E xiv
Ball Electric Light Co..... xvi
Ball Eogine Co.....xix
Ball & Wood Co., The .....!
Beacon Vacuum Pump & Elec. Co.i
Becker Mfg. Co., John..... xiii
Beggs, J. E., Mch. & Supply Co. x
Bernstein Electric Co..... ... xii
Boston Braid Mfg. Co..... xvi
Bowers Bros..... xvi
Bristols' Mfg. Co..... ..—
Brookfield, Wm..... xii
Brush Electric Co viii
Bryan, W. H.. i
Bryant Electric Co..... xii
Buckeye Electric Co., The..... ix
Butler Hard Rubber Co.....—
Carpenter Enamel Rheostat Co. xvi
Central Electric Co..... ... v
Chicago Electric Motor Co..... xii
Chicago Rawhide Mfg. Co.....—
Crescent Ins. Wire & Cable Co. xiii
Crocker-Wheeler Electric Co.. xiii
Cushing, F. W..... vii
Cutter, Geo..... i
Cutter Electrical & Mfg. Co... —
Dayton Globe Iron Works Co..xvii
Densmore Typewriter Co..... xii
Detroit Electrical Works..... xxiv
Diamond Electric Mfg. Co.... xii
Dixon Crucible Co., Jos..... xvii
Dudley & Co., W. W..... xvi
Duplex Electric Co., Ltd.....—
Eastern Electric Cable Co..... xiii
Easton Electric Co..... xvi
Eastman Kodak Co..... xiv
Edison General Electric Co.....viii
Electric Cons. & Supply Co... iv
Electric Engr'g & Supply Co .. ix
Electric Secret Service Co..... x
Electrician Pub. Co.... xv, xvi, xvii
Electrical Construction Co.,The. xii
Electrical Supply Co., The.... xxii
Elektron Mfg. Co..... xix
Empire China Works..... x
Enterprise Electric Co..... xv
Falls Rivet & Machine Co..... ix
Ferracute Machioe Co..... xvii
For Sale Advertisements... i, x, xii
Fort Wayne Electric Co..... xxiv
General Electric Co..... ix
Gravity Purifier Co..... ....—
Greeley & Co., The E. S.....!
Gregory, Chas. E..... i
Hart & Hegeman Mfg. Co..... x
Heisler Electric Co..... —
Hill Clutch Works..... xix
Hine Eliminator Co.....—
Holmes, Booth & Haydens.... xiv
Illinois Electric Lamp Co...:: xv
India Rubber & G. P. Ins. Co. xxiii
Institute of Technology..... xiv
Interior Conduit & Insulation Co. x
International Okonite Co..... i
Jewell Belting Co..... i
Johns Mfg. Co., H. W..... x
Kartavert Mfg Co..... xvi
Kelly Brothers ..... —
Knapp Electrical Works..... xxi
Lake, J. H. & D., Co ..... —
Lake Erie Engineering Works.xviii
Lane & Bodley Co.....—
La Roche Electric Works.....—
Leclanche Battery Co., The .. xvii
Lefmann, Julius xvii
Leffel, & Co., Jas xvii
Leonard & Co., H. W .... iv, xvii
Link Belt Machinery Co..... xiv
Loud, H. M. & Sons Lumber Co. xiv
Lovell Mfg. Co., Ltd..... xiii
Mather Electric Co..... iv
Morse & Co., A. M..... xv
Munsell & Co., Eugene..... xii
National Carbon Co..... xiv
National Electric Mfg. Co.... —
National India Rubber Co.... —
New York Insulated Wire Co. xv
N. Y. Safety Steam Power Co. xvi
New York & Ohio Co..... !
Ostrander & Co., W. R..... xix
Page Belting Co..... —
Partrick & Carter Co..... —
Pearson & Co., W. B.....xviii
Pelton Water Wheel Co..... xiv
Perkins Elec. Switch Mfg. Co. ix
Phoenix Glass Co..... xix
Pioneer Armature Co.....xiii
Porter-Leavitt Elec. Motor Co. xiii
Premier Electric Co., The..... xiv
Queen & Co..... xiii
Racine Hardware Mfg. Co.....—
Railway Equipment Co..... x
Ries Electric Specialty Co..... x
Roehling's Sons Co , J. A x
Rose Elec. Light Supply Co.. xii
Royal Electric Co.....—
Samson Cordage Works. xii
Sawyer-Man Electric Co..... v
Schuyler Electric Co..... iv
Sechrist, Albert..... xvii
Shultz Belting Co..... xvi
Siebert, G..... xiii
Siemens & Halske Electric Co. xiii
Sioux City Elec. Supply Co., —
Sioux City Engine Works.... xix
Smith, A. T..... .....—
Smith, Thos. G. Jr.....—
Somoff. J. L..... —
Sperry Elec. Mining Mach. Co. xvi
Standard Electric Co..... vi
Standard Paint Co xvii
Stanley Electric Mfg. Co..... vi
Star Electrix Co... xv
Stearns Mfg. Co..... xix
Sterling, W. C..... xv
Stilwell & Bierce Mfg. Co. xiv, xv
Sunbeam Incand. Lamp Co...xxiii
Taylor Engine Co.....—
Thomson-Houston Elec. Co.. ii, xx
Union Hardware Co..... xii
U. S. Electric Lighting Co..—
Utica Elec. Mfg. & Supply Co xvii
Van Nuis C. S..... i
Vulcanized Fibre Co..... xv
Waddell-Entz Company..... xii
Wannopee Pottery Co..... xix
Want Advertisements..... xiii
Western Electric Co.....xiv
Westinghouse, Church, Kerr & Co.....xviii
Westinghouse Elec. and Mfg Co.. xi
Weston Engine Co..... i
Woodhouse & Rawson, Ltd....—
Worthington, Henry R.....

CLASSIFIED LIST.

Annunciators.
Central Electric Co.
Detroit Electrical Works.
Electrical Supply Co., The.
Knapp Electrical Works.
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American Battery Co.
Central Electric Co.
Detroit Electrical Works.
Electrical Supply Co., The.
Greeley & Co., The E. S.
Leclanche Battery Co., The.
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American Battery Co.
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Detroit Electrical Works.
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Central Electric Co.
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Babcock & Wilcox Co., The.
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Cordage.
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Andrae, Julius.
Electric Cons. & Supply Co.
Electrical Construction Co., The.
Knapp Electrical Works.
Smith, Thos. G. Jr.
Western Electric Co.

Contractors, Electric Light, Engine Plants and Electric Railways.
American Engine Co.
Babcock & Wilcox Co., The.
Ball Electric Light Co.
Ball Engine Co.
Ball & Wood Co., The.
Bryan, W. H.
Brush Electric Co.
Detroit Electrical Works.
Diamond Electric Mfg. Co.
Edison General Electric Co.
General Electric Co.
Heisler Electric Co.
Lake Erie Engineering Works.
Lane & Bodley Co., The.
La Roche Electric Works.
Lefmann, Julius.
Leonard & Co., H. W.
Mather Electric Co.
Morse & Co., A. M.
N. Y. Safety Steam Power Co.
Pearson & Co., W. B.
Racine Hardware Mfg Co.
Royal Electric Co.
Siemens & Halske Electric Co.
Sioux City Engine Works.
Smith, Thos. G. Jr.
Standard Electric Co.
Taylor Engine Co.
Thomson-Houston Electric Co.
Waddell-Entz Company.
Westinghouse Electric & Mfg. Co.
Westinghouse, Church, Kerr & Co.
Western Electric Co.
Weston Engine Co.

Copper Wires and Tapes.
Central Electric Co.
Crescent Ins. Wire & Cable Co.
Cutter, Geo.
Detroit Electrical Works.
Edison General Electric Co.
Electrical Supply Co., The.
Enterprise Electric Co.
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International Okonite Co., The.
Knapp Electrical Works.
National India Rubber Co.
Roehling's Son's Co., J. A.
Sperry Elec. Mining Machine Co.
Western Electric Co.

Cross-Arms.
Central Electric Co.
Detroit Electrical Works.
Electrical Supply Co., The.
Lefmann, Julius.
Loud, H. M. & Sons Lumber Co.
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Andrae, Julius.
Bryant Electric Co.
Central Electric Co.
Cutter, Geo.
Cutter Electrical & Mfg. Co.
Electric Engineering & Supply Co.
Electric Secret Service Co.
Electrical Supply Co., The.
Enterprise Electric Co.
Hart & Hegeman Mfg. Co., The.
Knapp Electrical Works.
Perkins Elec. Switch Mfg. Co.
Sechrist, A.
Utica Elec. Mfg. & Supply Co.
Van Nuis, C. S.

Dynamos.
Ball Electric Light Co.
Brush Electric Co.
Detroit Electrical Works.
Diamond Electric Mfg. Co.
Duplex Electric Co., Ltd.
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Smith, A. T.

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Detroit Electrical Works.
Edison General Electric Co.
Ras, Frank B.
Siemens & Halske Electric Co.
Thomson-Houston Electric Co.
Westinghouse Electric & Mfg. Co.

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Bryan, W. H.
Leonard & Co., H. W.

Electrical Instruments.
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Electrical Supply Co., The.
Greeley & Co., The E. S.
Western Electric Co.

Electrical Intelligence.
Bryan W. H.
Leonard & Co., H. W.

Electrical Specialties.
Andras, Juline.
Bryant Electric Co.
Cutter, Geo.
Cutter Electrical & Mfg. Co.
Electric Engineering & Supply Co.
Ries Electric Specialty Co., The.
Utica Elec. Mfg. & Supply Co.

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Baggot, E.
Electrical Supply Co., The.
Thomson-Houston Electric Co.

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Detroit Electrical Works.
Thomson-Houston Electric Co.

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Cutter, Geo.
Cutter Electrical & Mfg. Co.
Detroit Electrical Works.
Edison General Electric Co.
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Electrical Supply Co., The.
Enterprise Electric Co.
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Hart & Hegeman Mfg. Co.
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Sioux City Elec. Supply Co.
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Edison General Electric Co.
Electric Engineering & Supply Co.
Electrical Supply Co., The.
Empire China Works.
Enterprise Electric Co.
Hart & Hegeman Mfg. Co.
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Crescent Ins. Wire & Cable Co.
Cushing, F. W.
Cutter, Geo.
Detroit Electrical Works.
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Edison General Electric Co.
Electrical Supply Co., The.
Enterprise Electric Co.
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International Okonite Co., The.
India Rubber & Gutta Percha Insulating Co.
Knapp Electrical Works.
National India Rubber Co.
New York Insulated Wire Co.
Roebling's Sons Co., J. A.
Sperry Elec. Mining Machine Co.
Waddell-Entz Company.
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Lamps, Incandescent
Beacon Vacuum Pump & Elec. Co.
Bernstein Electric Co.
Buckeye Electric Co.
Central Electric Co.
Cutter Electrical & Mfg. Co.
Edison General Electric Co.
Electrical Supply Co., The.
Illinois Electric Lamp Co.
Knapp Electrical Works.
New York and Ohio Co.
Sawyer-Man Electric Co.
Somoff, J. L.
Sunbeam Incandescant Lamp Co.
Thomson-Houston Electric Co.

Lightning Arresters.
Van Nuis, C. S.

Magnet Wire.
(See Insulated Wires.)

Mechanical Machinery.
Ferracute Machine Co.

Medical Batteries.
Detroit Electrical Works.
Partrick & Carter Co.

Mica.
Bowers Bros.
Johns Mfg. Co., H. W.
Munsell & Co., Eugene.

Mine Signals, Electric.
Detroit Electrical Works.

Mining Apparatus, Electric.
Edison General Electric Co.
Thomson-Houston Electric Co.
Sperry Elec. Mining Machine Co.
Westinghouse Electric & Mfg. Co.

Motors.
Brush Electric Co.
Crocker-Wheeler Electric Co.
Chicago Electric Motor Co.
Detroit Electrical Works.
Diehl & Company.
Easton Electric Co.
Edison General Electric Co.
General Electric Co.
La Roche Electric Works.
Lovell Mfg. Co., Ltd.
Mather Electric Co.
Porter-Leavitt Electric Motor Co.
Premier Electric Co.
Royal Electric Co.
Siemens & Halske Electric Co.
Thomson-Houston Electric Co.
Waddell-Entz Company.
Westinghouse Electric & Mfg Co.

Name Plates.
Becker Mfg. Co., John.

Office Furniture.
American Desk & Seating Co.
Andrews & Co., A. H.

Oil Purifiers.
Gravity Purifier Co.

Pins and Brackets.
Central Electric Co.
Electrical Supply Co., The.
Lefmann, Julius.
Loud, H. M. & Sons Lumber Co.
Railway Equipment Co.
Schindel & Shindel.
Western Electric Co.

Platinum.
Siebert, G.

Poles.
Electrical Supply Co., The.
Lefmann, Julius.
Loud, H. M. & Sons' Lumber Co.
Railway Equipment Co.

Porcelain.
Empire China Works.
Wannopee Pottery Co.

Publishers, Electrical.
Electrician Publishing Co.

Push Buttons.
Detroit Electrical Works.
Central Electric Co.
Electrical Supply Co., The.
Knapp Electrical Works.
Union Hardware Co.
Western Electric Co.

Railways, Electric.
(See electric railways.)

Recording Pressure Gauges.
Bristols' Mfg. Co., The.

Regulating Sockets.
Ries Electric Specialty Co.

Rheostats.
Carpenter Enamel Rheostat Co.

Separators, Steam.
Hine Eliminator Co.

Silk Braid.
Boston Braid Mfg. Co.

Speaking Tubes.
Central Electric Co.
Electrical Supply Co., The.
Knapp Electrical Works.
Ostrander & Co., W. R.
Western Electric Co.

Speed Indicators.
Queen & Co.

Steam Pumps.
Worthington, Henry R.

Supplies, Electric Railway.
Detroit Electrical Works.
Lefmann, Julius.
Railway Equipment Co.

Tapes, Insulating.
Andrae, Julius.
Central Electric Co.
Cushing, F. W.
Crescent Ins. Wire & Cable Co.
Eastern Electric Cable Co.
Edison General Electric Co.
Electrical Supply Co., The.
India Rubber & Gutta Percha Insulating Co.
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Telegraph Apparatus.
Central Electric Co.
Electric Secret Service Co.
Electrical Supply Co., The.
Greeley & Co., The E. S.
Knapp Electrical Works.
Western Electric Co.

Telephones, Electric.
Detroit Electrical Works.
Western Electric Co.

Test Instruments.
Central Electric Co.
Electrical Supply Co., The.
Greeley & Co., The E. S.
Knapp Electrical Works.
Western Electric Co.

Transformers.
Diamond Electric Mfg. Co.
National Electric Manufacturing Co.
Stanley Electric Mfg. Co.
Westinghouse Electric & Mfg. Co.

Trolley Cord.
Samson Cordage Works.

Trucks, Electric Car.
Detroit Electrical Works.
Edison General Electric Co.
Thomson-Houston Electric Co.
Westinghouse Electric & Mfg. Co.

Turbine Wheels.
Dayton Globe Iron Works Co.
Stilwell & Bierce Mfg. Co.

Typewriters.
Densmore Typewriter Co.

Universities.
Institute of Technology.

Water Wheels.
Leffel & Co., The Jas.
Pelton Water Wheel Co.

Wire, Bare.
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Crescent Ins. Wire & Cable Co.
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National India Rubber Co.
Railway Equipment Co.
Roebling's Sons' Co., J. A.
Sperry Elec. Mining Machine Co.

Questions and Answers.

Q :—What is the most important electric railway work now in progress?

A.:—The Cayadutta Electric Railway, connecting Fonda, Johnstown and Gloversville, N. Y., where an electric railway for passenger and freight service will, for the first time, compete with a parallel steam railway.

Q :—What is the handsomest power plant now being installed in N. Y. city?

A :—That of the Broadway Cable Railway at Houston St. and Broadway, where a fourteen story building is being erected for this purpose.

Q :—What is the handsomest office building now building in N. Y. City?

A.:—The Havemeyer Building, corner Cortlandt and Church Sts.

Q.:—What is the handsomest office building now building in Philadelphia?

A.:—The Betz Building, corner Broad and Penn Square.

Q :—What kind of plants and whose system will be used in these installations?

A.:—Direct coupled plants in the buildings named. That is, slow speed dynamos coupled directly on the engine shaft.

No "system" will be used. The best apparatus and methods of all makers will be selected and combined to make the most perfect plant possible.

Q.:—Who is installing these important plants, and who determines what shall be used?

A.:—H. Ward Leonard & Co., who are acting as Bulk Electric Contractors for all these plants.

Q.:—Why were the contracts awarded to this concern?

A.:—Because they could do the work cheaper, quicker and better than any manufacturers or concerns limited to the use of certain particular apparatus, and because of their familiarity with the requirements of such work, and the best methods and apparatus to use, in order to insure the most perfect result.

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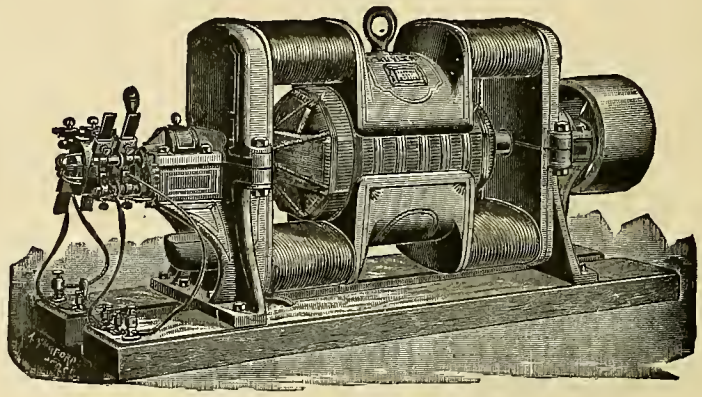

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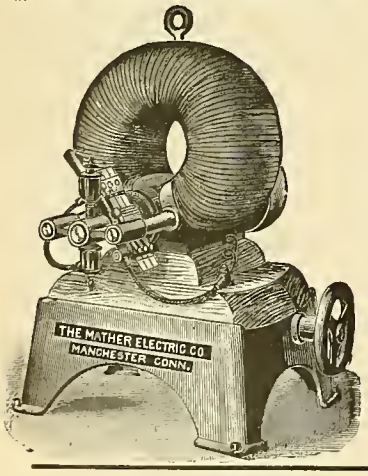

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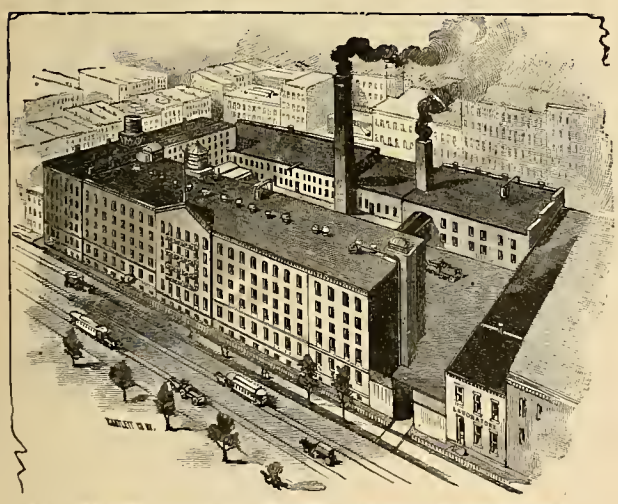

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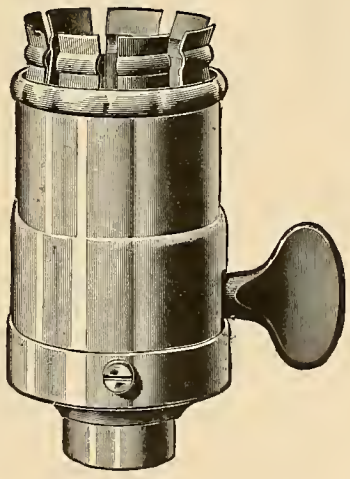

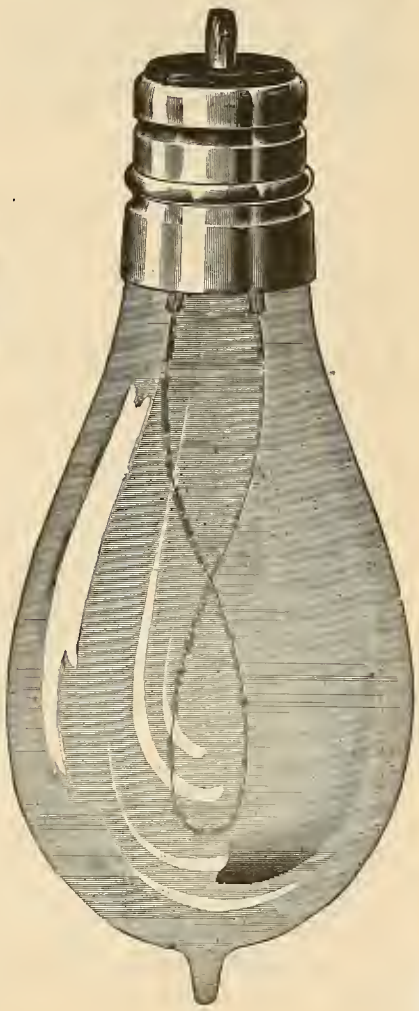

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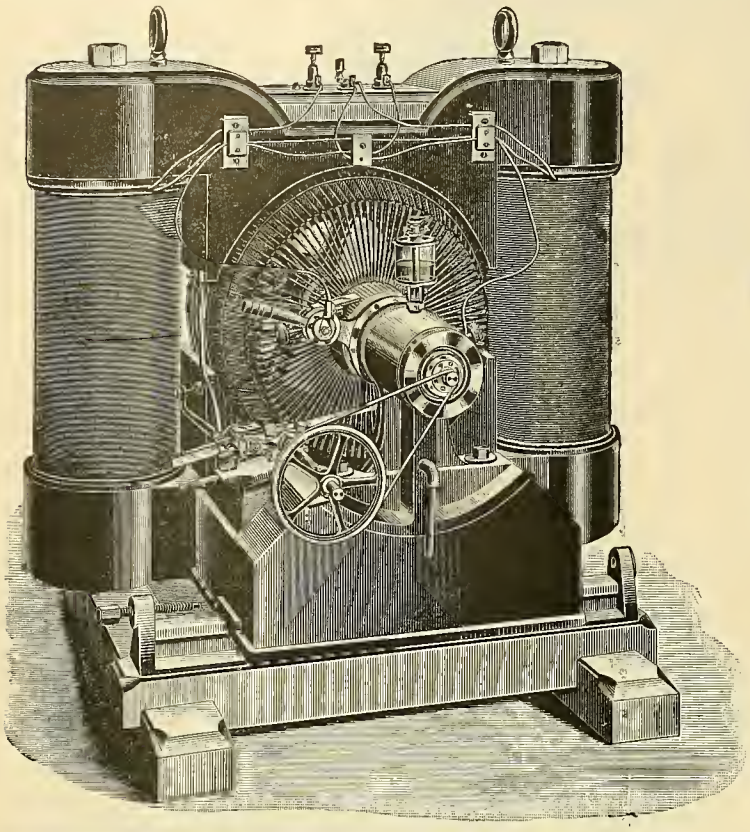

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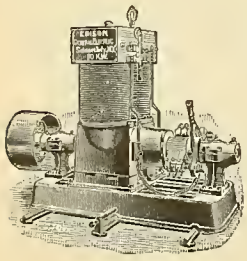

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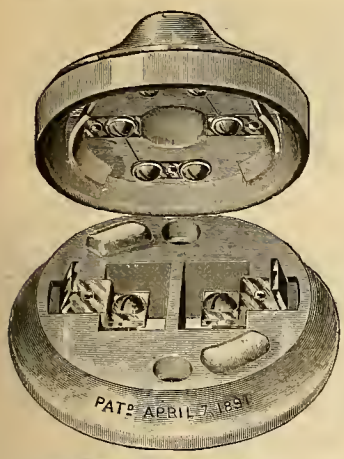

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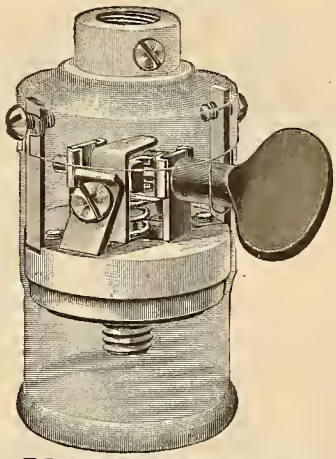
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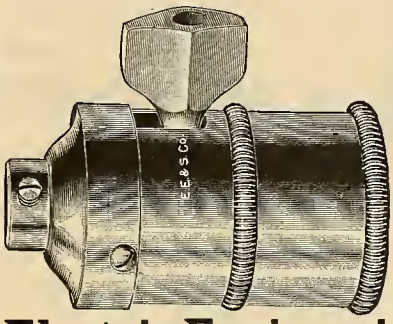

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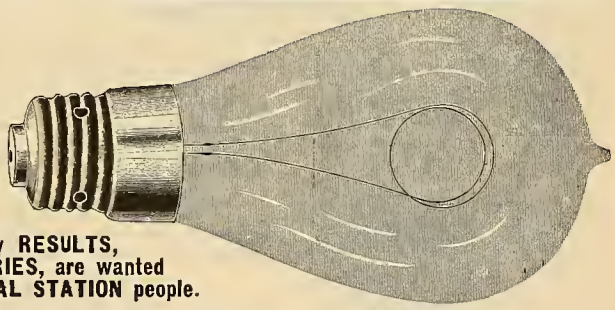
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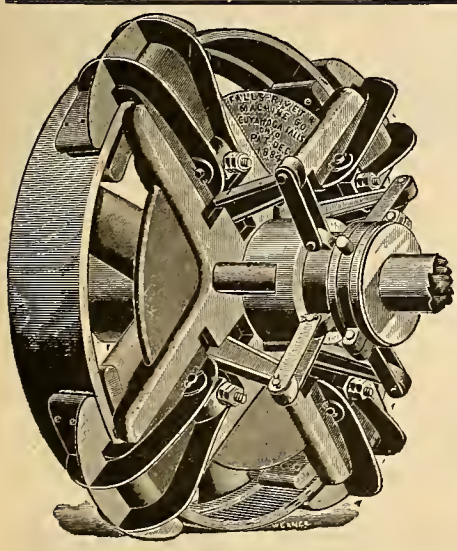

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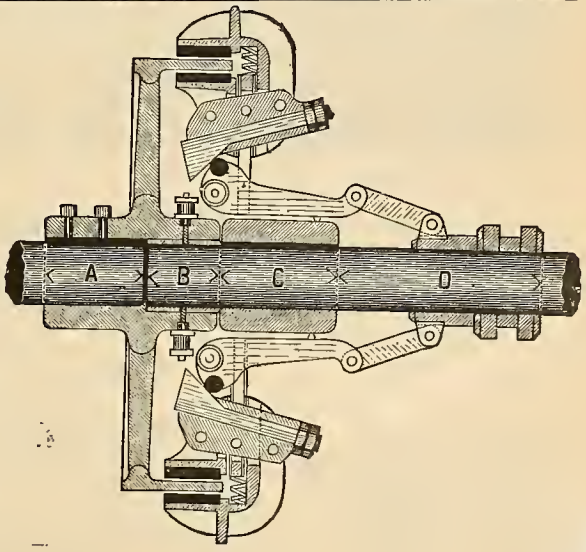

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We have sued H. T. Paiste, of Philadelphia, Penn., for infringement of our patent on Eccentric Snap Switches. The trade will please note that we have no intention to annoy them, but have sued Mr. Paiste, the manufacturer of the infringing switch. The case will be pushed to an early hearing and it is not too much to ask that the trade will in the meantime respect our patent rights and await the decision of the Court in the case.

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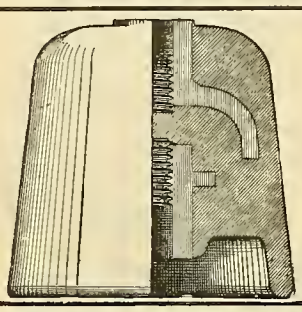

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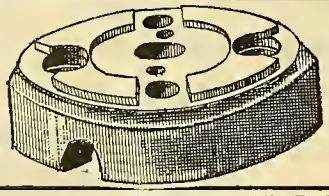

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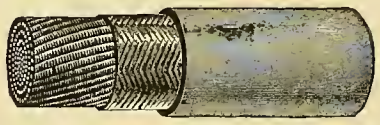

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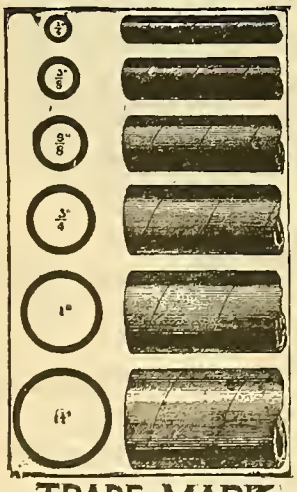

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NOTICE!!!

The Westinghouse Electric & Manufacturing Company will, at its own cost and expense, defend any and all suit or suits that may be instituted by any party against purchasers for the alleged infringement of patents, when such alleged infringement shall consist in the use of apparatus manufactured and sold by it.

We call the attention of users of electric railway and lighting apparatus to the attempts being made by the Edison-Thomson-Houston electric combination, or Trust, to secure, by threat and otherwise, a monopoly of the electric lighting and power business, which they are not entitled to, and cannot secure by means of their patents. If they could succeed in frightening users into entering into contracts binding them to take only the apparatus supplied by the Trust, then such users would be subject to a contract which they might have some difficulty in setting aside.

A proposed contract submitted by the Trust to one of our customers indicates that they intended to bind such customer to use exclusively apparatus manufactured by the Trust, and on such terms and for such prices as the Trust might name from time to time; and it is a fair presumption that the Trust would exact a margin of profit greatly above what is generally considered a fair manufacturing profit, in order to pay dividends on their immense capitalization (fifty million dollars capital stock, ten millions of which is preferred) and the interest on the proposed issue of ten millions of bonds.

The users of electric lighting and power apparatus, however, by refusing to purchase, except upon the terms and conditions on which they ordinarily purchase machinery, i. e., with the right to go into the open market unhampered to purchase their future supplies, or repairs, or alterations (as they should do), will always be free to select the best apparatus and details.

The Westinghouse Electric & Manufacturing Company sells all of its apparatus and makes all of its contracts on the above basis, and has never done otherwise, relying for future sales upon the merit of its apparatus.

We suggest the following as worthy of your careful consideration:

1. Enter into no contract with any electric light or power company except with respect to each purchase, and see that there are no hidden limitations or unreasonable provisions.

2. See that every contract contains a clause substantially as follows, for your protection as to patent matters, which clause is inserted in all of our contracts:

"The company shall at its own cost and expense defend any and all suit or suits that may be instituted by any party against the purchaser for the alleged infringement of a patent or patents, when such alleged infringement shall consist in the use of any apparatus, machinery or device, or parts thereof, manufactured or sold by the company, for which the purchaser shall have made all payments then due, provided that immediate notice of the institution of such suit or suits be given in writing by the purchaser to the company, and that the purchaser shall permit the company, through its counsel, to defend the same, and shall give all needed information, assistance and authority to enable the company to do so, and thereupon, in case of an award of damages in such suit or suits, the company shall pay such award, but the company shall not be bound to defend any such suit or suits, nor to pay any damages therein when the same shall arise by reason of the use of parts not furnished by the company."

3. Bear in mind that the agents of the Trust and its stockholders are numerous, and that specious arguments may be advanced, and threats used, to induce you to bind yourself to purchase apparatus only of the Trust.

4. If users of electric apparatus will act judiciously, then no Trust or Combination can expect to receive a higher price for apparatus than is warranted by fair competition.

When the Westinghouse Electric and Manufacturing Company entered upon the manufacture of railway apparatus, the price charged by the present members of the Trust was about $3,500.00 per car equipment. One-half of the above figure is the asking price to-day, and this reduction has been brought about by competition.

WHAT THE TRUST WOULD CHARGE IF THERE WERE NO COMPETITION.

The members of the Electric Trust (Thomson-Houston, Edison General, Fort Wayne and Brush Companies) made bids for the incandescent lighting of the World's Fair, in each instance amounting to about $1,800,000.00, and they have since offered to do the same work for $550,000.00, the result of our competition.

We invite the co-operation and support of all users of electrical apparatus, who desire to have the benefits of competition.

Pittsburg, Pa., April 29, 1892.

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1 Williams .....14½x20 inches.
1 Williams .....11½x16 inches.

All of the above were in use but four months, are the latest designs of the various makes, are in perfect order and complete in every way.

APPLY TO

Chicago Arc Light & Power Co.,

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Notice is hereby given that sealed proposals will be received by the City of Springfield, Mo., up to twelve o'clock, noon, of Tuesday, the 6th day of September, 1892, for furnishing said city and citizens thereof with Electric Lights.

Specifications and form of proposal will be furnished on application to the City Clerk.

By order of the Council.

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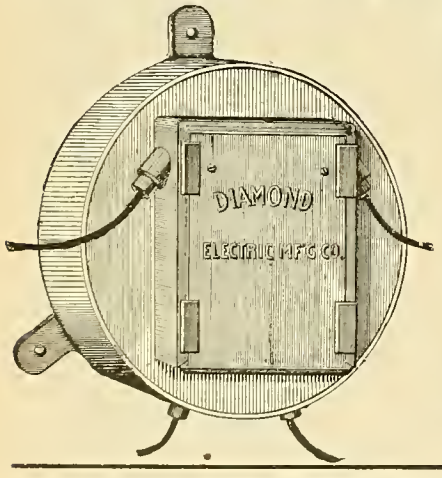

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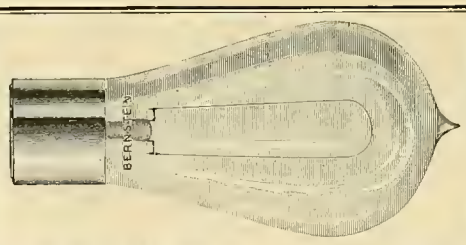

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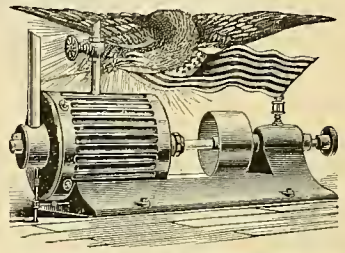

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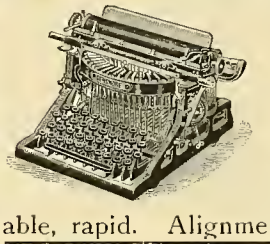

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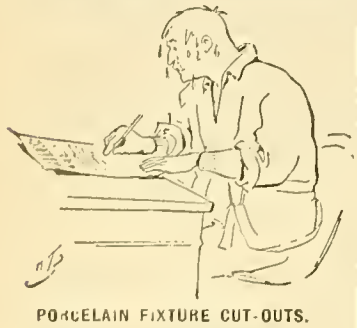

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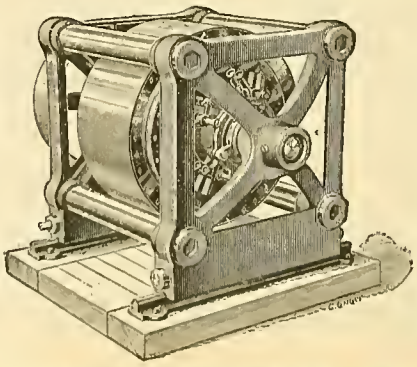

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Vol. XI. CHICAGO, AUGUST 13, 1892. No. 7

Isolated Lighting Plant in the Masonic Temple Chicago.

One of the finest of the many isolated plants for electric lighting in Chicago's great office buildings is that recently installed in the new Masonic Temple, on the corner of State and Randolph streets, and which is illustrated by the accompanying pictures. Aside from the fact that the plant—with its capacity of nearly 8,000 16 candle power lamps—is the second largest isolated installation in the city, being exceeded only by that in the great Auditorium, it possesses peculiar interest from the fact that it is located in the tallest building in Chicago—a city of tall buildings—and probably the tallest in the country. The Masonic Temple, with its 19 full stories and two additional stories in the dome or observatory, is a conspicuous landmark in Chicago. The highest point of the roof is over 300 feet from the sidewalk, and it is said that over 4,700 tons of steel entered into the construction of the building. There is no tower, and the dimension given indicates the extreme height of the homogeneous structure. The building is divided into stores, offices and assembly rooms for Masonic bodies. Sixteen elevators, distributed in a semi-circle about the central light shaft, give access to the upper stories.

The building is lighted entirely by incandescent lamps, all of 16 candle power, and attached to handsome dark steel-finished fixtures, which appear to add greatly to the brilliancy of the lights. The dynamo room is located in that portion of the basement projecting under the alley on the north side of the building. The plant consists of six Thomson-Houston in candescent machines rated as 1,000 lighters, but fully equal to a maximum output of 8,000 lights should occasion demand, the building being wired for about that number of lamps. The maximum electromotive force is 125 volts. The dynamos are very compactly arranged, as will be seen by Fig. 1. They are driven by a line of counter-shafting so arranged that one or more generators can be run while the others are at rest, thus obviating loss in friction, due to the unnecessary running of dynamos without load. This is effected by means of friction clutches on the countershaft, driven by two Corliss engines, which are connected so that either one or both can be run at one time, so that in case of the emergency of one engine breaking down the plant will be still in good running order.

The dynamos, which are compound wound, are connected by an equalizing connection by means of which all generators are kept at the same potential, thus securing for all an even share of the total load, which obviates the internal strains occasioned by undue overloading of any one generator. This equalizing connection consists of a bar of high conductivity copper two inches wide and half an inch thick, the distance between the machines being so slight that there is practically no difference of potential between any two terminals at which this equalizer connects with the various machines. The generators are supplied with self-oiling revolving ring bearings.

The switch-board, shown diagrammatically in Fig. 2, is of Italian marble and is immediately in the rear of the generators. It is 42 feet long and is divided into two sections—one for rheostats and measuring instruments and the other for switches. It is also provided with special single pole switches by which it is possible to make any combination of machines desired. The machines can be thrown into multiple on the main bus bars by throwing down special switches. The rheostats are of the non-combustible type, being composed of iron bodies with black lacquered slate fronts. All the connections of generators to switch-board and from switch-board to feeders are of the approved type of bright lacquered bus bar work. The main bus bars are of copper, 2½ by 1 inch, and receive the total current of all machines.

The system of distribution used throughout the building is the two wire multiple arc system. It is calculated that the total loss from the dynamo terminals to the farthest lamp is less than 5 per cent. The lamps are supplied with current from two risers, located in shafts at the opposite extremities of the line of elevators. These risers are of number 000 Simplex rubber covered wire. They are in turn fed by eight feeders, four feeders to each riser, which join the risers at equally distant points by special devices so arranged that at all parts of each riser the potential is practically the same. The risers are bound together at the points of junction with the feeders by equalizers, so that the difference of potential is practically the same at all points on both risers. The feeders on the north riser are respectively 754,000, 612,000, 472,000 and 315,000 circular mils in diameter, while the feeders on the south riser are respectively of 882,000, 737,000, 595,000 and 452,000 circular mils.

On each floor of the building there are two combined cut

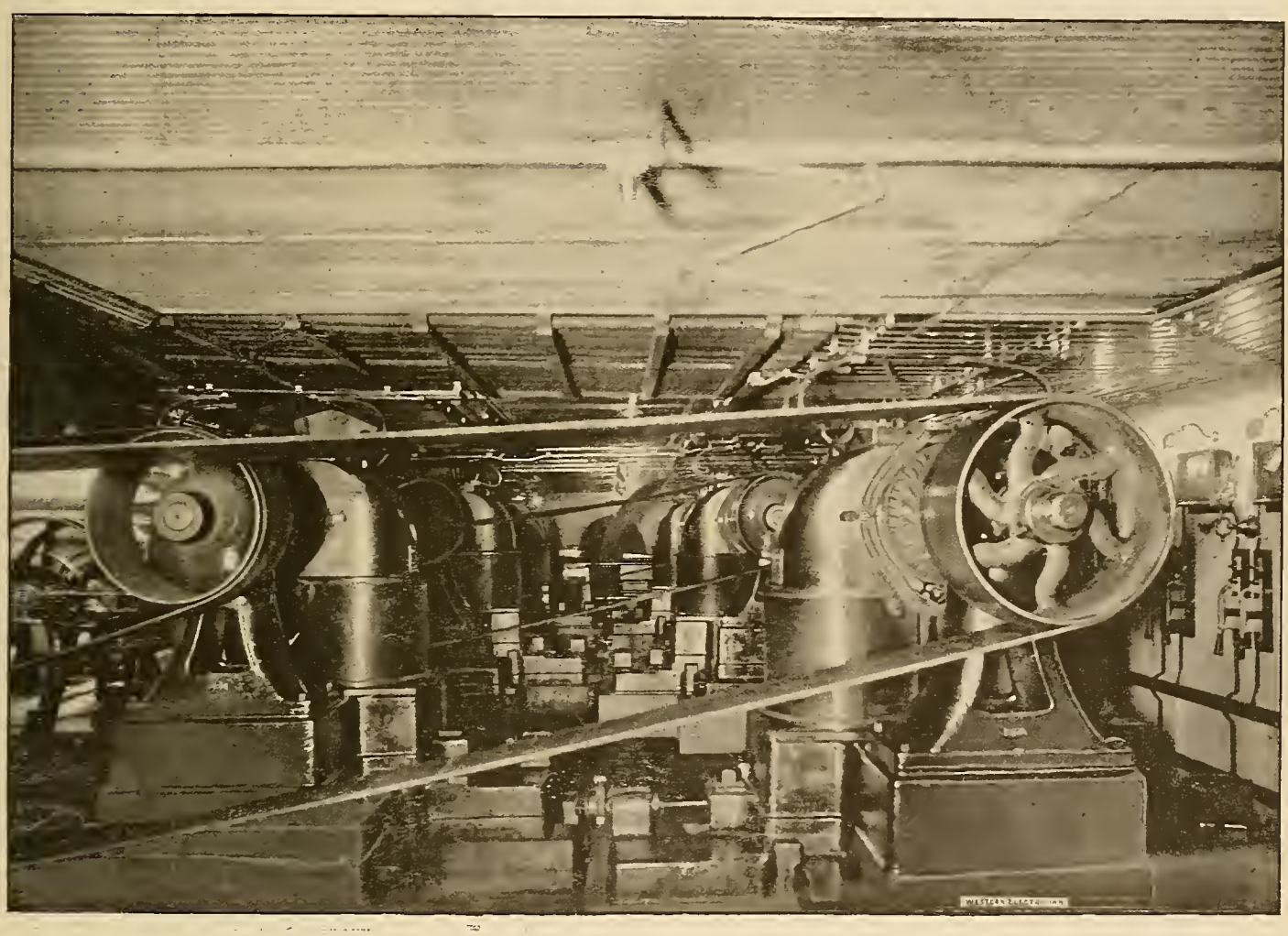


FIG. 1. ISOLATED LIGHTING PLANT IN THE MASONIC TEMPLE, CHICAGO.

out and switch cabinets, one connected to the south riser and the other to the north riser. These cabinets are fireproof and all cut-outs are porcelain, the switches being mounted on porcelain bases with nickel plated covers. By means of safety plugs the cabinets may be entirely disconnected from the risers while the main fuses are being replaced, allowing the lights to continue burning during the process of replacing fuses. In these cabinets there are individual cut-outs for about every six lights. From these cabinets stretch forward the maze of branch wiring, each cabinet taking one half of a floor. For this branch wiring there has been consumed no less than 240,000 feet of Simplex No. 14, B. & S. rubber covered wire, and 60,000 feet of No. 16 wire of the same insulation. Beside the 8,000 lamps of the building there are a number of small motors used for dental and other purposes. The branch wiring is all done on the concealed plan, and not a wire is to be seen in the whole building except in the shafts, where the main feeders run where they can be easily got at.

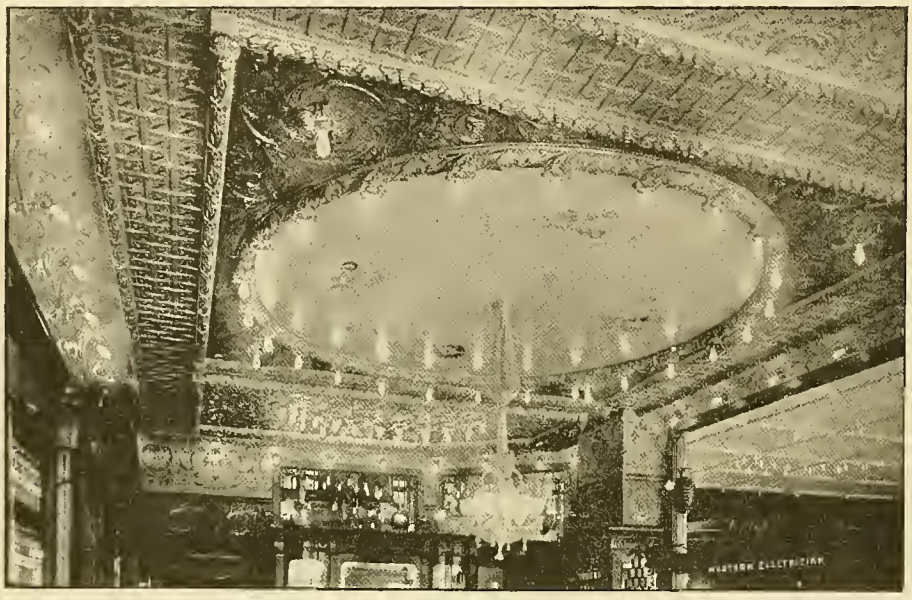


FIG 3. ISOLATED LIGHTING PLANT IN THE MASONIC TEMPLE, CHICAGO.

All of the fourteen passenger elevators are wired by means of a special flexible cable adapted to high speed work.

The entire electrical equipment was installed by the isolated lighting department of the western office of the Thomson-Houston Electric company, under the supervision of E. C. Noe, superintendent of the engineering department of the new General Electric company. The whole plant is wired strictly in accordance with the fire underwriters' regulations and is complete and satisfactory in every detail. Fraser & Chalmers of Chicago installed the steam plant.

FIG. 2. ISOLATED LIGHTING PLANT IN THE MASONIC TEMPLE, CHICAGO.

Fig. 3 shows a bit of the electric lighting effects in one of the stores of the building. The subject of the illustration is a portion of the ceiling of the drug store of Matkin Brothers on State street. The ceiling is handsomely decorated by means of a round central painting, typical of the four seasons, and elaborate designs in linerusta. A fine electrolier hangs from the center, and on either side incandescent lamps are arranged in the form of a star and a crescent. In all there are 115 lights, arranged on half a dozen circuits, so that all or a small portion can be burned at once. The general effect is very pretty.

An interesting computation shows that there are in the entire building 53 miles of electrical conductors, containing about 12 tons of copper.

The Bloomington, Ind., electric light plant was entirely destroyed by fire on July 27th. The total loss is $13,000; insurance $6,000. The stock is owned by a local company.

Electricity at the World's Fair.

The ways and means committee of the Exposition company, acting on the advice of its chairman, H. N. Higinbotham, who had the matter in charge, has set aside the recommendation of the construction department in favor of awarding the contract for electric launches to the Columbian Launch company of Chicago, and decided in favor of the Electric Launch & Navigation company of New York. This decision has been confirmed by the executive committee, and is regarded as final unless some new development comes up before the contract has been actually signed. Two weeks ago, when the construction department and the committee on grounds and buildings had reported in favor of the Chicago company, it was the general opinion that the local company would get the contract. The change well illustrates the uncertainty of final decision in the awarding of World's Fair contracts, of which the electrical fraternity has heretofore had experience. This is undoubtedly due to the number of officials who have to pass on each proposition, especially where financial and engineering considerations are mingled, and is probably inseparable from a concern of the magnitude of the World's Fair.

The contract was given to the Electric Launch & Navigation company on the ground that it offered a larger percentage to the Exposition company, had a better designed boat and a battery that was just as good as that of its competitor and not subject to the possibility of infringement suits. The construction department based its decision largely on the business dissensions among the members of the New York company, but Mr. Higinbotham evidently did not attach much importance to this objection. It is expected that about forty electric boats will be required for the regular line and twenty smaller ones for private parties. The work of building the launches will be divided among several firms. The Electra, the company's sample boat, will remain on the grounds, and will shortly be put to commercial use in carrying visitors about the lagoons. The price to be charged for the trip has not been decided upon, but twenty-five cents for the round trip, or fifteen cents one way, has been suggested. The route commences at the north landing in the basin and extends west on the basin, north on the north canal, passing through the lagoon on the eastern side of the wooded island, on into the north pond, to the landing at the art gallery. In returning to the starting point the same course is traversed, except that in going south the boats will pass west of the wooded island. This route gives access to the manufactures, government, fisheries, art gallery, Illinois, women's, horticultural, transportation mining, electricity, administration, machinery, agricultural and many smaller buildings. The concession is regarded as a valuable one, one Chicago paper estimating that it is worth $300,000 to the successful company.

In its naval news the *New York Herald* says that "Lieut. O. G. Dodge, who has successfully concluded his examination for the position of professor of mathematics, will probably be assigned to duty in charge of the electric light plants of the government buildings at the Columbian Exposition in Chicago." There must be some mistake about this, as the lights for the government building will be supplied from the central station in machinery hall.

The iron supports in the electric subways have all been placed in position, and the cement plastering will be finished within a month. Pumps driven by electric motors are used to pump out surface water in the unfinished portion of the subways.

It has been decided to locate the power house for the intermural railway in the southeastern corner of the park, near the forestry building.

A new Wood arc machine of 80 lights capacity has been added to the temporary lighting plant. It is used to supply lamps used in the work of elevating the tracks of the Illinois Central Railroad company outside the grounds. The dynamo belongs to the railroad people and is simply operated by the Exposition company.

The work of allotting space to exhibitors is occupying the time of Chief Barrett's assistants at present, and an elaborate plan has been prepared by the department for handling this business. The electrical building has been divided by main aisles into 68 blocks, 41 of which are on the first floor and 27 in the gallery. The number of exhibitors in each of these large blocks will control the number of allotment spaces in each. Independent of these divisions, the building has been divided into 27 sections, 17 below and 10 in the gallery, which have been named after the letters of the alphabet. This arrangement will make it possible for permits for space to indicate precisely the location of the space assigned. Small prints have been made giving these division lines, so that if John Smith & Co. are given a permit to occupy section A, block 3, No. 1, they will be able to refer directly to the print and locate the space without trouble. Conventional signs on these prints will indicate the physical characteristics, such as beams, posts, foundations, etc., the purpose being to give every exhibitor a full description of his space without having recourse to correspondence or actual measurements on the grounds.

The form of permits for space has been prepared by Prof. Barrett, and will be submitted to Director-general Davis in a few days. The final allotments will also be ready at that time, and the department expects to be able to send out official permits for the occupancy of space by September 1st.

While the systematic methods instituted by Prof. Barrett are calculated to secure precision and simplicity, yet the labor of keeping all the various interests in correct form before the department, and of always being in touch with the requirements of individual exhibitors, is very great. For this purpose a large ledger is kept, with special headings, so that an accurate account may be scheduled with each exhibitor. Under these heads each article intended to be exhibited is classed, giving the group and class to which it belongs in the official classification. The manner of exhibition, the method of arrangement, the power required, the special lighting, incandescent or arc, are also recorded, and the part the exhibitor intends to take in the electric equipment of the building. Thus, by opening the ledger to a given page, at a glance the whole purpose of an exhibitor may be seen.

The circular sent out in June, outlining the plan for a special equipment of the electrical building by exhibitors, has resulted in securing offers of all the apparatus necessary for the purpose. The larger firms have responded liberally to the call made by Prof. Barrett for service apparatus, and the department clerks are now scheduling all this apparatus, so that Prof. Barrett may present his plans

to the bureau of construction. The plan provides for 422 arc lamps for general illumination, 78 lamps for special purposes, 5,000 incandescent lamps and 500 horse power for motors, with a reserve of 500 horse power for additional incandescent lamps required by exhibitors.

The arrangement of exhibits has practically been settled. All heavy machinery will be located on the lower floor, where foundations can be built of sufficient sustaining strength. Most of the foreign countries have had space allotted them on this floor, at the north end of the building. Wires and insulation will be shown in the

FIG. 1. SPOKANE ELECTRIC RAILWAY SYSTEM.

gallery, with telegraph apparatus, specialties of all kinds, models, etc.

It is definitely settled that there shall be three railway tracks, at least 1,500 feet long, on the grounds for tramway exhibition purposes, and the electrical department is now preparing the detailed plan for this exhibit. It has been agreed that these tracks shall be used by the transportation exhibits department also for the exploitation of gas and ammonia motors wherever these will not interfere with the operation of the electric systems.

Portable Combination Telephone and Telegraph Set.

An interesting and ingenious combination of telephone and telegraph apparatus is represented in the device illustrated in the accompanying cut. The instrument is in use in the office of Fire Marshal Swenie at the city hall, Chicago. It is made of aluminum and weighs only three and a half pounds. It is a very handsome device and occupies very little room on the desk. It is essentially a

PORTABLE COMBINATION TELEPHONE AND TELEGRAPH SET.

portable desk telephone set comprising the usual transmitter and receiver of the Bell pattern, and by means of the switch in the base connection may be made with "central" or a private line. The switch lever is at the right, in the cut, directly under the receiver, while the call button is shown a little to the left. On the opposite side of the base and not shown in the cut there is a telegraph key connected to the city telegraph system. The outfit was devised and made by J. F. Mehren, who is connected with the city's electrical department.

It is proposed to increase the capital stock of the Springfield, Mass., Electric Light company from $400,000 to $500,000.

Spokane Electric Railway System.

The Spokane Street Railway company owns or controls nearly all the street railway lines in the city of Spokane, Wash. It recently purchased the franchises of the City Park Transit company over East Sprague street, Third street, Hatch street and part of Monroe and Pine streets, and it has also obtained the controlling interest in the Ross Park Street Railway company, which runs some four miles east of the city on the north side of the Spokane river through Ross Park addition. These recent purchases, together with the franchises already possessed, give the company the absolute control of the transportation business of the city. With the exception of two miles of cable the system of the company is electric throughout. The company took possession of the plant and franchises in 1889, previous to which time they were the property of private individuals, and a horse car system was used. Since this time great extensions have been made in every direction, and in every respect the system has undergone a complete transformation. In June, 1891, the company began to operate the electric system, and since then scarcely a month has passed without new lines being projected in some direction extending into the residence portions of the city to meet the requirements of the traveling public, twenty miles of double track being now in operation. The company possesses seventeen different franchises, which cover all the principal business streets of the city, as well as the principal streets and avenues leading to and from the center of the city to the residence portions outside of town.

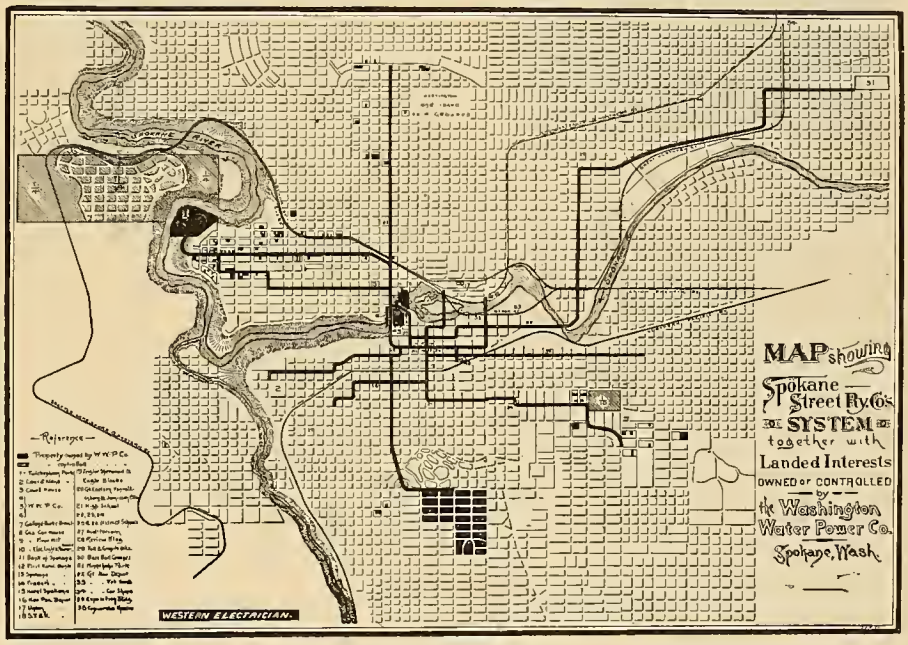


FIG. 2. SPOKANE ELECTRIC RAILWAY SYSTEM.

The entire system is divided into seven different routes, as follows: Broadway and Division, Pacific avenue and Division, Monroe and Second, Boone and Second, Ross Park line, Liberty Park and Union Pacific depot, Monroe street and South Side addition (the last named being operated by cable). These lines reach out in all directions to the residence portions of the city, as will be seen by the the map, Fig. 2. They are operated by separate sets of cars, and they all intersect at Riverside and Howard, which is the business center of the city. A view of the line at this point is presented in Fig. 1.

The track is standard gauge throughout, and is constructed in a thoroughly substantial manner. The rails used are 40 pound steel T rails on the sections on which there is the heaviest traffic, and 35 and 30 pound steel T rails on the other portions. The track is laid with the most perfect alignment and grade, and with the exception of 500 feet of track, which has a maximum grade of 5 per cent, no part of the system has a grade exceeding 1 per cent. Special care has been observed in the construction of curves. The minimum radius of curves on the system is 45 feet, and cars can pass over them at their maximum speed of twenty miles an hour without jars, jolts or strains.

The overhead construction is in accordance with the best practice, and cross suspension is used in the overhead work of the line. The whole line is divided into four sections, each section receiving current from an independent double feeder running direct to the power station where a fuse is placed, so that a short circuit in one section will not interfere with the operation on any of the other sections. The size of the trolley wire is No. 4 B. W. G. hard drawn copper. An auxiliary main is run parallel to the trolley, supported on side poles and feeding into the trolley every 500 feet on an insulated conductor. The trolley wire is supported entirely by vise clamps made of cast iron, no solder being used on the trolley line. Automatic switches are used throughout the system, and the mains from the dynamos feed into the system at eight different points.

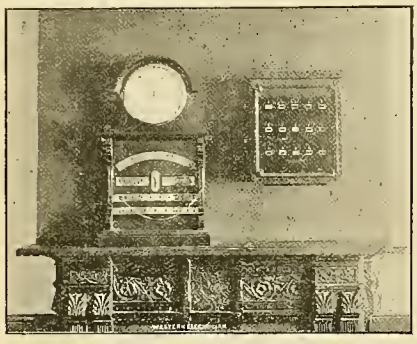
The Spokane river, which flows through the center of the city, divides the company's system; and in order to ensure continuous and successful operation on both sides of the river, the company found it necessary to construct a special bridge across the river connecting Bridge and Post streets. This bridge is 360 feet long; the largest span is 186 feet. It has one combination Pratt truss and one Howe truss. The track across the bridge is composed of girdered rails. The bridge was designed, the iron rolled, the timber sawed, and the whole structure erected within 30 days, and this during high stage of water. The company is now preparing to operate the lines across the new Monroe street bridge, which has just been built by the city.

The car equipment of the company consists of 32 cars. Sixteen of these are of the J. G. Brill company's manufacture, having maximum traction double trucks. Nine open summer cars manufactured by the Stockton Car company and 7 cars of the Pullman manufacture, with Bemis trucks, complete the equipment. The maximum traction truck on the Brill cars has two pairs of 30" driving wheels, to which are attached the motors, and one pair of 18" wheels in the center of the truck. The arrangement of these trucks is such that 80 per cent. of the weight of the cars is carried by the 30" driving wheels. By making the center wheels smaller it enables the car body to be placed about 12 inches nearer the ground than is ordinarily done on double truck motors, the smaller wheels swinging clear of the floor beams when passing over curves. This arrangement and also the design of the car bodies on these trucks is the work of B. C. Riblet, construction engineer of the company. The car bodies are 29 feet long, open at the ends and closed in the middle. The seats at the open ends are transverse; in the closed compartment they are longitudinal. Each car has a seating capacity for 44 people, and is capable of carrying 150 passengers. The artistic finish of these cars, as well as of the Pullman cars, is exceedingly fine. Ten of the Brill cars and five of the Stockton cars are equipped with Edison double reduction motors, all the other cars being equipped with Thomson-Houston single and double reduction water-proof 30 horse power motors. The company also possess one snow plow of the latest design of the Thomson-Houston company.

On one of the suburban lines running out to Liberty Park the company is running four small dummy cars, each having two longitudinal seats, similar to cable dummies. Each of these is mounted with a single water-proof 30 horse power Thomson-Houston motor equipment. The motorman stands in the center of the car and controls it from the same point as the gripman in the cable dummy.

The axles of the wheels are connected by a sprocket chain. These little cars are able to run at a great speed and give admirable service. They have not had a dollar's worth of repair since they began to run some two month ago.

The car house of the company is situatued near the center of the system at Bridge and Lincoln streets, so as to be easily accessible to cars from all the routes. It is two stories high, built of brick, its dimensions being 140 feet by 72 feet. The floor is laid with six separate sets of tracks, and switches are arranged so that a car can pass from the main line to any of the tracks in the car house without having to go on a transfer table. A force of mechanics is kept constantly employed in the car house mounting new equipments and looking after the mechanical work of the system. The company does all its own armature winding, and facilities are being arranged whereby the company can perform regular machine shop work in connection with its own system as well as that of the Edison Electric Illuminating company. The company is



WILDER ELECTRIC HOTEL CALL.

also putting an electric elevator in the car house capable of raising 15 tons from one floor to the other.

The company receives the electric power for the system from the Edison Electric Illuminating company, whose plant and water power station were fully described in the WESTERN ELECTRICIAN of May 16, 1891. Two 80 kilowatt 500 volt Edison street railway generators and three 500 volt Thomson-Houston street railway generators supply the necessary current. These generators are placed at the south side of the station on the second floor. The switchboard, indicating and controlling aparatus is arranged on the south wall of the station, altogether apart from the electrical gallery of the Edison company's plant. The positive wires of the generators are connected to earth through the penstocks of the station, the negative wires going to the trolley line. This arrangement causes the arc which forms between the trolley wheel of the car and the trolley wire to cling to the wheel when the circuit is broken by the trolley arm leaving the wire, as the arc always clings to the positive side. This saves the trolley wire from breaking in many places owing to the burning action of the arc. The trolley wheel when worn can easily be replaced.

The hydraulic machinery of the station is arranged on the first floor. There are five generators. Four of them are driven from one pair of 17½ inch Victor turbine twin horizontal wheels of 450 horse power capacity, the fifth being driven from a pair of ten inch wheels by direct and almost perpendicular belting to the floor above. These wheels have a speed of 600 revolutions per minute, being somewhat less than the speed of the generators. The head of water under which they operate is 50 feet, with an additional fall of 20 feet from the wheel case to the tail race. The wheel case opens into the main penstock, which is 7 feet in diameter, and which is laid along the first floor of the station from east to west. Each pair of wheels operates on the one shaft, which projects through the center of each side of the wheel case. Four driving pulleys are placed on the shaft of the 17 1-2 inch wheels, two on each side of the wheel case, and one pulley drives one generator. These four generators are therefore driven with exactly the same velocity. Each pulley is supplied with a friction clutch, so that any one or more of the machines can be thrown out without interfering with the running of the others. All the hydraulic equipment was supplied by the Stilwell & Bierce Manufacturing company, Dayton, O. For the first few months of operation the company experienced considerable difficulty in the regulation of the extremely varying loads to which the system is subjected. The company has recently introduced the Woodward governor, which gives good satisfaction.

The cable line of the company, which is 2½ miles in length, is operated from an independent set of wheels in the station. This line runs south on Monroe and Cliff streets to the South Side addition, and has a rather steep grade. The bulk of the cable line was changed into electric recently, after the company began to operate the electric system, as it was found that electricity was much more satisfactory in every way. The Spokane Cable Railway company is nominally a separate organization, but it has been practically absorbed into the general system of the Spokane Street Railway company.

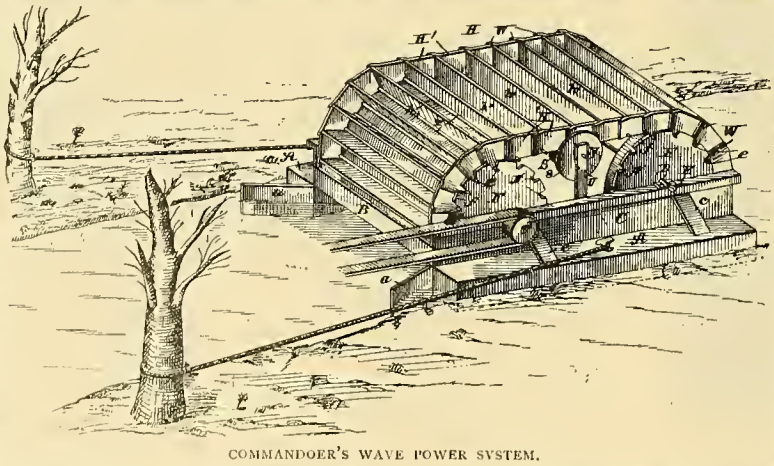
The capital stock of the Spokane Street Railway company is $500,000. The officers are: President, H. Bolster; vice-president, H. Brook; treasurer, J. D. Sherwood; secretary and general manager, W. S. Norman; superintendent, O. De Camp, assistant superintendent, E. E. Knowles; electrician, J. B. Fisken; construction engineer, B. C. Riblet. Mr. Riblet has had charge of the construction work of the entire system from its commencement as an electric road, and all who have examined it are impressed with the thoroughness and completeness of the work.

The stock of the Spokane Street Railway company is owned entirely by the Washington Water Power company. This latter company also owns the stock of the Edison Electric Illuminating company of Spokane, and two-thirds of the power of the Spokane river at this point, with considerable adjoining real estate property. The Spokane Street Railway company also owns a large amount of real estate in various parts of the city.

Commandoer's Wave Power System.

The utilization of the power of small streams, which has so long been neglected, has of late received considerable attention from those interested in the transmission and distribution of power by electricity. The latest device in this line is that introduced by Herman Commandoer, of Milwaukee. This device, which is illustrated in the accompanying cut, can be used, it is claimed, in small streams, water falls and rapids, and also with a few modifications, in artificial chutes.

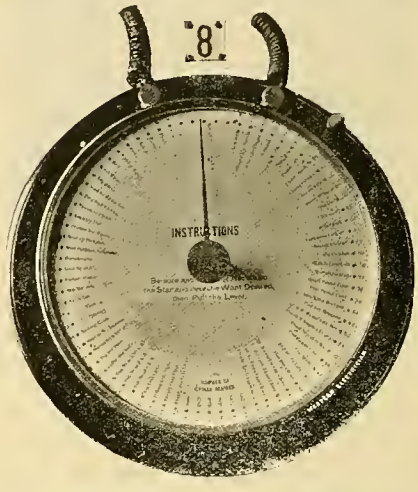
Referring to the cuts, *A* represents parallel floats united by end beams *B*, arranged above the top of the floats, and connecting side walls *C*, which rise some distance from the inner edges of the floats and are braced by diagonal braces *c*. At the end of the floats, which is upstream or opposed to the current, are arranged divergent wings *a*, which gather and direct the water through the space between the floats. These wings may be omitted if the stream be too narrow or may be lengthened if the stream be broad or the current gentle. By a slight change in the construction of parts the device may be adapted for use under falls, rapids, or at the mouth of artificial chutes. In the latter case the passage way between the floats should be closed across



COMMANDOER'S WAVE POWER SYSTEM.

the bottom. Upon the upper edge of each side wall is a bearing, and journaled in these bearings across each end of the device is a shaft, one end of which carries a driving pulley, from which a belt may be led to the machinery to be operated.

The buckets when arranged for use in the device are so placed that the front edge of the end pieces *H'* of one bucket will come just inside the wing *W* of the bucket next in front, and passing transversely across each bucket is a shaft *T*, each of whose ends extends through the lower front corner of an end piece *H'* and through the lower portion of the wing *W*, its extremity *e* extending a sufficient distance to engage one of the notches *N* in the large wheel on the shaft and just inside the bearing. Several buckets are connected as described, forming an endless chain, which passes at each end of the device over a pair of the large wheels *F*, where the ends of the bottoms *h* of the buckets bear upon the peripheries of the wheels. The flanges *f* prevent the longitudinal displacement of the buckets, and the extremities *e* of the shafts *T* rest in the notches *N*. Between these large wheels the lower side of this endless chain passes longitudinally between the floats *A* and sinks sufficiently below the water level to receive the water which is flowing between the floats. The upper side of the endless chain passes over a pair of supporting wheels *S*, which also may be provided with flanges *s*,



WILDER ELECTRIC HOTEL CALL.

mounted on a shaft *V*, journaled at its ends in uprights *U*, rising from the centers of the side walls *C*.

It is claimed for this device that, by the arrangement of buckets, every available pound of water that passes between the floats is utilized.

Wilder Electric Hotel Call.

A number of electrical and pneumatic devices for affording a speedy means of communication between the office and any room of a hotel have been exploited, the most satisfactory of which have been those in which the general principle of the electric multiple call box has been followed, but the vastly greater number of "wants" to be transmitted to the hotel office than are necessary in the case of the ordinary district messenger service, has lead to the production of systems much too intricate and scientific for the matter-of-fact service of a modern hotel. The system herewith illustrated is quite applicable, without any change whatever in the running of the wires, to the ordinary push-button and annunciator call system so extensively employed in hotels at the present time. Consequently but one wire to each room and a neutral return wire are necessary in its operation.

A dial form of transmitter, not much larger than the common multiple call box, is placed in each room. On the face of the dial, arranged in a circle, are printed a large number of wants, such as "boy," "coupe," "doctor," "bill," "ice-water," etc. On the present dial seventy five different wants are printed, but any additional number could be readily arranged for. In this transmitter are contained a magnet and a large break wheel.

To procure any desired service the occupant of a room, say 24, places a pointer, on the face of the dial, over a given service and then pulls the crank in the usual way for sending in a call. The circuit leading to the annunciator is closed and the clerk is apprised of the signal. The clerk thereupon inserts a metallic plug in a switch, which transfers the circuit of the room from the annunciator to the circuit of a magnet contained in a box termed the receiver, and at the same time inserts into the circuit an extra battery. This extra battery has the effect of attracting the armature of the magnet within the transmitter, in room 24, and thereby causes the release of the large break wheel. This wheel is capable of causing 75 makes and breaks of the circuit. The number of such makes and breaks that it may cause, however, is regulated entirely

by the distance from zero to which the pointer must be moved by the occupant in placing it over a desired want. The receiver in the hotel office is also provided with a dial and pointer similar to the dial and pointer of the transmitter, and having corresponding wants printed on its dial. The receiver is also provided with a large tooth or pin wheel, corresponding in size and number of teeth or pins to the teeth of the break wheel of the transmitter. This wheel is given a tendency to rotate by an ordinary recoil spring, but its rotation is regulated by a "step by-step" device, controlled by the magnet in the receiver. This magnet is placed, by the action of the clerk, in the circuit of any room desired. Normally, the point of the receiver, which is mounted on the same shaft as the wheel, is placed

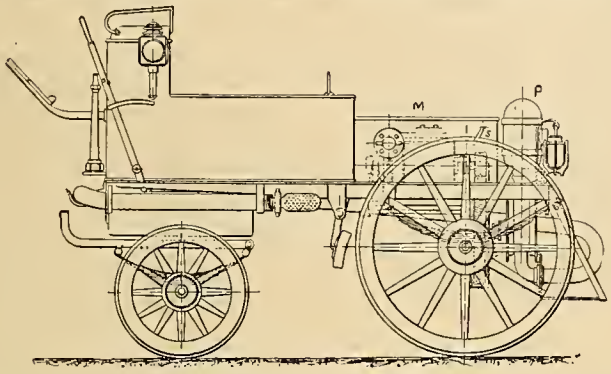


FIG. 2. ELECTRIC FIRE ENGINE.

at zero If, for instance, room 24 should have desired "ice-water," and assuming that to place the pointer of the transmitter over "ice-water" the break wheel was moved 15 teeth past zero. it is clear that in returning to its starting point it will send in 30 makes and breaks. The circuit having thus been made and broken 30 times, it is obvious that the step-by-step motion of the toothed wheel in the receiver will carry its pointers around to the "ice-water" mark on its dial.

The annunciator thus indicates the room calling, and the receiver dial the nature of the service desired, of both of which the hotel clerk makes note, after which he resets the dial to zero, the act of doing which rewinds the recoil spring. The movement of the pointer back to the starting point is an indication to the occupant of the room that his call has been received.

The plug may be removed from the switch and connected with any other room that may in the meantime have called.

The device is the invention of E. R. Wilder.

Electric Fire Engine.

When electricity is as extensively distributed as water the electric fire engine will doubtless come into general use; even now it is being used to a limited degree. The combination of an electric motor and a pump has manifest advantages over the steam fire engine, provided a supply of current is available. In the case of the latter it is always necessary to keep up steam, so that time will not be lost when an alarm is sounded, and for this reason the machine is costly for the actual power which it develops when needed. The fact that the motor is instantly ready for service as soon as a current is turned on makes it obviously superior, and the simplicity of the motor and pump as compared with the steam fire engine constitutes a rather substantial advantage. No one questions the fact that the day will come when the distribution of electricity will be so general that the pump operated by an electric motor will be the most important piece of fire-fighting apparatus.

A number of inventors have designed electric fire pumps well adapted to the purpose; that illustrated in Fig. 1 was exhibited at the Naval Exposition in London by Siemens Brothers. The pump with its motor is mounted in a wagon, and it is noticeable that the absence of a boiler leaves considerable space in the vehicle which may be occupied by firemen. The pump, as will be seen by reference to Fig. 2, is driven by a Siemens motor of 20 horse power capacity, making 1,000 revolutions per second. The shaft of the Gramme ring armature carries a pinion which meshes with a gear on the shaft of the rotating pump. The reduction of speed is in the ratio of 1 to 3. For the connection of the motor to the source of supply there is arranged in the wagon a Siemens flexible concentric cable about 200 feet in length. The cable is connected to the rheostat *S* of the cable, the other end terminating in a joint so designed that by means of a nut the cable can be connected to a corresponding joint in another length of cable or to a joint tap on a local main, Fig 4. Fig. 3 shows how this joint is made. The cable *e* ends in the cone *e*, which fits into a similar cone. The outside conductor is prolonged by a split tube *dd*. The coupling is shown at *g* for connection with a second cable or with the terminals of the supply circuit, Fig. 4. As is shown in the latter figure the terminals are covered by a glass padlocked *c*, so that the maliciously disposed cannot tamper with it.

The combination has proved highly efficient wherever it has been tested. In an experiment with one of these engines at the late Crystal Palace electrical exhibition, the motor was worked on a circuit at a pressure of 105 volts. With this pressure, when running at about 450 revolutions per minute, the pump propelled a jet of water from a 1 inch nozzle to a height of 100 feet, the water pressure being 75 pounds per square inch. With two delivery hose pipes on at once, having nozzles respectively 1 inch and ⅞ inch, the motor ran at 550 revolutions per minute, and the pressure was 45 pounds per square inch, the two jets rising to a height of about 80 feet.

The D'Unger Case.

Dr. Robert D'Unger, owner of the renowned D'Unger telephone, proposes to sue the city of Chicago for $500,000

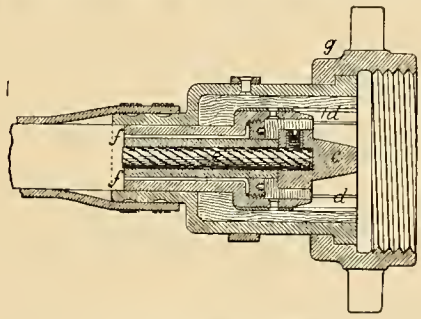


FIG. 3. ELECTRIC FIRE ENGINE.

damages. He says that suit will be brought in the United States Circuit court. The claim is based on a novel point of law, which it is said has never before been raised. Three telephone patents have been issued to D'Unger by the United States patent office. They cover an improved transmitter, a receiver and a diaphragm with buffers. The patentee has twice applied for a franchise for his telephone system in Chicago, but has not succeeded in gaining one. He now threatens to bring suit for the amount stated on the ground that while his letters patent grant him permission to "use, sell and manufacture" the D'Unger telephone anywhere in the United States, the aldermen of Chicago have unlawfully interfered with this right, so far as Chicago is concerned. The authorities of the city are not greatly troubled about the matter.

Reported Electric Railway Consolidation in Chicago.

There is a possibility of a consolidation of the Calumet and South Chicago Electric Railway companies, that promises to be of importance to the entire Hyde Park dis-

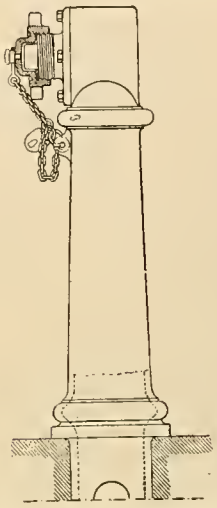


FIG. 4. ELECTRIC FIRE ENGINE.

trict if consummated. The report is that Columbus R. Cummings is negotiating for a controlling interest in both roads in order to combine the two systems into one and make numerous extensions throughout Hyde Park. The Calumet electric road has been in operation for about a year and controls some valuable franchises. It runs on Ninety-third street, from South Chicago to Dauphin Park and thence north on Cottage Grove avenue to Seventy-first street. W. V. Jacobs is president of the company. The South Chicago road has a line in operation on Stony Island avenue and has franchises for several prominent streets in the eastern portion of Hyde Park. This road is under the management of Dwight R. Cameron.

The English electrical papers describe an arrangement that was made to display the returns of the recent general election in London. A large board was hung out of the tower of the National Liberal club building, on the Thames embankment, and on this the results were flashed in letters and figures four feet high. A large light at the top of the board was shown to report a liberal victory, while a small light at the bottom signified conservative victories. The name of constituency and the majority of the successful candidate were displayed. Another use which electricity was put in connection with the general election is to be found in the employment of hand lamps. The Lithanode company furnished Colonel Wyndham Murray with a portable electric hand-lamp for carriage use or for lecturing purposes.

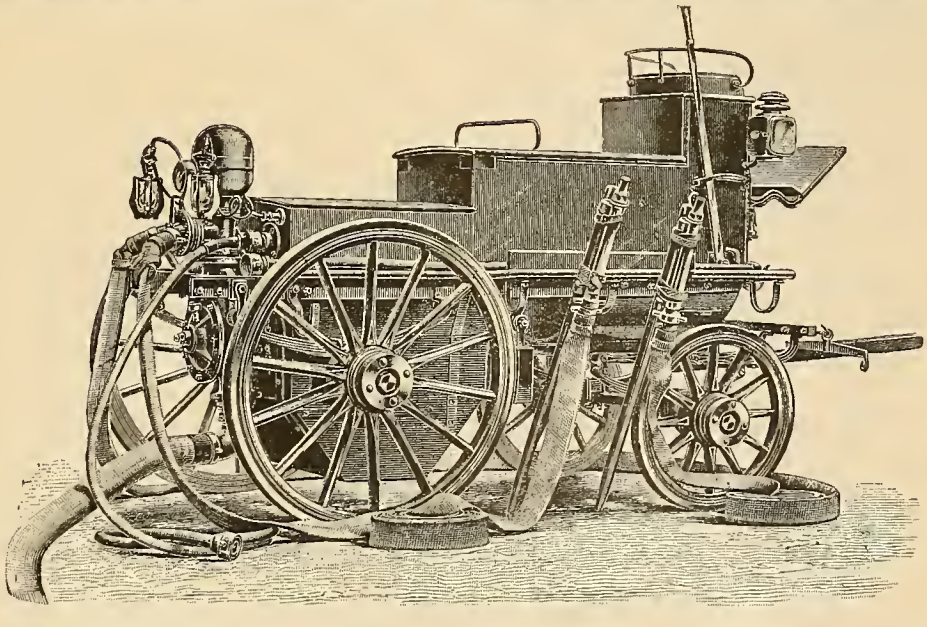


FIG. 1. ELECTRIC FIRE ENGINE.

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CORRESPONDENCE relating to electricity, or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

	PAGE.
Isolated Lighting Plant in the Masonic Temple, Chicago. Illustrated	85, 86
Electricity at the World's Fair	86, 87
Portable Combination Telephone and Telegraph Set. Illustrated.	87
Spokane Electric Railway System. Illustrated	87, 88
Commandeer's Wave Power System. Illustrated	88
The Wilder Electric Hotel Call System. Illustrated	88, 89
Electric Fire Engine. Illustrated	89
The D'Unger Case	89
Reported Electric Railway Consolidation in Chicago	89
Electric Railroading in Ohio	89
Editorial	90
The Electric Percussion Drill in Theory and Practice. By Harry N. Marvin. Illustrated. (American Institute of Electrical Engineers)	91, 92, 93
Alarm Bell Indicator	93
Arrester for Incandescent Circuits. Illustrated	93, 94
New Electric Wiring Computer. Illustrated	94
Physicians and Electricians	94

DEPARTMENTS.

Correspondence	94
New Incorporations	95
Electric Lighting	95
Electric Railways	95
Electric Mining	95
Telephone	95
Telegraph	95
Miscellaneous	95
Trade News	95, 96
Business	96
Electrical Patents	96

A VERY large and complete isolated electric lighting plant is illustrated in this issue. It is that installed in the nineteen-story Masonic Temple building in Chicago, which is probably the tallest office building in America. The work of installation has been thoroughly done, and there are many central station plants in ambitious cities that are neither so large nor so well equipped for incandescent lighting as this plant, which is devoted entirely to one building. A careful estimate shows that the edifice contains fully twelve tons of copper in electrical conductors.

ANNOUNCEMENT is made that the issuing of official permits for the occupancy of space in the electricity building at the World's Fair will be begun about September 1st. Some idea of the general plan of the arrangement of exhibits and the plan of recording them adopted in Chief Barrett's department is given on another page. The prospect of the complete success of the display in this department will gratify every person engaged in electrical study or industry. The only cause for regret at present is the possibility that the foreign exhibits may not be as representative as is desired.

EVIDENCE of the progress that the trolley system is making is found in many western towns, but there are few that have contributed so much to the system as the city of Spokane, Wash. There the electric railway reigns supreme. The city is covered with a net work of railways that give fine service not only in the business district, but also in the residence portions of the town. This service has contributed greatly to the prosperity of the city, and its advantages are fully appreciated by the people of Spokane. Evidence of this is shown in the fact that the old cable system has been largely replaced by electricity. Full details of the progress of this system and the interesting features of the road are given in the article presented elsewhere in this issue.

GRADUALLY New York is coming in line with modern progress in the matter of surface railways for outlying districts. The daily papers in that city are terribly alarmed at the flattering prospect of an electric railway on Columbus avenue, from Sixty-fourth to One Hundred and Tenth street, operated by means of overhead wires. Undisturbed by the shrieking of the journalistic calamity howlers, the property owners along the street have calmly given the needed consents, and there is good ground for the hope that the aldermen will pass the necessary ordinance and that the measure will receive the signature of the mayor. New York is bound to have electric street railways, operated, undoubtedly, on the overhead system, and the sooner the newspapers recognize this fact and bow to the inevitable the better for all concerned.

A VERY practical article on "Testing Dynamos," by Foree Bain, presented in the last issue, attracted considerable attention. Mr. Bain makes good use of the voltmeter and ammeter to measure insulation resistance, locate ordinary armature short circuits, and also to locate trouble without unsoldering connections on a finished armature, or without burning a coil. In another article published recently Mr. Bain talked very plainly on the subject of lightning arresters. It may be said that Mr. Bain is not an enthusiastic advocate of any type of lightning arrester now on the market. He reluctantly admitted that too many of the so-called "arresters" fail to act when most needed. However, Mr. Bain differs from many writers who are deft in finding fault but are singularly backward in suggesting remedies. In his short article on "Protecting Dynamos" simple and, it is claimed, most efficient means of arresting lightning and also of carrying off static charges were presented. Written as they were by a practical man who knows whereof he speaks, the articles are worthy of careful perusual.

METHODS of conducting a systematic warfare upon insects are being considered by fruit growers. One of these is described by an exchange. It is proposed to place electric lamps in orchards, a few feet above the tree tops, surmounting each lamp by an umbrella shaped wire screen. When the current is turned on in the evening the light will attract the insects. The screens could be charged and when the insects would come in contact with the wires they would be instantly killed.

A device in some respects quite similar was described in the WESTERN ELECTRICIAN, December 20, 1890. It was used successfully in a park at Munich, Bavaria, which had been visited by myriads of insects. A rough frame work was built with a large electric projector at the top. At the same point was a powerful exhaust fan operated by a motor leading to a kind of grinding mill. The insects, attracted by the light, would be drawn by the draft into a passage leading them down to death and mutilation in the grinder. In some parts of Northern Europe it is claimed that these pests have been turned to good account, the crushed insects being mixed with flour and water and baked, the cake being used for feeding poultry.

THE advancement that has been made in the application of electricity to drilling is related in a most concise form in Mr. Marvin's Institute paper published in this issue. Mr. Marvin believes that the electric percussion drill has reached the stage where it can safely be relied upon to do its work, and that it will compare favorably with other styles of drills. "The efficiency of those machines," he says, "compared with other forms of electric motors is of course low, but this factor is of comparatively little moment in percussion drill work. It is far more important that the machine should be able to endure the development of a large amount of power with a small weight, than that it should be highly efficient. It would seem that the general mechanical design of these machines admits of greater durability and simplicity of construction than air drills, as there are no steam tight joints required, and a very great wear upon the moving parts does not reduce the effectiveness of the drill. The general flexibility of the electrical system and its peculiar adaptation to mining work are well recognized, but it has been urged that for drill work compressed air is a necessary factor for ventilation. A careful investigation of this matter reveals the fact that there is little or no weight in this objection. The instances are extremely rare where compressed air is relied upon for ventilation, and I have found few miners who consider this matter of importance."

Mr. Marvin's conclusions will be generally accepted by those who have investigated the conditions attending the introduction of electricity in mines. Moreover, his statements are corroborated by reports of those who have had practical experience in handling drills in mines. The favor with which these applications are now received shows that mining engineers are beginning to appreciate the practicability and possibilities of the system.

THE temptation to reproduce the queer things said about electricity in the daily newspapers is sometimes irresistible. The following is taken from a paper published in Lancaster, Pa.:

Wm. Breen was badly burned last night by electricity. The crossing of an electric light wire with the car trolley wire formed a series of ground currents which danced like blue demons on the motors. Mr. Breen started up a positive pole with an iron magnetic monkey wrench in his hand. Somehow his body formed an arc and he received a charge of 5,000 volts. He was knocked down and feels pretty shaky to-day.

If it is true that Mr. Breen has seen a "series of ground currents" dancing "like blue demons on the motors" and has experienced a shock from a current of electricity having a potential of 5,000 volts, with no more serious results than feeling a "little shaky," he should take the lecture platform at once. A recital of his experiences would be of great popular interest as well as of importance to the scientist. Stereopticon views showing the gay and agile ground currents at their demonical revels would greatly add to the attractiveness of the entertainment.

THE conservative opinion held by the majority of American electrical engineers in relation to the prospect of the displacement of steam locomotives for long distance transportation on trunk lines, so ably voiced by Frank J. Sprague in his address at the last meeting of the American Institute of Electrical Engineers, appears to meet the general approval of British engineers. "It has yet to be proved," says the *Engineer* of London, "that it is possible to make an electric motor which will comply with all the multifarious conditions inexorably dictated by the exigencies of traffic. In the United States nothing of the sort has yet been produced, and it is fair to assume that they know as much at the other side of the Atlantic as is known at this about electricity. Apparently a very wide departure from existing methods and principles of construction may be needed to secure success, and no one can say that the field of invention in this direction is nearly filled. It seems, however, to be almost time that some one with the requisite knowledge and ingenuity set himself in earnest to the work of designing a real electrical locomotive." Probably the machines now building for hauling trains of passenger and freight cars of normal type through the Baltimore tunnel form the nearest approach to what our contemporary calls "a real electrical locomotive." The Baltimore experiment is being watched with interest on both sides of the Atlantic.

IT is a noteworthy fact that a distinct tendency toward the consolidation of electric lighting companies in cities is observable. Buffalo, Rochester, Minneapolis, Louisville and New Orleans afford recent examples of plans of this character in different stages of advancement. Many consumers, no doubt, will look on this movement with distrust, taking it as a step in the direction of increased prices. There is no reason to believe that this fear is well founded, however. The ultimate effect of concentration will be to reduce the cost of operation to the lowest possible point. Considering the state of the electric lighting business in the country at large, it is safe to assume that the consolidated companies will be content with a reasonable profit after meeting the cost and the fixed charges. In the case of many of the companies entering the combinations this will be doing better than the accomplishment of years past. The movement toward consolidation promises better and more extensive service at fair, but not exorbitant, prices. It is in conformity with a similar tendency visible in all other lines of business. Unless a decided change takes place in the electrical business of the United States, it will be impossible for any huge parent company to establish a monopoly of the electric lighting business. This being the case, the public can afford to look with equanimity on the consolidations of local companies, for it is difficult to conceive of any manner in which they could so completely intrench themselves as to defy a resolute attempt at competition in case undue exactions were made. But there is every reason to believe that the new combinations will be content with reasonable returns and an unmolested business.

The Electric Percussion Drill in Theory and Practice.

By Harry N. Marvin.[1]

Wherever rock is to be excavated in mining, tunnelling, or quarrying, there, of necessity, we find the percussion drill. Until about a year ago two types of drills held the field, the hand drill and the direct acting steam or air drill. With the extension of electrical methods of power transmission to mining operations came the urgent demand for an electrically operated percussion drill. The mechanical and electrical requirements of this machine are particularly severe. It is called upon to continuously endure an action that is, in almost all other machinery, studiously avoided, namely, a practically uncushioned reciprocation and a blow

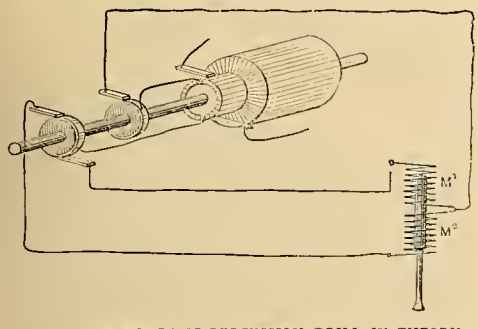


FIG. 1. THE ELECTRIC PERCUSSION DRILL IN THEORY AND PRACTICE.

upon substances harder than cast iron. The general requirements of an electric percussion drill for mining work are that it shall be light enough to be quickly handled by two or three men, powerful enough to compete with an air drill that absorbs eight or ten horse power; and so simple in design that it can readily be repaired by an ordinary mechanic without electrical experience. It must be so constructed that the complete machine and its several parts can be soaked in mud and water without injury. It should be incapable of burning out. It must be able to endure almost any amount of the roughest handling without injury, and the materials employed should be as little subject to crystallization as possible. My experience suggests the

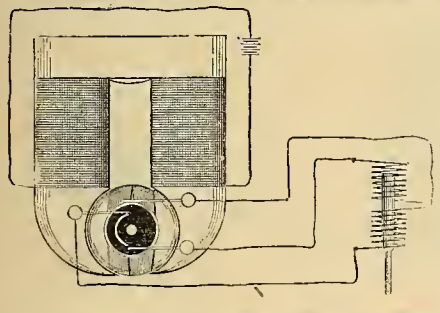


FIG. 2. THE ELECTRIC PERCUSSION DRILL IN THEORY AND PRACTICE.

following elements of construction to be avoided: traveling conductors, commutating or current shifting devices, sliding contacts, spring contacts, cotton insulated wire, and all insulating material capable of carbonization, switches, lamination of the moving parts, close fittings and joints liable to be impaired by considerable wear, all constructions liable to be impaired by careless or unskilled attention. For the benefit of those unfamiliar with the actions of the air drill, I will state that the general practice at present is to give the machine a stroke of from five to seven inches, to strike as nearly as possible an uncushioned blow upon the rock, and to make as many blows per minute as the power applied will develop, usually from two to four

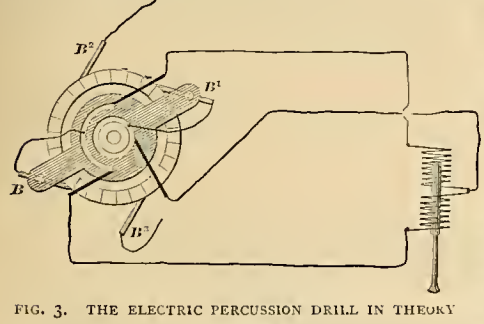


FIG. 3. THE ELECTRIC PERCUSSION DRILL IN THEORY AND PRACTICE.

hundred per minute. It is found that a stroke of about five inches is necessary to properly free the hole from mud.

In the electrical solution of the problem, the solenoid and plunger affords the simplest method of developing this action, and most of the work in this field has been confined to this line. After much experimental work with divided solenoids and commutating devices mounted upon the drill, I abandoned these methods and in 1888 devised the system of operation that is at present rather well known, but for clearness this may be illustrated.

Fig. 1, shows an ordinary continuous current, dynamo having two opposite poles of its armature connected to a solid collecting ring and a half ring respectively. The outer terminals of the drill coils M^1 and M^2 are connected by line wires to the two brushes alternately bearing upon the half ring. The inner terminals of the coil are joined and led to the solid ring. It appears that as the armature revolves, current impulses are directed into the drill coils in alternation, causing a reciprocation of the plunger in synchronism with the dynamo armature. It will be noticed that the action here closely resembles the action of a steam engine, force being exerted first in one direction and then in the other, one end of the cylinder being idle while the other end is active. Of course connections are such that the polarity of the plunger is never reversed. This system simplifies to the utmost the construction of the drill and enables it to be designed so as to satisfy all of the conditions before mentioned. The complications of this system are more apparent in theory than in practice. Three wires are required, but once placed they give no further trouble. The generator can be used to develope continuous current and pulsating currents at the same time if desired, but I believe that it is better practice to use a separately excited drill generator without regular commutator. The machine then becomes extremely simple, as shown in Fig. 2. I have found it desirable to run these drills at a speed of about 400 per minute, a rather slow speed for small dynamos. This difficulty may be avoided at the expense of simplicity in several ways. One method is shown in Fig. 3. The regular commutator of a continuous current armature is equipped with a pair of revolving brushes $B\,B^1$, one of which connects to the solid ring of the drill circuit commutator and the other to

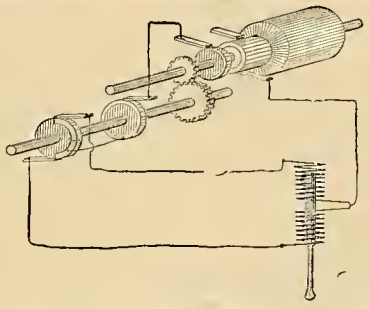


FIG. 4. THE ELECTRIC PERCUSSION DRILL IN THEORY AND PRACTICE.

the half ring. In this manner pulsations are developed in the drill circuit as the brushes, $B\,B^1$, are rotated and with a frequency entirely independent of the armature speed. With this arrangement we are also able to take off 100 volt alternating currents from a commutator that is also supplying a 500 volt continuous current circuit, by spacing the brushes B and B^1, an amount less than 180°.

Another method of reducing the frequency of the pulsations is shown in Fig. 4, where the drill commutator is geared to the dynamo shaft, reducing the frequency to one-half of the speed of the generator.

The general character of the impressed electromotive force in the two drill circuits in these systems is shown in Fig. 5, curve A showing the voltage over the upper coil and curve B showing the voltage over the lower coil.

A method of operation by which a somewhat different curve is obtained is shown in Fig 6. It will be noticed that current is admitted to the drill circuit when the voltage is at a maximum, the curve of impressed electromotive force being generally as shown. The general plan of ad-

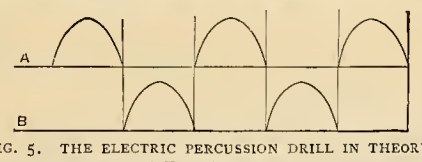


FIG. 5. THE ELECTRIC PERCUSSION DRILL IN THEORY AND PRACTICE.

mitting the current alternately to the two drill circuits, one circuit being idle while the other is active, characterizes all of these methods. This may be called plan A.

I have devised a method for affecting this without commutation, as shown in Fig. 7. Here one wire from a simple alternator is led to the drill while the other wire passes through the secondaries of two converters $C\,C^1$. The cores of these converters are continuously saturated by continuous currents in the primary coils as shown, the windings of the converters being opposite. When current endeavors to pass through these it is checked considerably in the converter whose magnetism it tends to reduce and to much less degree by the converter whose magnetism it tends to increase. A reverse current is opposed by the other converter and thus pulsations of one polarity are strong in one coil while those of the reverse polarity are strong in the other drill coil. This would not probably be a very efficient method.

Another general plan of drill operation, which I will call plan B, has been developed to some extent by the late Mr. Van Depoele. This plan is based on a difference of phase of current in the two coils, and is shown in its simplest form in Fig. 8. The two outer drill wires are connected to the two regular brushes of the armature A, and the middle wire connects to the solid ring connected to one point of the armature. As the armature revolves, currents rises in one drill coil and falls in the other, producing the reciprocation of the plunger. The voltage curves for this type of machine are shown by Fig. 9. An armature giving two alternate currents of 90° difference of phase may also be used, but with the disadvantage of reversing the polarity of the drill plunger. This appears to be less efficient than plan A, for the reason that the drill coils are constantly working against each other, and heated by current opposing the action of the drill.

A third plan of operation, which we may call plan B, is that devised by Siemens & Halske, and shown in Fig. 10. Here three coils are used in the drill, the middle coil being excited by a continuous current and the two end coils by an alternate current of proper frequency. The function of the middle coil is to maintain a constant polarity in the bar, and the motion is effected by the effort of the two end coils. In this system, both motor coils are continously excited as in plan C, but there appears to be less waste of energy.

Aside from the extra complication of drill construction,

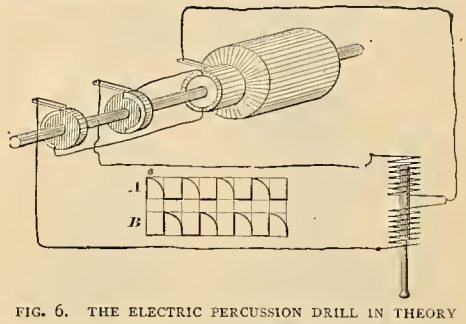


FIG. 6. THE ELECTRIC PERCUSSION DRILL IN THEORY AND PRACTICE.

it is questionable if as much power can be obtained from a given weight of wire with this arrangement as can be realized on plan A. It must be borne in mind that in these machines it is necessary to get the utmost power possible out of a given weight of copper and iron, and the heating limit is the only practical consideration. The efficiency of the machine is secondary.

Plan C has been reduced to practice in this country by the late Mr. Van Depoele, who avoided the use of a fourth wire in the system by an ingenious method shown in Fig. 11. The regular commutator A is applied with rotating brushes, B^2B^3 in addition to the regular brushes BB'. It appears that as the rotating brushes revolve a simple alter-

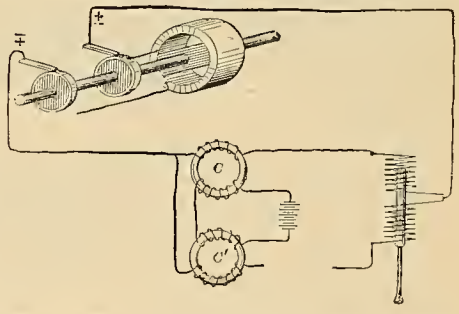


FIG. 7. THE ELECTRIC PERCUSSION DRILL IN THEORY AND PRACTICE.

nating current flows through the end coils of the drill, while a unidirection pulsating current of one half the frequency circulates in the middle coil.

The requirements of construction and service have thus far induced me to employ a rather low voltage in the operations of drills, our present practice being to use about 100 volts alternating upon the drill. I have employed several methods of operating drills from high voltage circuits.

Referring to Fig. 3, if the regular brushes B^2 B^3 be connected to a 500 volt circuit, the armature will run as a motor, and if the rotating brushes B B^1 be spaced by a suitable amount, less than 180°, they will take off the pulsating current for the drill circuit at, say, 100 volts.

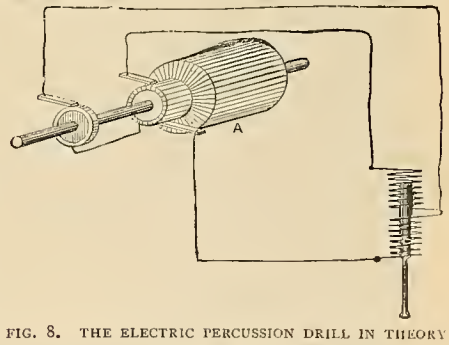


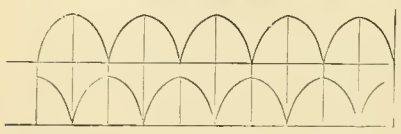
FIG. 8. THE ELECTRIC PERCUSSION DRILL IN THEORY AND PRACTICE.

Another method is shown in Fig. 12, where a 1,000 volt alternating circuit is lead from the prime generator A, to the vicinity of the mine where it passes through the primary of a converter C, in which the voltage is reduced to 100 volts. A small motor M, running in synchronism with the generator A, directs the alternate pulsations into the drill circuits.

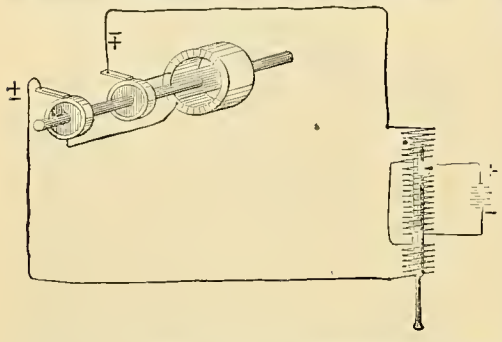
Turning now to the drill construction, Fig. 13, shows the first form in which the percussion drill was put upon the market. This I call a type A machine. As appears in the sketch the machine consists of a 7 inch boiler tube provided with a suitable mounting. Within the tube are

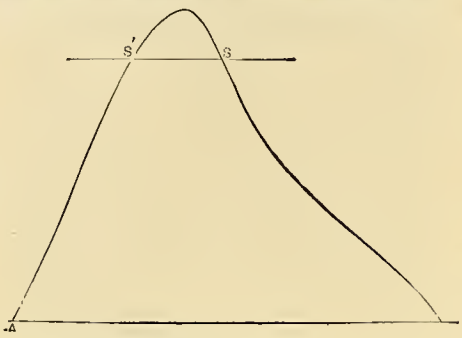
1. Read at the general meeting of the American Institute of Electrical Engineers, Chicago, June 7, 1892.

two solenoids, B B^1, a rotating device and a cushion spring. Traveling through the coils is a two inch plunger D, the middle portion of which is of iron; the upper end is of brass and is rifled, as shown to fit the rotating device, while the lower end is also of brass and is enlarged at the end into a chuck to hold the bit. The three sections of the plunger are welded together. The weight of this plunger was 33 pounds.



FIGS. 9 AND 22. THE ELECTRIC PERCUSSION DRILL IN THEORY AND PRACTICE.





FIGS. 10 AND 21. THE ELECTRIC PERCUSSION DRILL IN THEORY AND PRACTICE.

This machine was designed to make 600 blows per minute with a 3 inch to 4 inch stroke. The first of these machines to be put into a mine was that started in May, 1891, in the Black Bear mine at Gem, Idaho. This was, I believe, the first commercial electric percussion drill plant ever operated. During the next few months several other mines and quarries were equipped with these drills, with the general result that where the rock was not excessively hard the work was fairly satisfactory, but in extremely hard rock several defects developed. The brass portion of the plunger would crystallize and break a short distance above the chuck. Under the severe strain of continuous work in hard rock the coils would become so heated as to ground, and the spring connections between the cable and the coils would give out. The construction of these drill coils deserves special description. Fig. 14 shows a coil complete, ready to be put into the drill. The coil is constructed as follows: Upon a brass spool, the body and heads of which are insulated with mica, is wound a bare copper wire of square section. This wire is insulated, as it is wound with mica. The complete coil is wrapped with mica and a metal tube slipped over the whole and soldered to the coil heads, making the completed coil water-proof and heat-proof, as it is insulated with mica alone and nothing but mica and metal being used in its construction. The trouble with our first coils was that they were soldered up with a comparatively soft solder, and when the coils got very hot this solder softened, the joints opened, and oil and dirt getting in, carbonized and developed a ground. As an example of the treatment these drills received I will state that while visiting one of our drill plants that was used for railroad grading on the Great Northern railroad in Idaho, I saw the men dump one of these drills bodily off a flat car in a dump of broken stone down which the drill rolled some twenty feet. I might add that this was one of our most successful plants, 18 foot holes being regularly drilled in granite rock. In view of the defects mentioned the design of the machine was altered, as shown in Fig. 15, which shows a type B machine. The plunger has been enlarged to 2¼ inches and is what I call the double magnet type. The forward part D^2 is also of steel, and the connecting piece D^1 is of brass. The design gives a solid steel chuck and brings the brass part of the plunger within the drill body. The coils are now encased in boiler tube jackets brazed up with hard spelter and are heated to a bright red in process of manufacture. The spring connections have been abandoned and solid set screw connections now fasten the cable to the drill. A switch is inserted in the cable near the drill. This machine seems to overcome the defects of the old drill and has thus far proved very satisfactory. This machine takes a stroke of about 5 inches and runs at about 380 blows per minute. This longer stroke is found more effective in keeping the hole free from mud.

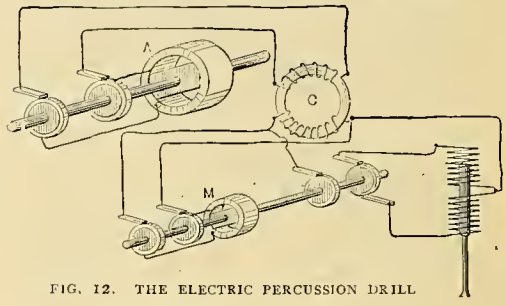
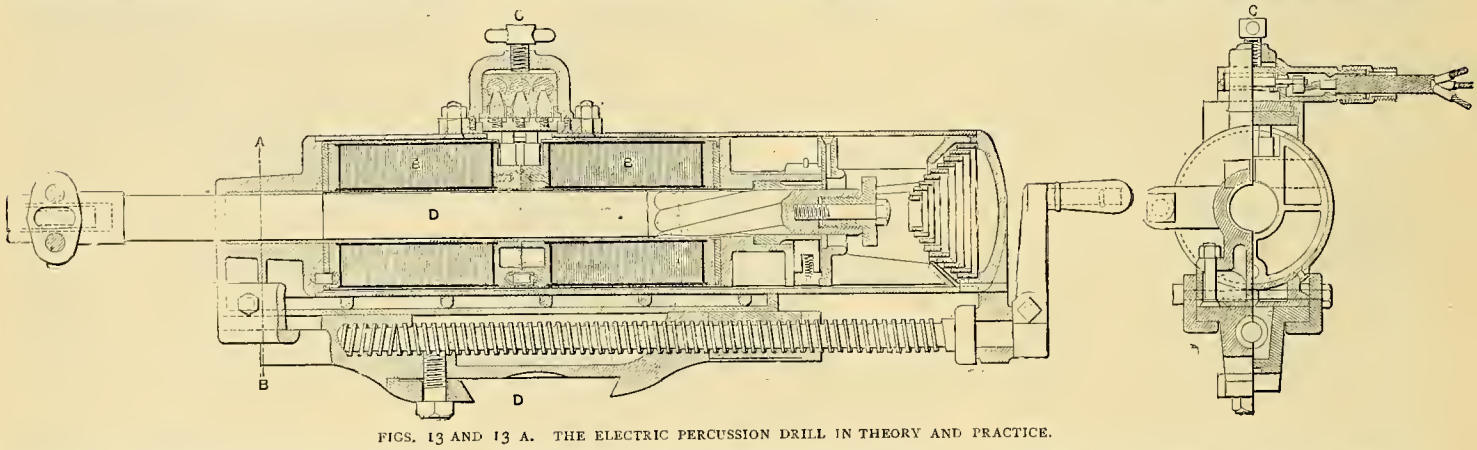


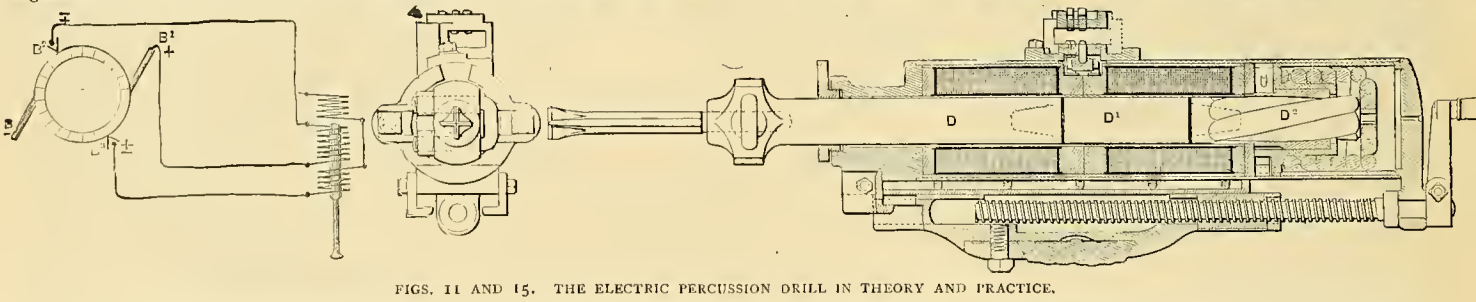
FIG. 12. THE ELECTRIC PERCUSSION DRILL IN THEORY AND PRACTICE.

Fig. 16 shows a still later type of drill that I have recently built and which promises to be much better than the others. The outside dimensions of this machine are about the same as the type A machines, but the plunger of this machine is a solid steel forging and 4 inches in diameter. No brass is used in the plunger, the metal being reduced in section where it passes through the front head. The rachet device is similar to that used in air drills, and in fact, the whole design of the machine quite closely follows the air drill construction. This machine takes a stroke of from 6½ to 7½ inches and makes about 380 blows per minute; the plunger weighs 80 pounds.

Fig. 17 shows the cable connection and switch A and the cable fuse box B, through which connection is made from the mains to the cable. A study of the operations of these machines present many interesting features. In Fig. 18 is shown what may be termed an energy curve of the machine. This curve is obtained in a manner similar to an indicator card of a steam engine. Referring to Fig. 19 A is a cylinder mounted parallel to the drill rod. This cylinder is geared to the armature shaft in such a manner that it rotates in synchronism with it. A pencil carried by



FIGS. 13 AND 13 A. THE ELECTRIC PERCUSSION DRILL IN THEORY AND PRACTICE.



FIGS. 11 AND 15. THE ELECTRIC PERCUSSION DRILL IN THEORY AND PRACTICE.

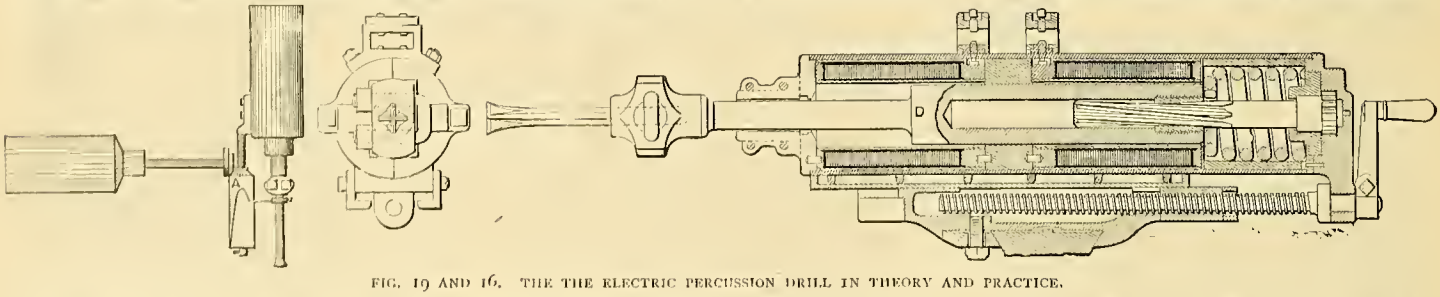


FIG. 19 AND 16. THE THE ELECTRIC PERCUSSION DRILL IN THEORY AND PRACTICE.

the drill rod rests upon the cylinder A; it appears that as the drill rod reciprocates and the cylinder A rotates a curve will be traced by the pencil. Fig 18 shows such a curve. The direction of motion of the paper being from left to right, it appears that the angle X of the curve at any point indicates the velocity of the plunger at that instant. A is the point where the plunger strikes the rock

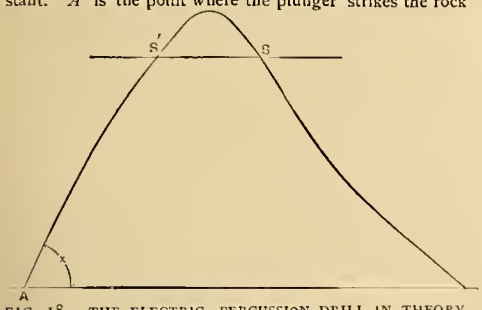


FIG. 18. THE ELECTRIC PERCUSSION DRILL IN THEORY AND PRACTICE.

and the sharp rebound is shown by the angle. The concave character of the curve at M shows the backward acceleration of the plunger. The buffing spring is encountered at S, and the angles at S and S^1 show that there is little loss in the spring. The angle X gives the find velocity of the plunger when it strikes the rock. A simple calculation gives the energy of the blow in foot pounds.

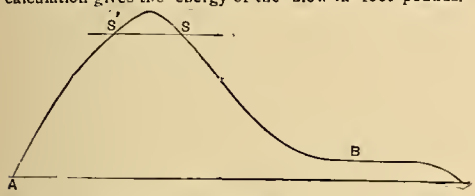
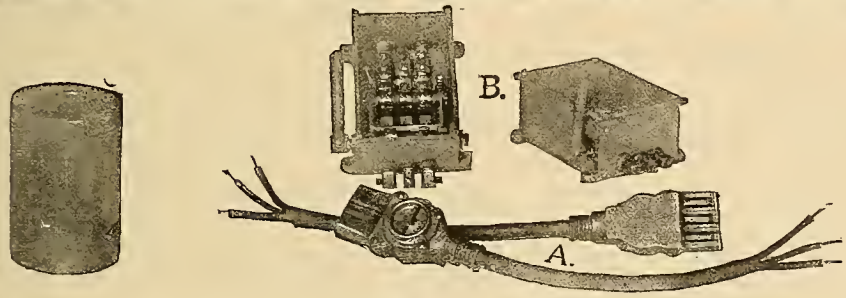


FIG. 20. THE ELECTRIC PERCUSSION DRILL IN THEORY AND PRACTICE.

This affords a good method of comparison between different machines and conditions. The general character of the curve reveals the general action of the forces during the stroke. The curve in Fig. 20, for example, shows that the drill rebounded sharply at A and then stood still for a considerable time at B, indicating that the stroke



FIGS. 14 AND 17. THE ELECTRIC PERCUSSION DRILL IN THEORY AND PRACTICE.

was too short for the power applied and the frequency of the stroke. On Fig. 21 we have shown the reverse conditions, where the concave character of the curve at B indicates a loss of velocity and the length of stroke is evidently too great for the power applied. Fig. 22 shows

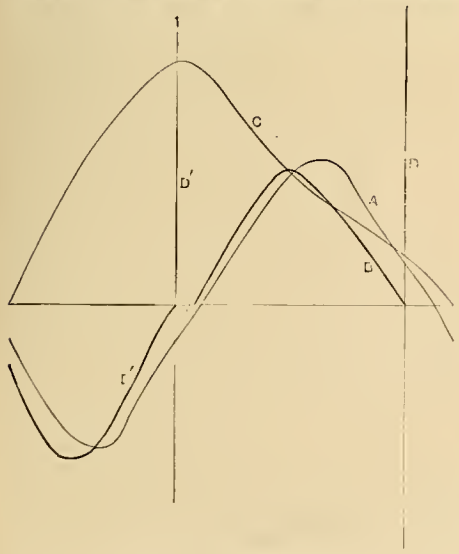


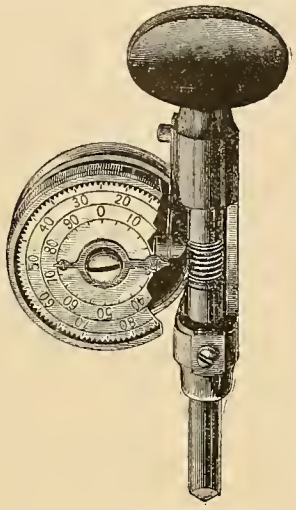
FIG. 23. THE ELECTRIC PERCUSSION DRILL IN THEORY AND PRACTICE.

a curve taken on a type A drill with an 18 foot bit drilling downward in slate rock.

The energy of the blow being determined it can then be decided whether the drill delivers the greater amount of energy upon the rock by a few long strokes or by a greater number of strokes.

Some other interesting curves are shown in Fig. 23. Curve A shows the voltage on the drill circuit. Curve B and B^1 the current in the two coils. Curve C is the energy curve. The lines D D^1 indicate where the brushes make contact with the half ring.

The efficiency of these machines, compared with other forms of electro-motors, is of course low, but this factor is of comparatively little, moment in percussion drill work. It is far more important that the machine should be able to endure the development of a large amount of power with a small weight, than that it should be highly efficient. It would seem that the general mechanical design of these machines admits of greater durability and simplicity of construction than air drills, as there are no steam-tight



ALARM BELL INDICATOR.

joints required, and a very great wear upon the moving parts does not reduce the effectiveness of the drill. The general flexibility of the electrical system and its peculiar adaptation to mining work are well recognized, but it has been urged that for drill work compressed air is a necessary factor for ventilation. A careful investigation of this matter reveals the fact that there is little or no weight in this objection. The instances are extremely rare where compressed air is relied upon for ventilation, and I have found few miners who considered this matter of importance.

Although the introduction of the percussion drill has been attended with many difficulties, I believe that the obstacles have been so far overcome that the machine is to-day in thoroughly practical shape.

Alarm Bell Indicator.

The cut illustrates the Gem double speed alarm bell indicator. It is a very neat combination of a speed indicator and alarm bell. It is nickel plated, and in size is only $3\frac{3}{8}$x$1\frac{1}{2}$x$\frac{7}{8}$ inches, and may be easily carried in the vest pocket.

To use the indicator, apply the engaging point to the shaft of the machine being tested, and, with watch in hand, wait until the bell rings. Upon the ringing of the bell, begin to observe the time and continue as long as may be desired, it being simply necessary to count the strokes of the bell thereafter, each stroke indicating 100 revolutions. Upon the expiration of time limit remove the indicator and add any fraction of 100 that may be shown upon the dial to the full hundreds previously counted by bell strokes. The E. S. Greeley & Co., New York, is placing thesedevices on the market.

Arrester for Incandescent Circuits.

The accompanying illustrations represent a new style of lightning arrester for incandescent circuits, which is

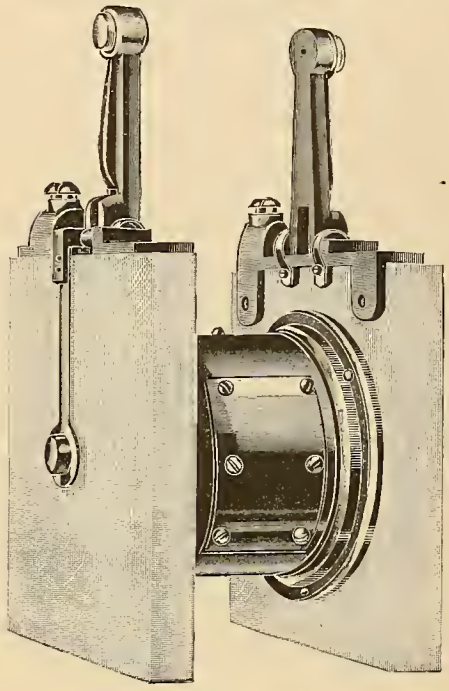


FIG. 1 ARRESTER FOR INCANDESCENT CIRCUITS.

a modification of the Wurts-Winsor device. Its distinctive features are that it is made out of incombustible material, operates without any electro-magnetic device, and its arc is self-destructive.

Fig. 1 represents the lightning arrester in its normal position ready for a discharge. The apparatus is compact, consisting of very few parts. It has a cylindrical air chamber of brass, each end of which is covered with a marble plate. Two discharge points on opposite sides of the air chamber, consisting of brass tubes tipped with carbon, are attached to brass lever arms in such a manner as to swing freely through circular openings in the marble plates. Within the air chamber is a carbon ball held stationary in the center, and the two discharge points approach this ball to within one-sixteenth of an inch. The carbon ball is grounded and the lever arms connected to the respective poles of the generator.

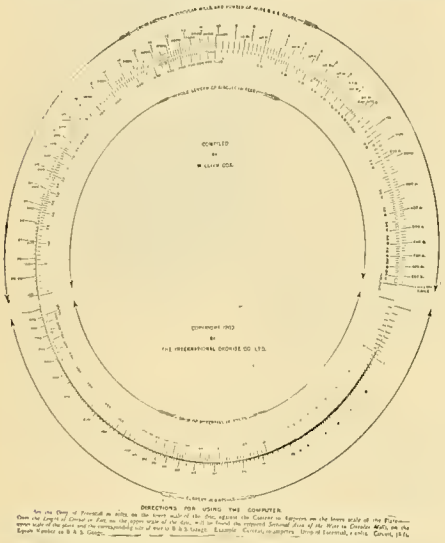
FIG. 2. ARRESTER FOR INCANDESCENT CIRCUITS.

The operation of a discharge is as simple as it is effective. Supposing a lightning discharge to come in from the line, the discharge will take place from the two dis-

charge points to the carbon ball and from thence to the ground, forming a double arc in the air chamber. The dynamo current will then follow, causing a short circuit on the generator, and the heat produced by these arcs will expand the air in the chamber and drive the two discharge points out, thus extinguishing the arcs and rupturing the short circuit. The next moment the discharge points swing back to their former position within the chamber and the apparatus is at once ready for another discharge. The entire operation is automatic, and when the lightning arrester is once placed in position it requires no further attention.

Fig. 2 is a reproduction of a photograph and represents the arrester in actual operation. In testing one of these arresters the binding posts were connected to the poles of a 1,000 volt 1,500 light alternator, and the two air-spaces were bridged over with a small strip of tin foil. Then by the throw of a switch the generator was short circuited through the arrester, the tin foil was fused, the air expanded, the discharge points were forced out of the air chamber against the bumpers, the arcs were blown out with a report like a pistol shot, and the discharge points returned to their normal positions ready for a fresh discharge, all in an inconceivably short space of time. After several hundred such discharges the arrester showed no deterioration whatever.

The device is manufactured by the Westinghouse Electric & Manufacturing company, which also makes lightning



NEW ELECTRIC WIRING COMPUTER.

arresters on the same principle, but differing in construction, for power house installations and car equipments of electric street railway companies.

A New Electric Wiring Computer.

The accompanying cut illustrates a device invented by William Cox, by means of which the sectional area and the number of wires suitable for lighting and other purposes may be obtained.

It consists of a suitable foundation plate, with a revolving circular disk about eight inches in diameter, both graduated in accordance with the factors of the formulae whose solution it gives.

This is the well-known one:

$$C.\ M. = \frac{l \times c \times 10.8}{V}$$

in which

l = whole length of circuit in feet,

c = current in amperes,

V = drop of potential in volts,

C. M. = sectional area of suitable wire in circular mills.

The method of using this computer may be illustrated by the following example, in which there are 76 feet as the whole length of circuit, current of 10 amperes and loss of 2 volts. Turn the disk around until the division representing 2 volts is opposite and coincides with the one representing 10 amperes. It will now be found on the outer upper scale that 4,100 circular mills, which corresponds to No. 14 wire, B. & S. guage, is the number of the wire suited to the circumstances.

Mr. Cox has sold his invention to the Okonite Company, limited, New York.

Burlington Electric Lighting company, Burlington, Iowa; capital stock, $150,000; to equip and operate a lighting and power plant in Burlington, Ia. Frank G. Jones, Burlington, Ia.

CORRESPONDENCE.

New York Notes.

NEW YORK, August 6.—Wire tappers are again at work in New York, if the *Herald* is to be believed, although the truth of the story is denied by the Western Union company. According to the newspaper in question, which published a column account of the affair on Tuesday, the tapping was done by experienced operators, who engaged a front room and bedroom in a tenement house near Third avenue and Twenty-sixth street. "Sixty cells of a dry battery were concealed in a trunk which ostensibly contained the clothing of the young man who rented the rooms," says the *Herald*, "and the race wire was tapped with the finest of wire. The connections were made so neatly that the most expert lineman would be weeks in discovering how the thing had been managed. The wires were run down the chimney of the tenement, and then the whole arrangement was put through after the men had tested the wires for several days to see that there was no possibility of a hitch. The men in the scheme included a Brooklyn sporting character, two linemen, an Englishman with some money and five men with a throrough knowledge of telegraphy. It had been arranged to hold back the returns on seven races, and it was thought that if nothing went wrong from $2,000 to $5,000 would be divided. It is customary for the Western Union company to send out 'flash' messages when a horse is heavily played at the track just before the racers are started. It was by this means that the men who were to lay the money at the pool rooms were to be advised by the men who were tapping the wire as to which horse won. The men at the 'tap' held back the start and a description of the races, and when they received the name of the winner in cipher they sent a 'flash' message over the wire to the pool rooms. Four or five minutes later they sent the description of the race." By this means it is asserted that several pool room keepers in Harlem lost considerable money. The chief of the Western Union's racing department says that there is no foundation for the story, however.

Despite the hysterical attacks of the New York press it now appears probable that an electric railway, operated by means of overhead wire, will soon be built on Columbus avenue. The chief promoters of the plan have every assurance of success. When the idea of operating trolley cars on Columbus avenue was first broached, as the suggestion of John D. Crimmins, the recently chosen president of the so-called Broadway syndicate, it was announced also that the property-owners along the route were in sympathy with the idea. It is now learned that virtually all of the necessary consents have been obtained in spite of the nonsensical outcry in the papers. From Sixty-fourth to One Hundred and Tenth street, on Columbus avenue, under the Ninth avenue elevated structure, nothing is now needed for the erection of an electric road except the passage of an ordinance by the Board of Aldermen and its approval by the Mayor. The company has secured the consents of owners who hold $6,093,000 of the property on this line, the total assessed value of which is $9,627,000, and the law only requires the consent of one-half in value. The company in June made application to the Board of Aldermen for the requisite permission, and the Railroad committee of the board held a hearing on the application on July 27th. A final committee hearing was then set down for September 28th. Among the property owners on Columbus avenue who have given their consent are Oscar C. Ferris, William F. Havemeyer, John M. Pinkney, Theodore A. Havemeyer, the Romaine family, Robert Marshall's estate, John Casey, Henry Clausen, Jr., Randolph Guggenheimer, C. A. Peabody, the Reckendorfer family, H. B. Auchincloss and the Hudson River Bank. Of the properties for which consents could not be obtained, a number were in litigation and others were so-held in trust that no legal power of giving consent existed.

The first electrical execution in Clinton Prison, Dannemora, took place on August 2d, when Joseph, or, as he was better known, "Cal" Wood, was executed for the killing of his father-in-law, Leander Pasco, at Stony Creek, Warren county, May 10, 1890. The current was turned on four times, the total length of contact being 35 seconds, the shortest on record. It is said that there was no burning of flesh and but a slight contraction of the muscles. A current of seven amperes at 1,560 volts was used.

Electricity guards many of the treasures of the Metropolitan Museum of Art in New York. In the room containing the Moses Lazarus collection of miniatures, painted porcelain, and other rich and valuable objects of art, there are wires running underneath the lid of each. If anybody tried to lift the cover or disturb it in anyway a bell would ring in the trustees' office, and also give warning on the ground floor by ringing a big gong. There is a similar arrangement in use with other valuable cases.

Highway robbers have a new object of attack in electric cars. A car on the Central electric railroad, of Paterson, was held up by six members of the Cream gang one night last week. They stopped the car on the road leading from Passaic to Paterson. They overpowered the conductor and cut off the current. There were only two passengers on the car, and they rushed for help. When help arrived the roughs beat a retreat. The gang failed to get any money.

The will of Cyrus W. Field was filed for probate in the Westchester County Surrogate's Court at White Plains on Tuesday. It was dated January 22, 1892, which was after the failure of his son Edward M. Field, and it probably was made then to revoke all the wills or testaments that were made before that time. A summary of this interesting document follows:

The will first directs that the sum of $50,000 shall be given to his son-in-law, Daniel A. Lindley, and his friend John Lindley, to be invested and held in trust for his daughter, Alice D. Field, so that she may have the income during her life. In case the sum mentioned is not sufficient to properly support his daughter, she is earnestly commended to the rest of his children. To the rest of his children, excepting his daughter Alice and son Edward M. Field, is left a number of articles of personal property. The list is varied, and in many cases the articles were gifts from well known men and serve to show the esteem and honor in which Mr. Field was held by the people of this country as well as those of other nations. These articles are to be divided by mutual agreement, and comprise the gold medal presented to Mr. Field by the unanimous vote of the Congress of the United States; and duplicate of the same, the original having been lost or mis'aid in the Treasury Department at Washington, but afterward found; the gold snuffbox presented by the City of New York, with the freedom of the city; the grand prize medal presented by the Exposition Universelle of 1867 at Paris; the gold medal presented by the Chamber of Commerce of the State of New York; the gold medal presented by the merchants of New York; the gold medal presented by the American Chamber of Commerce of Liverpool; the gold medal presented by the State of Wisconsin; the Decoration presented by Victor Emmanuel, King of Italy; the silver service presented by George Peabody of London; the silver epergne presented by Peter Cooper, Moses Taylor, Marshall O. Roberts and Wilson G. Hunt, who were for many years co-directors with Mr. Field in the New York, Newfoundland & London Telegraph company; the silver pitcher presented by clerks in his employment, the tankard made from wood of the Charter Oak at Hartford and presented by the workmen at Central Park. Other articles thus disposed of by Mr. Field are his gold watch, emerald pin, diamond pin, the old portrait of Prof. S. F. B. Morse, photographs of John Bright, Richard Cobden and M. de Lesseps, each of which had been presented by the person photographed with his autograph; the dining table on which the contract was signed March 10, 1854, for connecting Europe and America by submarine telegraph cable, and also the chairs and other articles of furniture belonging to the same set with the table; the sideboard which formerly belonged to Thomas Jefferson and was used by him while he was President of the United States; the American and English flags wrought into one which floated at the masthead of the steamship Niagara in the cable expeditions of 1857 and 1858 and of the English steamship Great Eastern while the cables of 1865 and 1866 were laid; the collection of fossils and mineral specimens, together with the cabinets and cases in which they are usually kept; the carved hairs and carved table now in Mr. Field's library; the patronship which he had in the Metropolitan Museum of Art, and the Fellowship in the American Museum of Natural History; all other furniture, books, works of art, paintings, engravings, photographs, bronzes, porcelain, curios from foreign countries, bric-a-brac, and silverware. The six oil paintings and forty-seven water-color paintings illustrating the laying of the Atlantic cable have been given by the will to the New York Historical Society. All the rest of the property is divided into five equal shares, and one share each is left to the testator's daughters, Grace F. Lindley, Isabella F. Judson and Frances F. Andrews. Another share is left to Daniel A. Lindley and John Lindley in trust in separate though not necessarily divided portions for the children of Edward M. Field, each such portion to constitute a separate trust fund. The remaining share is left in trust to his friend, George Waddington, for his son Cyrus William Field, the net income to be applied to his son, Cyrus William Field.

The Board of Electrical control has let the privilege of extending the electric street lights through more streets of the annexed district than are being lighted by electricity now. The lights in the Twenty third and Twenty fourth wards, as furnished by the North New York Electric Light company, have been very satisfactory, and when all the electric lights contracted for are in place the district will doubtless be the most brilliantly lighted in the city, as the system is to be extended as far as Jerome Park. Work is to begin at once and will probably be finished within sixty days.

W. F. O.

Electric motors are used to operate looms for weaving in Blackburn, England.

PERSONAL.

Geo. Martin, western auditor for the General Electric company, visited Omaha last week.

Henry M. Byllesby, the president of the Northwest Thomsoo-Houston company of St. Paul, was seriously injured at Ely, Minn., a short time ago by being thrown from a buggy.

A. L Riker, president of the Riker Electric Motor company of Brooklyn, and wife, have just returned from a two weeks cruise on Long Island Sound in the yacht Charlotte. They stopped at Newport and Bristol.

NEW INCORPORATIONS.

Mohawk Valley Electric Light & Power company, Canajoharie, N. Y.; capital stock, $40,000; to furnish heat, light and power.

Four Lakes Light & Power company, Madison, Wis.; capital stock, $50,000; to construct and operate an electric plant; J. M. Olin, Madison, Wis.

Yuma Water & Light company, Saco, Maine; capital stock, $100,000; to manufacture and sell water pumping and electric light machinery; Fairfield & Moore, Saco, Maine.

Berwick Electric Light company, Berwick, Pa; capital stock, $25,000; furnishing light by means of electricity for the Boro of Berwick and vicinity; C. W. Miller, Bloomsburg, Pa.

Titusville Electric Light & Power company, Titusville, Pa.; capital stock, $100 000; supplying light, heat and power by means of electricity at Titusville, Pa.; Chas. Neubert, Kittanning, Pa.

Electrical Development company, Chicago, Ill.; capital stock, $1,000,000; to develop, manufacture, buy and use electrical inventions; E. E. Hinckley, First National Bank building, Chicago, Ill.

Columbus Gas company, Columbus, O.; capital stock, $1,800,000; to manufacture and sell appliances for generating and conveying electric currents; Columbus Gas company, Columbus, O.

Portland Gas company, Portland, Ore.; capital stock, $1,000,000; to manufacture generate and sell gas and electricity for light, fuel and power; Dolph, Bellinger, Mallory & Simon, Portland, Ore.

Beacon Electric company, Chicago, Ill.; capital stock, $30,000; to manufacture, use, sell and deal in electrical apparatus and operate electric plants; Barton & Brown, 1430 Monadnock building, Chicago, Ill.

Elmwood & Fairmount Park Passenger Railway company, Philadelphia, Pa.; capital stock. $50 000; constructing and operating an electric street railway in Philadelphia; Henry V. Massey, 505 Chestnut street, Philadelphia, Pa.

Fairmount Park & Haddington Passenger Railway company, Philadelphia, Pa.; capital stock, $50,000; constructing and operating an electric street railway in Philadelphia; Henry V. Massey, 505 Chestnut street, Philadelphia, Pa.

Charleroi Heat, Light & Power company, Charleroi, Pa.; capital stock, $5,000; supplying heat, light, and power or any of them by electricity to the public in Charleroi; Geo. D. Quaill, 81 Diamond street, Pittsburg, Pa.

Philadelphia & Bryn Mawr Passenger Railway company, Philadelphia, Pa.; capital stock, $50,000; constructing and operating an electric railway in Philadelphia and Montgomery county; Henry V. Massey, 505 Chestnut street, Philadelphia, Pa.

Kalispell Water & Electric company, Kalispell, Mont.; capital stock, $250,000; acquiring water rights and storing and utilizing water for manufacturing, irrigating, mining and domestic purposes, operating electric power plants for lighting, heating, manufacturing purposes, operating electric telegraph, telephone and electric lighting plants, lines and systems; carrying on manufacturing, mining, mechanical and chemical business.

ELECTRIC LIGHTING.

Lafayette, Colo., is to have an electric light plant.

The villa e of Millis, Mass., recently celebrated the introduction of an electric lighting system.

The new Omaha Thomson-Houston Electric company has just put in two 50 arc light Thomson Houston machines for use in city lighting.

The new United States cruiser Marblehead is to be lighted with electricity throughout, and fitted with two search-light projectors of the latest and most approved Mangin type, including pedestals and a combination automatic and hand lamp for each, designed for eighty to ninety amperes of current.

The Pennsylvania Railroad company will improve the union passenger station at Canal and Adams streets, Chicago. A power house will be erected near the corner of Madison and Canal streets. It will contain the power plant for operating the elevators in the station, and also the plant for lighting the buildings and grounds by electricity.

The much talked of Mt. Washington search light has not yet materialized. The main difficulty so far relates to securing the necessary power to generate the current. It will require a 40 horse power engine to do the work. It has been suggested that the difficulty be overcome by utilizing Ammonoosuc river at the base of the mountain. This could be done, but it would necessitate an expenditure of upward of $3,000 for wire to convey the current to the summit.

In discussing the question of street lighting City Electrician Fairfield, of Nashville, Tenn., said at a recent council meeting that "an average of six cities per month are now putting in their own electric light plants as rapidly as their contracts with companies are expiring. More than 200 cities in Europe now own their own electric light plants." The authority for these statements was not given.

At the annual meeting of the California Electric Light company, which was recently held in San Francisco, the financial report showed that the company had made a net profit for the year of $68,202 62, including $64,716 which was received as dividends from the Edison Light & Power company, being the earnings of the latter company from its plant in San Francisco, not including the conduit system, beside $7,000 in profits from the sale of the plant at Yreka. The net assets of the company were stated as amounting to $730,495, including $663,680, which is the value or cost to the company of the stock of the Edison Light & Power company.

The Rochester Gas & Electric company is the name of the new concern incorporated at Rochester, N. Y., in which the gas and electric lighting interests of the city have consolidated. The capital stock is $4,300,000 and is divided among the companies as follows: Gas company, 20 500 shares, half common and half preferred stock; Edison company, 6,000 shares, half common and half preferred stock; Rochester Electric Light company, 4,000 shares, half common and half preferred stock. Twelve thousand five hundred shares of stock, half common and half preferred, is authorized to be issued by the directors to be used in the purchase of not less than two-thirds of the capital stock of the Brush Electric Light company on the basis of not more than five shares of stock of the consolidated company for each share of the Brush company. The officers of the corporation have been elected as follows: President, J. Lee Judson; first vice-president, William Runkle; second vice-president, Frederick Cook; treasurer, George W. Archer; assistant treasurer, H. G. Runkle; secretary, George C Hollister, assistant secretary, H. G. Runkle; attorney, W. H. Harris.

ELECTRIC RAILWAYS.

Electric street cars are now running in Hartford, Conn., from the city hall to East Hartford and Glastonbury.

Columbus, O., conductors and motormen have organized a union, and there may be a general strike for $2 a day.

The Dover, N. H., Electric Railway company uses storage batteries, conveniently installed in a small house, to help out the overhead current on steep grades.

The Coast Line railroad of Savannah, Ga., to be equipped with electricity, will hereafter be operated by the Savannah, Thunderbolt & Isle of Hope Railroad company. This company will also equip an electrical railroad from Thunderbolt to Sandfly.

The Buffalo, North Main street and Tonewanda, N. Y. electric railroad is to be completed by October 1st. The contract for grading has been let and work has been begun. The contract for the construction of the entire road of 5½ miles was awarded to the Field Engineering company at $100,000. The route is from Main street in Buffalo, at the poorhouse, along the Townline road to the intersection at the Eggertsville road, and thence along the Eggertsville road to that portion of the same thoroughfare known as Young street, and thence along Young street into the village of Tonawanda.

A meeting of property owners favorable to the construction of an electric street railroad on Ninety-fifth street in Chicago was held on August 2d. The main discussion was as to whether the proposed road should be built from Oak Lawn to Western avenue only, or to State street, a distance of six and one-half miles. It was finally determined to proceed with the road as far as Western avenue, on the understanding that the rest of the distance to State street would be covered in the future as a matter of necessity. A committee was appointed to ascertain the names of all property owners on Ninety-fifth street, and obtain consents for the right of way. It was claimed at the meeting that the right of way was already pledged for a sufficient distance to begin work at once. Another meeting will be held at an early date to complete the organization and build the road.

TELEGRAPH.

A cablegram from London states that Premier Dibbs of New South Wales has left London on his journey homeward. He will spend a few days in New York and go thence to Montreal and Ottawa. His object in visiting Canada is to sound prominent capitalists in the Dominion in regard to the plan of laying new cables between England and Canada, and the laying of a line between Vancouver and Australia.

In speaking of the interest taken in the recent British elections on this side of the water, *Electricity* of London says: The United Press received by cable from its London agents, the Central News, the result of every election immediately after the figures were announced by the returning officers; the names politics and votes polled being given in full, as in the London newspapers. The United Press also received daily from 1,000 to 2,000 words descriptive of the chief contests and explanatory of the general political situation as it varied from hour to hour and day to day. An election cable service of such extensive dimensions had never before been attempted. The cables used were those of the Commercial and Direct companies, and both performed their work without a hitch.

ELECTRIC MINING.

A survey is being made from the water power of the Champion mill near Idaho Springs, Colorado, for a pipe line to the Salisbury mill. The old stamp mill, at the mouth of Trail Run, will, in all probability, be torn down as it is of no further use. This will make a valuable power and can be utilized in running the mill hoister by electricity.

It is reported that Thomas Rickey is about to erect an electric power plant about twelve miles from Bodie, California, for the purpose of furnishing power to the Bodie mines and mills. The power will have to be conveyed about twelve miles. There is sufficient water power where the plant is to be erected to keep the mines and mills in operation the year around.

TELEPHONE.

It is said that a telephone service between Korat and Nong Khai, in Siam, a distance of 210 miles, has been established.

The Providence, R. I., Telephone company has perfected a plan for putting its wires underground at cost of from $200,000 to $300,000.

A dispatch from Peoria, Ill., dated July 31st, says: At 10 o'clock to-night a fire in the telephone exchange destroyed all the connections, and the city is without telephone service. The damage is so extensive that it will require several days to repair it.

Eighteen girls employed in the operating room of the Central Union Telephone company at Indianapolis quit work at noon on July 28th, and refused to answer any calls till the manager should discharge Miss Jennie Coodell, the chief operator. The girls claimed that they were subjected to a great many annoyances by Miss Condell. When the manager entered the office he found the girls sitting idly in the room and a dozen people in the office demanding that their telephones be looked after, as they had been calling for an hour and could get no answer. The manager questioned the strikers, and they demanded Miss Condell's discharge. Manager Cherry granted the demand, discharged the head operator and the girls returned to work.

MISCELLANEOUS.

Oakland, Cal., claims to have the best fire alarm telegraph system west of Chicago.

A special correspondent of the *Boston Daily Traveller* wrote a column account of the Westinghouse factory at Pittsburg for the issue of July 30th.

A branch of the National Brotherhood of Electrical Workers has been organized at Newark, N. J. It is expected that many of the employes of the Edison works will join.

A case has occurred in France which points to the importance of long and persistent treatment of persons struck by lightning. Two young women were prostrated by a lightning flash during a violent storm. They were taken to the village doctor, who treated them continously for two hours, when signs of returning life were seen, and early the next morning the consciousness of both returned. One was soon well, but the other was left with a profound sciatica. Her tongue was also paralyzed for two months, after which she also recovered.

In an article on electric fans the New York *Mail and Express* says: One of them placed on a butler's tray near a dinner table will make dining a positive luxury even on a day when the mercury dances up and down between 90 and 100. Placed by one's bedside, they will guarantee a night's rest that even the mountain breezes and zephyrs from the sea will sometimes fail to give. The servant can use them in the kitchen, the invalid in the sick chamber, the clergyman in his study; in fact, they are applicable to any and all places, and can be regulated to give much or little air.

There is a mechanical genius in town, says the *Memphis Commercial*, who set about cleaning his electric fan yesterday In some manner, in turning off the current from his fan, he threw the whole circuit out of gear, and the patrons of the Electric Light & Power company almost burned out the company's telephone, so rapidly did they follow each other in their inquiries about the stoppage of their fans. A man was started out to find the trouble, and after some fifty fans had been examined, the lineman came across the genius tinkering with his fan complacently, while every one else was working himself into a fever.

Mr. Cavanaugh, of Kent, Wash., believes that he has a scheme that will create destruction among fruit tree pests. He describes it as follows: "I have in mind an insect destroyer that I believe will work to perfection. If my orchard were larger I would try it at once. It is simply this. Conduct electricity from the Kent electric works to my orchard and have powerful lamps put in at an elevation of a few feet above the tops of the apple trees. Only a few would be needed per acre. Surmount each lamp or burner by a steel wire screen umbrella-shaped. At evening, in May, June and July, turn on the light. The bright light will attract the winged insects of all sorts. The wire screen should be charged with electricity, and the insects, flying against it as they naturally will, will be killed instantly."

A torpedo militia company for the United States Navy, to be composed exclusively of Thomson-Houston men, is being organized in the works at Lynn. The company will be composed of 58 officers and men, to serve for a term of three years. It will be drilled one evening in every week in one of the armories of the state militia in Lynn. Later on an armory especially for the company may be built. Every summer the company will have active duty on the water in

a five days' cruise on one of the naval vessels. A different cruise will be arranged every summer, and it will extend as far as the time limit will allow. The chief officials of the company have been consulted and have very generously consented to let the men off for the cruise every summer, providing too many are not drawn from any one department, paying them in full as though they had worked. The company will also be required to spend one day in the field every fall.

TRADE NEWS.

The Star Electric company of Philadelphia has removed its factory from Broad street to 1308 Filbert street.

Manager P. G. Fielder of the Boston Braid Manufacturing company of Boston was a visitor at the New York office of the WESTERN ELECTRICIAN last week.

Those interested in electricity should write the WESTERN ELECTRICIAN, 6 Lakeside building, Chicago, for a copy of the most complete catalogue of electrical books published. Chapter headings and tables of contents are given.

The Boston Braid Manufacturing company of Boston has now over 60 braiding machines in operation and is receiving many orders for silk braid for electrical purposes. Since the company's removal from 28 to 27 Beach street, it has been enabled to double its output.

The Riker Electric Motor company of Brooklyn is introducing quite a novelty in the way of fans for incandescent circuits. Placed at any desired height upon the side of the wall an iron cast base is screwed as a foundation for a swivel support upon which is mounted a $\frac{1}{6}$ horse power motor. The fan is of the 15 inch size. By this arrangement it may be set in any direction required.

The LaRoche Electrical company of Philadelphia is running its factory an average of 16 hours daily. Some of its recent installations include: Standard Theater, Philadelphia; Richard Hayes & Co., Berry, Orton & Co., W. P. Troth & Co., and the Standard Iron Foundry company, Philadelphia; Stephen F. Whitman & Sons, Philadelphia; Lake Bluff Hotel Park company, Lake Bluff, Ill.; Chas. C Hallowell, Hatboro, Pa.; C. C. Lockstaedt and J. F. McGrew, Chicago.

"A Modern Triumvirate" is the name of the handsome souvenir that has been issued by Bartlett & Co., New York. The "modern triumvirate" which this screed tells about is composed of three men who have formed a coalition and is known as Bartlett & Co., of New York. It is composed of an artist, an engraver, and a printer. In this little brochure they call themselves a "central station," and in the five chapters describe as well as illustrate the different departments and show the kind of work produced by this central station.

The Enterprise Electric company, Chicago, has opened a branch salesroom and agency at 15 N. Ninth street, St. Louis, in order to handle in a more satisfactory manner a rapidly increasing southern and southwestern trade. Mr. McKinlock is recognized as a pioneer in the electric supply business in St Louis, and his Chicago company has, very naturally, been able to do a very fine business in that city from the day of its inception. The business in St. Louis will be done in the name of the Chicago company, the Enterprise Electric company, with Wm. H. Ferris in charge as manager. Mr. Ferris has until recently held a prominent position with the Southern Electric supply company, St. Louis, and is well and favorably known to the trade.

BUSINESS.

The Rodney Hunt Machine company of Orange, Mass. reports the sales of a large number of water wheels to woolen, paper and cotton factories through the country, operated by water power. The company's new buildings, which will greatly increase the capacity of the works, will be completed shortly.

A correspondent of the Jos. Dixon Crucible company, Jersey City, N. J., says: "I have used handhole and manhole gaskets eight to ten times by carefully smearing the surface next boiler shell, taken out at periods of three to four weeks, using steam pressure as high as 100 pounds. In packing water glasses, by putting a little graphite and oil on the gasket, they would vulcanize as soft as lamp wick and retain their elasticity until the glass was changed, when the old rubber could be removed without trouble, while by the old way I have spent much time in digging out the rubber, baked hard as vulcanite. Another thing I used it for was, after putting back my handhole plate or plugs in back connection, I carefully brush away all the soot and ashes, then with a small brush paint a good coat of graphite over flange, stud and nuts. After running boiler from three to six months, and using coke for fuel, with forced draft, the nuts can be removed without trouble, as the heat has not been great enough to burn the lead."

The Ball Engine company, Erie, Pa., has shipped during the last three weeks the following: Compania Mexicana y Luz Electrica, City of Mexico, two 60 horse power engines, two 60 horse power heaters; Hot Springs Electric company, Hot Springs, Va., one 100 horse power engine, two 80 horse power boilers, one 200 horse power heater, one 200 horse power pump; Ames Bonner company, Toledo, O., one 80 horse power engine; Brooklyn Navy Yard, Brooklyn, N. Y., one 80 horse power engine; Arnold Ore Mines, Ferrona, N. Y., one 35 horse power engine; Northwestern Supply company, Tacoma, Wash., one 25 horse power engine; Carbon Iron company, Pittsburg, Pa., one 130 horse power engine; Diamond Light & Power company, Sheldon, Iowa, one 80 horse power engine; North Hudson County Railroad company, Hoboken, N. J., one 250 horse power engine; Puget Sound Pulp & Paper company, Everett, Wash., one 25 horse power engine; Pittsburg Iron & Steel Engineering company, Pittsburg, Pa., one 130 horse power engine; Whitman & Barnes Manufacturing company, Akron, one O., 80 horse power engine; Fort Clark Street Railway company, Peoria, Ill., one 130 horse power engine; Boulder Electric Light company, Boulder, Colo., one 100 horse power engine, one 100 horse power boiler, one 150 horse power pump; two 100 horse power heaters; Shamokin Electric Railway company, Shamokin, Pa., one 130 horse power engine; North Avenue Street Railway company, Baltimore, Md, two 130 horse power engines; Mt. Vernon Electric Light company, Mt. Vernon, O., one 150 horse power engine; H. F. Watson & Co., Erie, Pa., one 350 horse power cross compound engine; Rock Cut Clay company, Alfred Center, N. Y., one 60 horse power engine; Metropolitan Telephone building, New York City, one 60 horse power engine; La Gran Fundicion Nacional Mexicana, Monterey, Mexico, one 60 horse power engine.

ELECTRICAL PATENTS.

Issued August 2, 1892.

479,781. Process of Purifying Liquors. Courtland W. Brunson, Hamilton, O.

479,782. Mechanical Telegraph Instrument. Benjamin F. Butler, Logansport, Ind.

479,786. Galvanic Battery. Martin M. Clark, Chicago, Ill.

Means are provided whereby an exhausted cell may be replenished with fresh electrolyte without unsealing it.

479,791. Incandescent Lamp Guard. George W. Dimmick, Lynn, Mass.

479,793. Commutator. William B. Elkins, Cambridge, Mass.

479,795. Valve Controller. Charles L. Fortier, Milwaukee, Wis.

479,802. Brush Holder. Francis J. Haeseler, U. S. Navy.

479,804. Electro-magnet Bobbin. Edward B. Hatch and Charles A. Colton, Hartford, Conn.

The bobbin is provided with projecting flanges of partially vulcanized india rubber and asbestos composition.

479,809. Closed Conduit for Electric Railways. Edward H. Johnson, New York, N. Y.

479,814. Electrical Water Heater. Rankin Kennedy, Kilmarnock, Scotland.

One or more chambers or receptacles for containing liquid are provided with an iron core. A magnetizing coil surrounds the core and an alternating current is sent through the coil to heat the core.

479,821. Electric Switch. Andreas P. Lundberg, London, Eng.

479,828. Electric Steering Gear. Edgar H. Mumford, Detroit, Mich.

In this invention curved arms attached to the tiller of a vessel act as plungers for a pair of electro-magnets.

479,834. Device for Indicating Washouts in Railroad Beds. Jose O. y Espinosa, Mexico, Mex.

479,835. Storage Battery Plate, Harry G. Osburn, Chicago, Ill.

The electrode is a grid consisting of longitudinal webs, and the transverse ribs or bars are deflected alternately in opposite directions, and the active material is placed in the receptacles thus formed.

479,849. Thermostat. Thomas W. Shepherd, Peabody, Mass.

479,859. Telegraph Key. Albert F. Tucker, Auburndale, Mass.

479,886. Electric Current Regulator. Alvaro S. Krotz, Defiance, O.

A solenoid is included in a shunt circuit and devices are connected with the core of the solenoid and vary the strength of the current in the main circuit, while electrically operating devices are included in the main circuit for controlling the operation of the solenoid.

479,887. Galvanic Battery. Felix de Lalande, Paris, France.

479,891. Mold for the Manufacture of Electrical Switchboards. John B. Lyon, Brooklyn, N. Y.

479,928. Electric Signaling Apparatus. Adoniram J. Wilson, Port Chester, N. Y.

479,932. Electric Meter. Lucien V. Brillie, Paris, France.

The meter consists of an electro-dynamometer, an electromotor, a retarder consisting of two relatively movable members, one connected to the dynamometer to be oscillated thereby, and the other connected to the motor to be rotated thereby, and a current regulator for controlling the motor operated by the dynamometer.

477,941. Influence Generator of Electricity. William Henry, Detroit, Mich.

A group of insulated metallic sectors is electrified to form positive and negative inductors, and another group is adapted to move in inductive relation to the first to produce a continuous current by static induction.

479,948. Reciprocating Electric Drill. Frank F. Loomis, Akron, O.

Two duplex wound solenoids are arranged in alignment; one wire of each is connected with the direct and return circuits of a dynamo, and the second wires of each are connected with branches from the direct and return circuits, and a circuit breaker is interposed in the branch direct circuit and arranged to alternately connect the wires therewith.

479,949. Electric Switch. Frank F. Loomis, Akron, O.

The switch comprises a tank and a revolving non-conducting cylinder partially covered with a conducting plate and brushes arranged to rest on the cylinder, and an acid metallic solution in the tank.

479,950. Fire Alarm Telegraph Indicator. Frank F. Loomis, Akron, O.

479,951. Pulsating Current Generator. Harry N. Marvin, Schenectady, N. Y.

Bearing brushes or blocks are adapted to rotate about the commutator, and means are provided for establishing connection alternately between the brushes to excite two circuits.

479,960. Controlling Mechanism for Reciprocating Electric Engines. Charles J. Van Depoele, Lynn, Mass.

The invention comprises a reciprocating electric engine, comprising a magnetic piston and motor coils for imparting motion to the same, the coils being excited by alternating currents.

479,961. Feed Mechanism for Electric Reciprocating Engines. Charles J. Van Depoele, Lynn, Mass.

479,962. Reciprocating Electric Engine. Charles J. Van Depoele, Lynn, Mass.

A sectional commutator is provided at the generator, and means are provided for dividing the current of the generator; two separate and independent circuits extend between the generator and the engine, each including part of the coils of the engine, and the divided current is directed into these circuits.

479,963. System of Supplying Currents to Reciprocating Electric Engines. Charles J. Van Depoele, Lynn, Mass.

The engine utilizes currents of constant direction for magnetizing the plunger and alternating currents to energize coils to react upon the constant polarity of the iron parts.

479,964. System of Distributing Electric Currents. Charles J. Van Depoele, Lynn, Mass.

A brush bears upon the commutator at the negative neutral point and two other diametrically opposite brushes are adapted to be rotated about the commutator; by making the proper connections between the conductors leading from these brushes pulsating currents of continuous or alternating direction may be obtained.

479,965. Reciprocating Eclectric Pile Driver. Charles J. Van Depoele, Lynn, Mass.

479,966. Electrical Transmission of Power. Charles J. Van Depoele, Lynn, Mass.

479,994. Spark Arrester for Electric Arc Lamps. Charles Smallwood, Birmingham, Ala.

480,004. Electric Railway. Charles H. Baker, Lake Geneva, Wis.

480,009. Safety Cut-out. Rudolph Furgang, Boston, Mass.

480,011. Insulator. John J. Green, Boonton, N. J.

480,033. Method of Preparing Battery Solution. Edward Poppourtsch, Brooklyn, N. Y.

480,038. Testing Apparatus for Electric Lighting Circuits. Charles H. Rudd, Evanston, Ill.

A ground testing apparatus employs the principle of the Wheatstone bridge, in which the four sides are respectively: From one dynamo terminal through the lamps to the ground to be detected; from second terminal to the same ground through remaining lamps; from first terminal to a plug in a resistance box; from second terminal to the same plug through the remaining resistance of the box; while the diagonal limb contains the dynamo and the other a galvanometer in a grounded branch from the plug.

480,049. Field Magnet Frame for Dynamo-electric Machines. Ernest P. Werner, Chicago, Ill.

In this frame the support is brought near the armature shaft by extending the field magnet cores downward below the support so as to be enclosed within the framework of the sliding carriage upon which the frame is supported

480,050. Duplex Arc Lamp. Ernest P. Werner, Chicago, Ill.

A unitary electro-magnetic device controls the carbons and a polarized electro-magnetic switching device is adapted upon the reversal of the current to transfer the arc from one pair of carbons to the other.

480,073 Train Order Annunciator. Leonard T. Crabtree, Embarrass, Wis.

480,099. Electric Jail Plate. William S. Hull, Sheffield, Ia.

480,100. Electric Screen for Doors or Windows. William S. Hull, Sheffield, Ala.

480,147. Automatic Device for Electric Block Signals. Joseph B. Stewart, Haverstraw, N. Y.

480,039. Device for Measuring Electrical Currents. Charles H. Rudd, Evanston, Ill.

The device embodies two concentric coils, one conveying the current to be measured and the other containing a telephone receiver in circuit; one of the coils is rotatable, and when moved to such an angle that no sound appears in the telephone the tangent of the angle between the planes of the coils gives a measure of the strength of the current flowing.

480,051. Rheostat. Charles W. Tobey, New Bedford, Mass.

480,152. Electric Cord Tip. Charles W. Tobey, New Bedford, Mass.

480,201. Reflector. Charles A. Meadows, Yonkers, N. Y.

480,240. Trolley for Electric Cars. George E. Purple and Charles W. Purple, Minneapolis, Minn.

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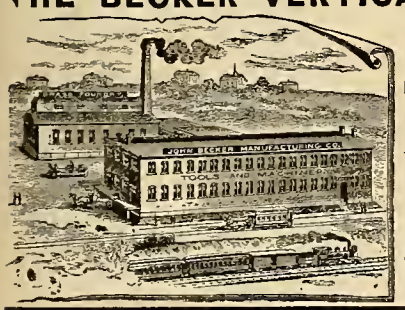

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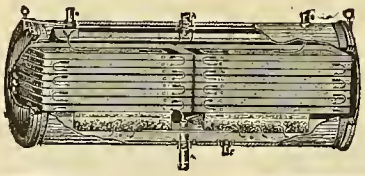

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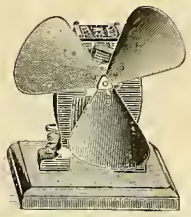

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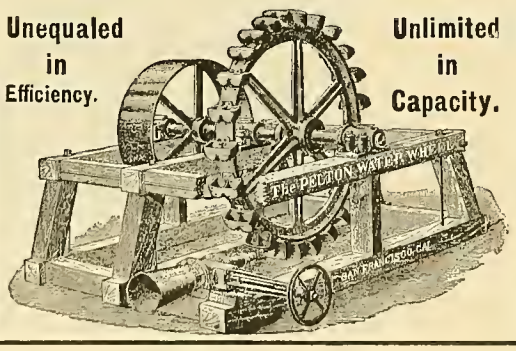

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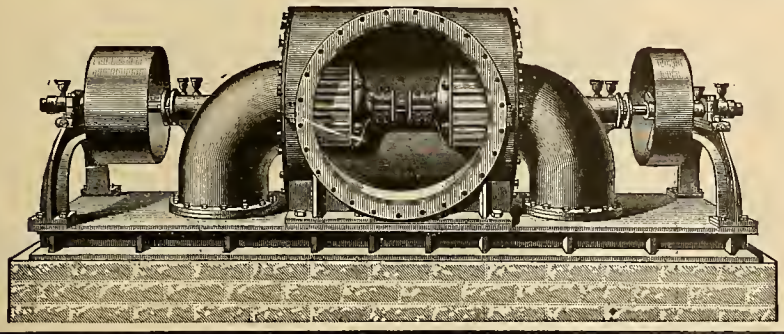

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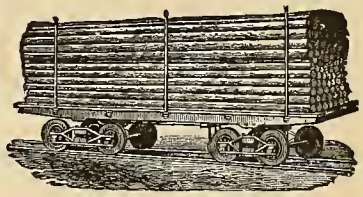

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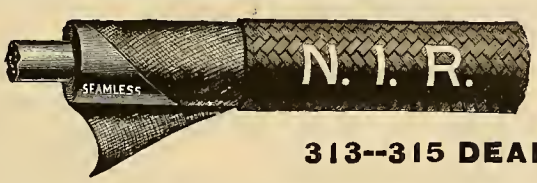

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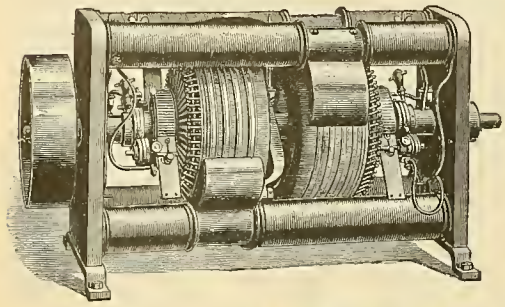

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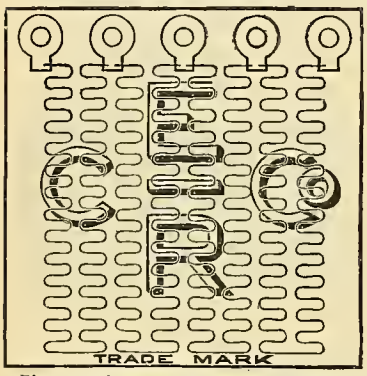

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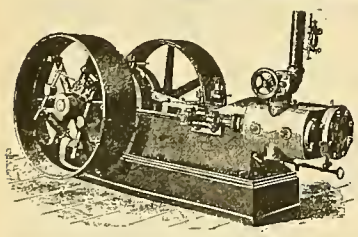

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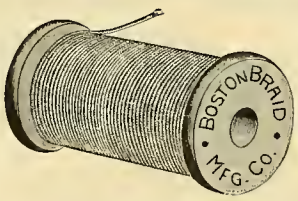

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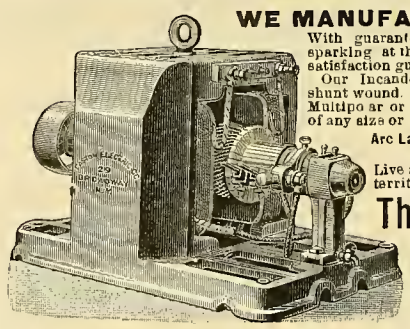

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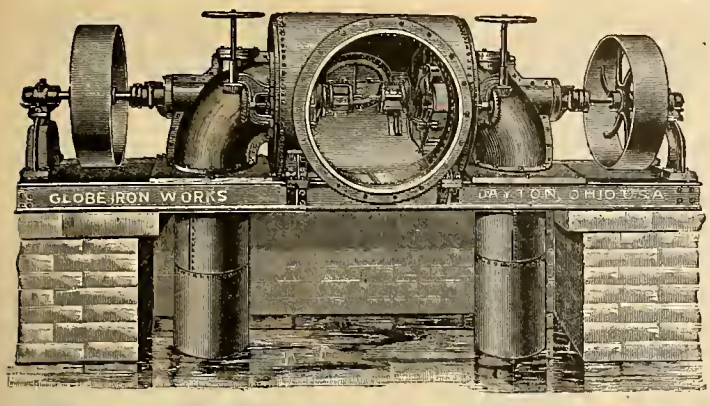

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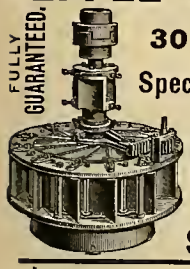

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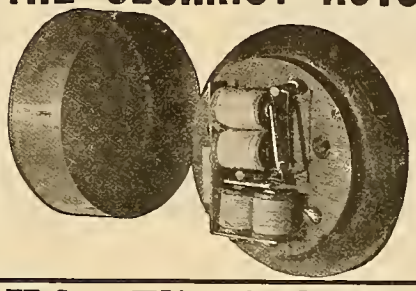

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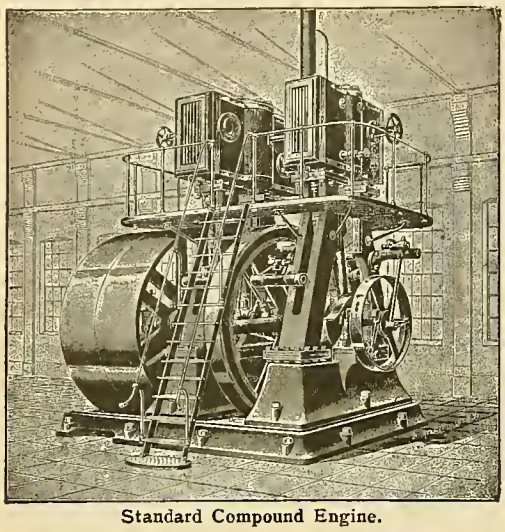

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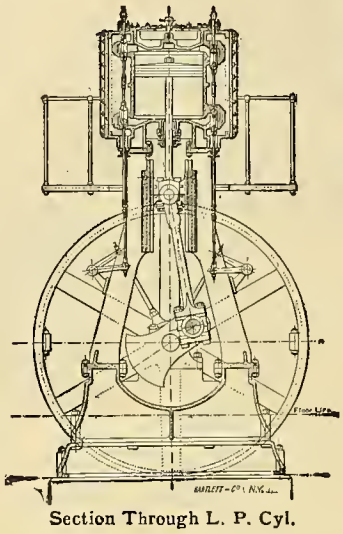

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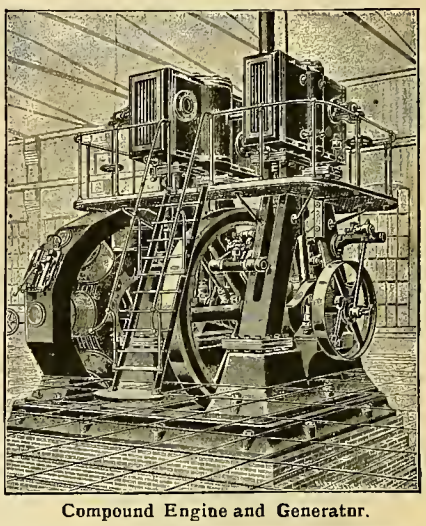

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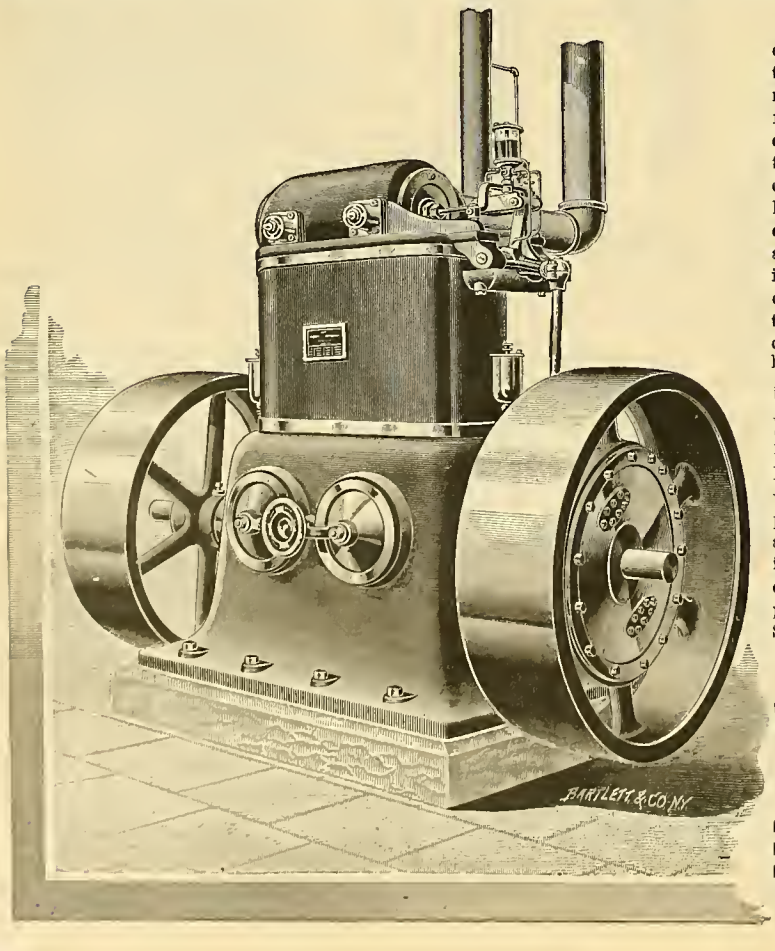

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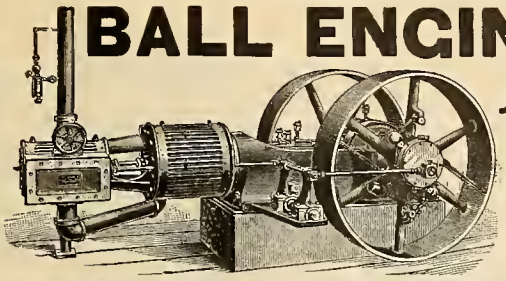

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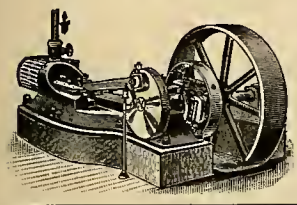

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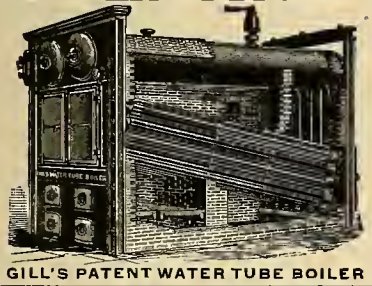

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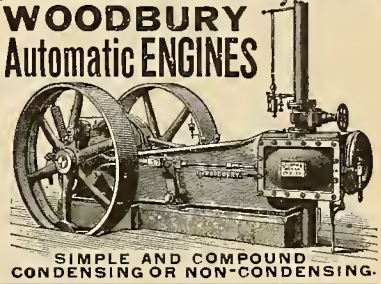

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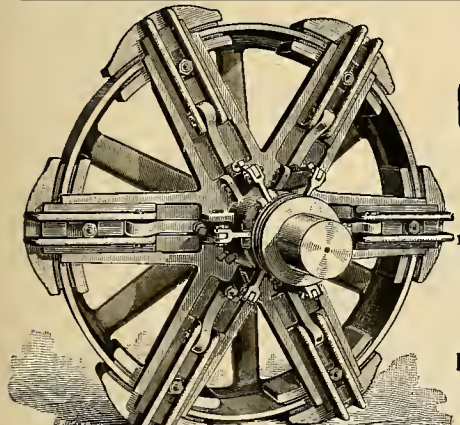

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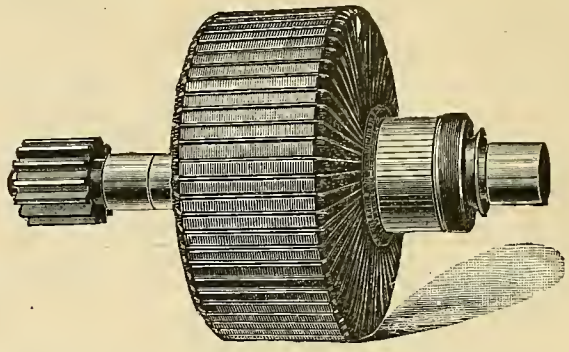

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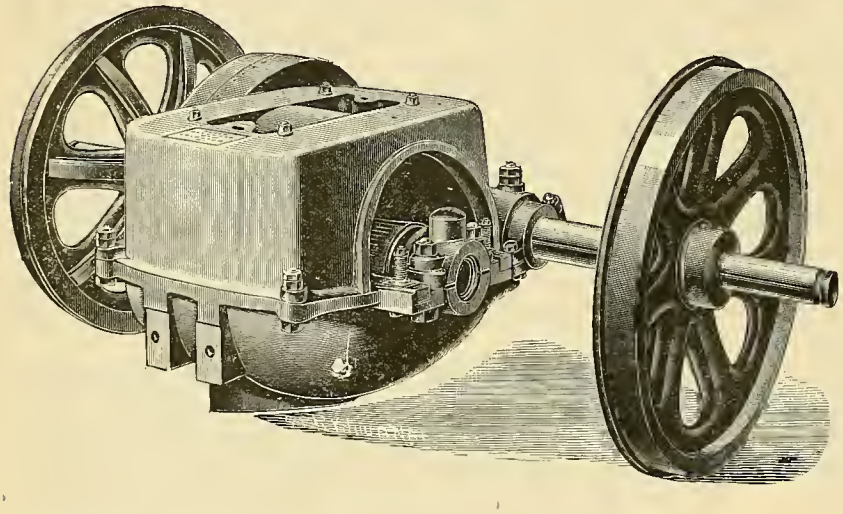

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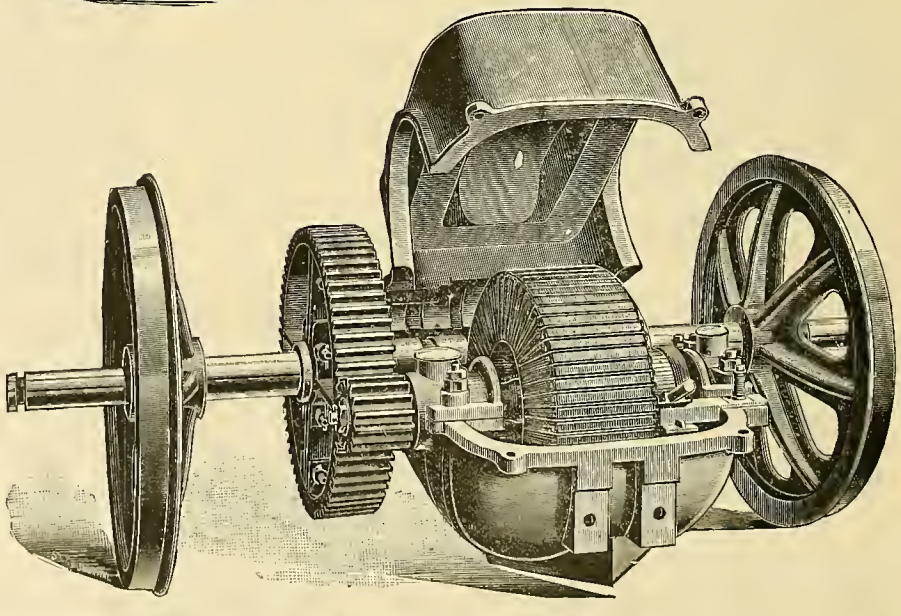

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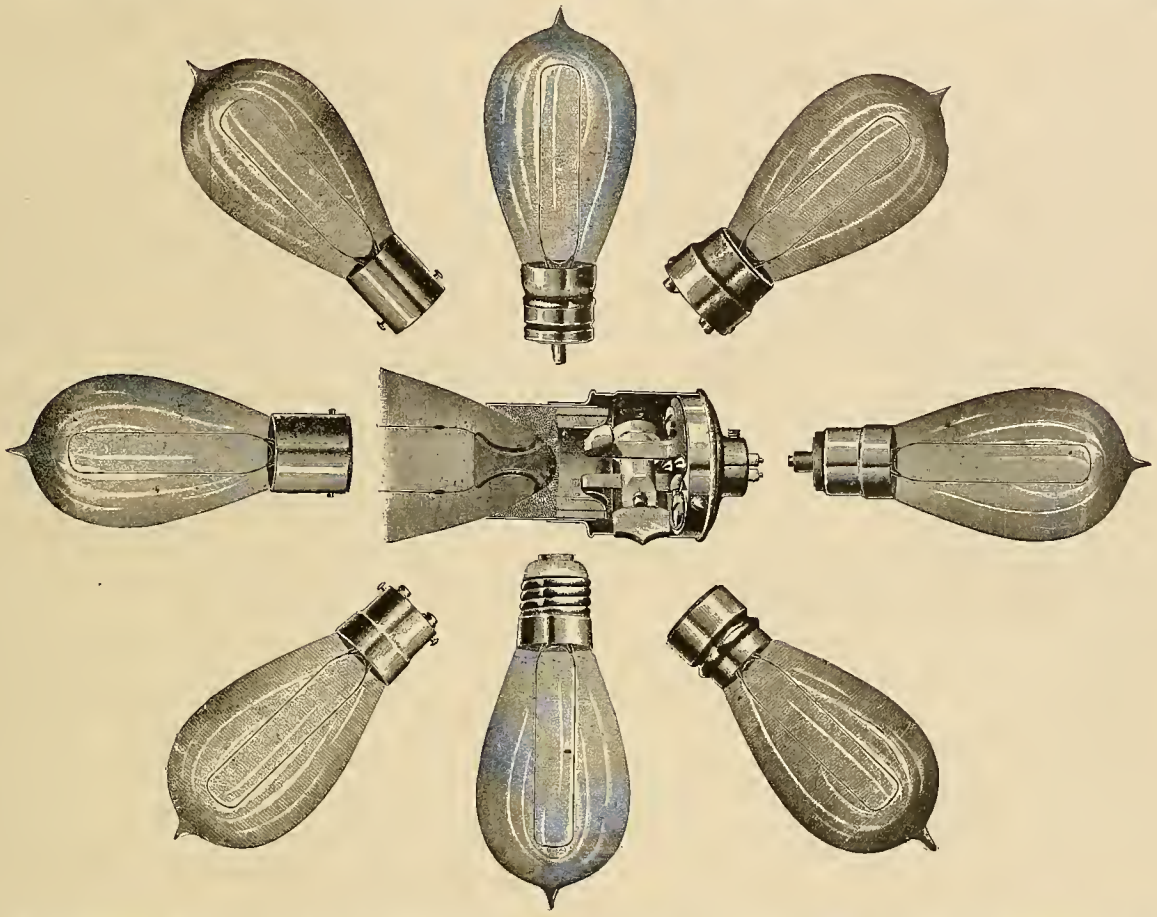

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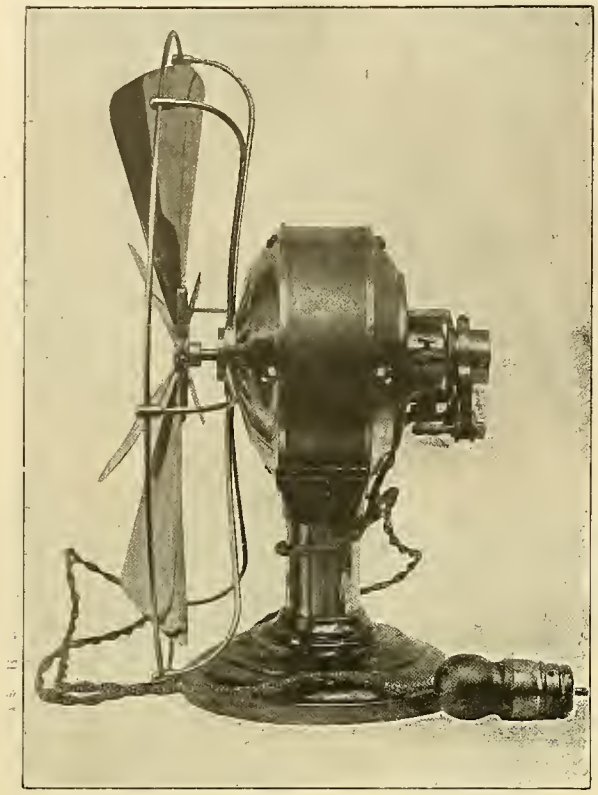

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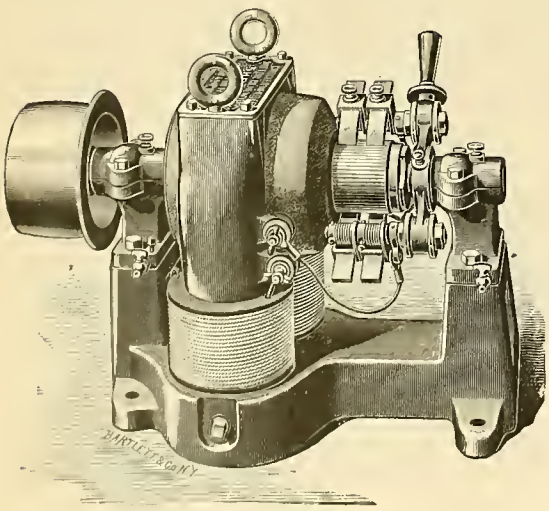

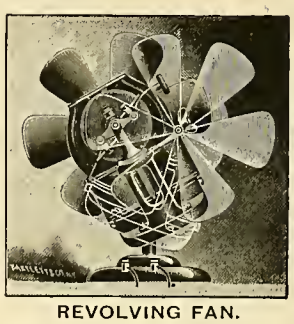

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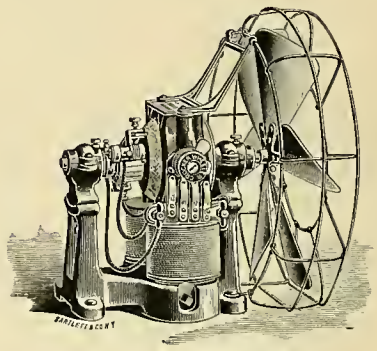

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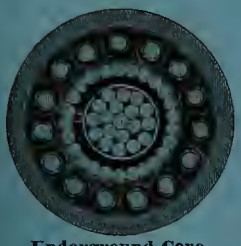
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Underground Core, N. J. Central R. R.

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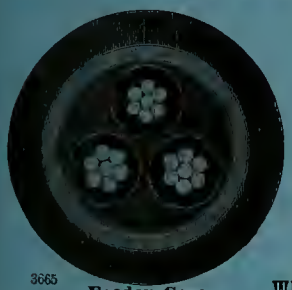
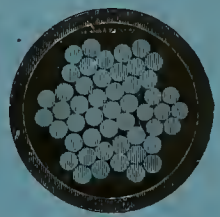

3665 Feeder Core.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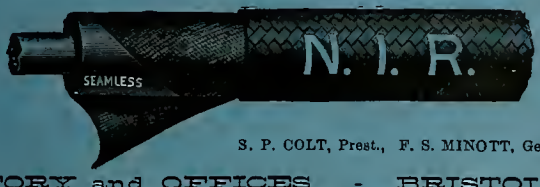

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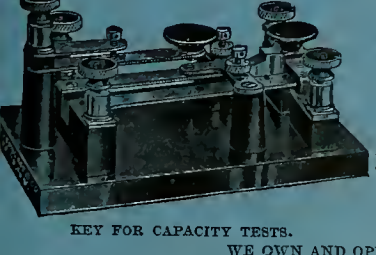

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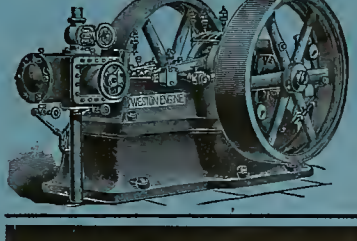

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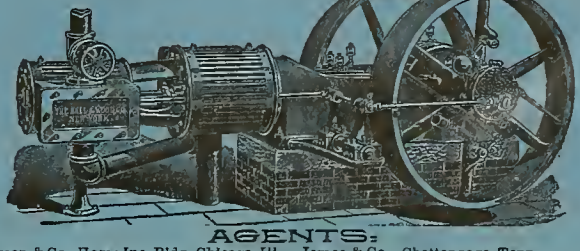

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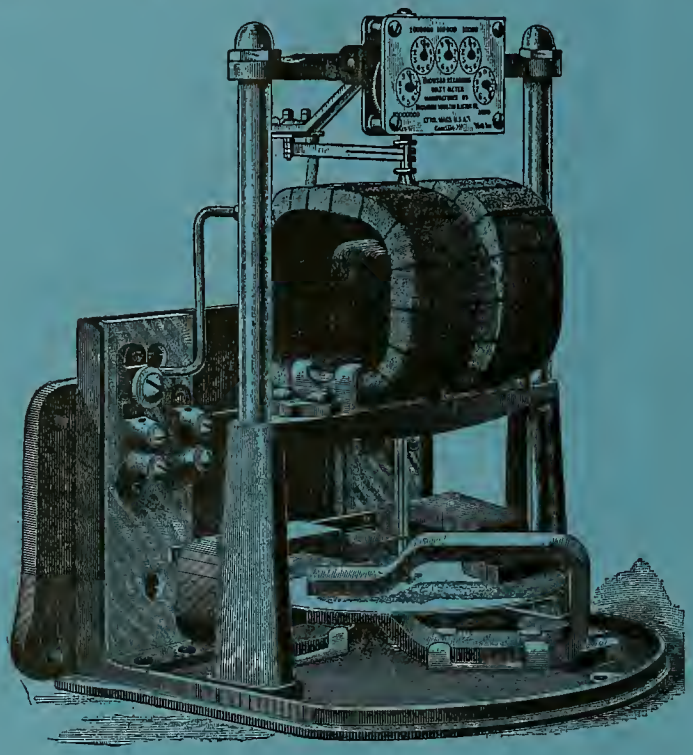

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(Signed) Chas. M. Allen, Supt.

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(Signed) E. F. Cooley, Supt.

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PRINCIPAL OFFICE,
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INDEX AND CLASSIFICATION OF ADVERTISEMENTS.

ALPHABETICAL LIST.

American Battery Co..... ix
American Desk & Seating Co..—
American District Steam Co.... xvi
American Engine Co..... xii
Andrae, Julius..... xii
Andrews & Co., A. H..... xiv
Babcock & Wilcox Co., The.... i
Baggot, E xiv
Ball Electric Light Co..... ix
Ball Engine Co.....xix
Ball & Wood Co., The 1
Beacon Vacuum Pump & Elec. Co.i
Becker Mfg. Co., John.....—
Beggs, J. E., Mch. & Supply Co. x
Bernstein Electric Co..... ..iv, xiii
Boston Braid Mfg. Co..... xvi
Bowers Bros..... xvi
Bridgeport Mach. Tool Wks... xii
Bristols' Mfg. Co..... .. i
Brookfield, Wm..... xii
Brush Electric Co viii
Bryan, W. H..... i
Bryant Electric Co.....—
Buckeye Electric Co., The..... ix
Butler Hard Rubber Co..... vi
Carpenter Enamel Rheostat Co. xvi
Central Electric Co..... ... v
Chicago Electric Motor Co.....—
Chicago Rawhide Mfg. Co..... xix
Crescent Ins. Wire & Cable Co. xiii
Crocker-Wheeler Electric Co.. xiii
Cushing, F. W..... vii
Cutter, Geo.....
Cutter Electrical & Mfg. Co... xvi
Dayton Globe Iron Works Co..xvii
Densmore Typewriter Co.....—
Detroit Electrical Works..... xxiv
Diamond Electric Mfg. Co....—
Dixon Crucible Co., Jos..... xix
Dudley & Co., W. W..... xvi
Duplex Electric Co., Ltd..... xii
Eastern Electric Cable Co..... xiii
Easton Electric Co..... .....—
Eastman Kodak Co..... xiv
Edison General Electric Co.....viii
Electric Cons. & Supply Co... vi
Electric Engr'g & Supply Co .. ix
Electric Mfg. Co., The..... iv
Electric Secret Service Co..... x
Electrician Pub. Co..... .....—
Electrical Construction Co.,The.xiii
Electrical Supply Co., The... xxii
Elektron Mfg. Co.....—
Empire China Works..... x
Enterprise Electric Co..... xv
Falls Rivet & Machine Co..... ix
Ferracute Machine Co..... —
For Sale Advertisements... i, x, xiii
Fort Wayne Electric Co..... xxiv
General Electric Co..... ix
Gravity Purifier Co..... ....—
Greeley & Co., The E. S.....1
Gregory, Chas. E..... i
Hart & Hegeman Mfg. Co..... x
Heisler Electric Co..... xviii
Hill Clutch Works.....—
Hine Eliminator Co..... xii
Holmes, Booth & Haydens.... xiv
Illinois Electric Lamp Co..... xv
India Rubber & G. P. Ins. Co. xxiii
Institute of Technology..... xiii
Interior Conduit & Insulation Co. x
International Okonite Co..... i
Jewell Belting Co..... i
Johns Mfg. Co., H. W.....—
Kartavert Mfg Co..... xvi
Kelly Brothers xix
Knapp Electrical Works..... xxi
Lake, J. H. & D., Co .....—
Lake Erie Engineering Works.xviii
Lane & Bodley Co.....—
La Roche Electric Works..... xix
Leclanche Battery Co., The .. xvii
Lefmann, Julius xvii
Leffel, & Co., Jas xvii
Leonard & Co., H. W.....xvii
Link Belt Machinery Co..... xiv
Loud, H. M. & Sons Lumber Co. xiv
Lovell Mfg. Co., Ltd..... xiii
Mather Electric Co..... iv
Morse & Co., A. M..... .. xv
Munsell & Co., Eugene.....xiii
National Carbon Co..... xiv
National Electric Mfg. Co.... v
National India Rubber Co.... i
New York Insulated Wire Co. xv
N. Y. Safety Steam Power Co. x
New York & Ohio Co..... I
Ostrander & Co., W. R..... xiv
Page Belting Co.....—
Partrick & Carter Co..... xvi
Pearson & Co., W. B.....xviii
Pelton Water Wheel Co..... xiv
Perkins Elec. Switch Mfg. Co.—
Phoenix Glass Co.....—
Pioneer Armature Co.....xiii
Porter-Leavitt Elec. Motor Co.—
Queen & Co..... xiii
Racine Hardware Mfg. Co..... xii
Railway Equipment Co..... x
Ries Electric Specialty Co..... x
Roebling's Sons Co , J. A ....—
Rose Elec. Light Supply Co...—
Royal Electric Co..... xi
Samson Cordage Works..... xii
Sawyer-Man Electric Co..... xi
Schuyler Electric Co.....xviii
Sechrist, Albert..... xvii
Shultz Belting Co.....—
Siebert, G..... xiii
Siemens & Halske Electric Co. xiii
Sioux City Elec. Supply Co., xiv
Sioux City Engine Works.... xix
Smith, A. T..... xv
Smith, Thos. G. Jr..... xix
Somoff, J. L..... xv
Sperry Elec. Mining Mach. Co. xvi
Standard Electric Co..... vi
Standard Paint Co xvi
Stanley Electric Mfg. Co.....—
Star Electrlx Co... xv
Stearns Mfg. Co..... xix
Sterling, W. C..... xv
Stilwell & Bierce Mfg. Co. xiv, xv
Sunbeam Incand. Lamp Co...xxiii
Taylor Engine Co..... x
Thomson-Houston Elec. Co.. ii, xx
Union Hardware Co..... xii
U. S. Electric Lighting Co.. xi
Utica Elec. Mfg. & Supply Co. x
Van Nuis C. S.....—
Vulcanized Fibre Co..... xv
Waddell-Entz Company..... xii
Wannopee Pottery Co..... xix
Want Advertisements..... xiii
Western Electric Co.....xiv
Westinghouse, Church, Kerr & Co..... xvii
Westinghouse Elec. and Mfg Co —
Weston Engine Co..... i
Woodhouse & Rawson, Ltd....—
Worthington, Henry R.....—

CLASSIFIED LIST.

Annunciators.
Central Electric Co.
Detroit Electrical Works.
Electrical Supply Co., The.
Knapp Electrical Works.
Ostrander & Co., W. R.
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Central Electric Co.
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Lake Erie Engineering Works.
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La Roche Electric Works.
Lefmann, Julius.
Leonard & Co., H. W.
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Detroit Electrical Works.
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Electrical Supply Co., The.
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Knapp Electrical Works.
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Sperry Elec. Mining Machine Co.
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Central Electric Co.
Detroit Electrical Works.
Electrical Supply Co., The.
Lefmann, Julius.
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Andrae, Julius.
Bryant Electric Co.
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Cutter, Geo.
Cutter Electrical & Mfg. Co.
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Electrical Supply Co., The.
Enterprise Electric Co.
Hart & Hegeman Mfg. Co., The.
Knapp Electrical Works.
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Dynamos.
Ball Electric Light Co.
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Detroit Electrical Works.
Diamond Electric Mfg. Co.
Duplex Electric Co., Ltd.
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Andrae, Julius.
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Cutter Electrical & Mfg. Co.
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Ries Electric Specialty Co , The.
Utica Elec. Mfg. & Supply Co.

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Detroit Electrical Works.
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General Electrical Supplies.
Andrae, Julius.
Beacon Vacuum Pump & Elec. Co.
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Cutter Electrical & Mfg. Co.
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Brookfield, Wm.
Bryant Electric Co.
Cushing, F. W.
Edison General Electric Co.
Electric Engineering & Supply Co.
Electrical Supply Co., The.
Empire China Works.
Enterprise Electric Co.
Hart & Hegeman Mfg. Co.
Interior Conduit & Insulation Co.
International Okonite Co., The.
Johns Mfg. Co., H. W.
Kartavert Mfg. Co.
Lefmann, Julius.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Standard Paint Co.
Utica Elec. Mfg. & Supply Co.
Vulcanized Fibre Co.
Wannopee Pottery Co.
Western Electric Co.

Insulated Wires and Cables. Magnet Wire.
Central Electric Co.
Crescent Ins. Wire & Cable Co.
Cushing, F. W.
Cutter, Geo.
Detroit Electrical Works.
Eastern Electric Cable Co.
Edison General Electric Co.
Electrical Supply Co., The.
Enterprise Electric Co.
Holmes, Booth & Haydens.
International Okonite Co., The.
India Rubber & Gutta Percha Insulating Co.
Knapp Electrical Works.
National India Rubber Co.
New York Insulated Wire Co.
Roebling's Sons Co., J. A.
Sperry Elec. Mining Machine Co.
Waddell-Entz Company.
Western Electric Co.

Lamps, Incandescent.
Beacon Vacuum Pump & Elec. Co.
Bernstein Electric Co.
Buckeye Electric Co.
Central Electric Co.
Cutter Electrical & Mfg. Co.
Edison General Electric Co.
Electric Manufacturing Co., The.
Electrical Supply Co., The.
Illinois Electric Lamp Co.
Knapp Electrical Works.
New York and Ohio Co.
Sawyer-Man Electric Co.
Somoff, J. L.
Sunbeam Incandescent Lamp Co.
Thomson-Houston Electric Co.

Lathes.
Bridgeport Machine Tool Works.

Lightning Arresters.
Van Nuis, C. S.

Magnet Wire.
(See Insulated Wires.)

Mechanical Machinery.
Ferracute Machine Co.

Medical Batteries.
Detroit Electrical Works.
Partrick & Carter Co.

Mica.
Bowers Bros.
Johns Mfg. Co., H. W.
Munsell & Co., Eugene.

Mine Signals, Electric.
Detroit Electrical Works.

Mining Apparatus, Electric.
Edison General Electric Co.
Thomson-Houston Electric Co.
Sperry Elec. Mining Machine Co.
Westinghouse Electric & Mfg. Co.

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Brush Electric Co.
Crocker-Wheeler Electric Co.
Chicago Electric Motor Co.
Detroit Electrical Works.
Easton Electric Co.
Edison General Electric Co.
General Electric Co.
La Roche Electric Works.
Lovell Mfg. Co., Ltd.
Mather Electric Co.
Porter-Leavitt Electric Motor Co.
Royal Electric Co.
Siemens & Halske Electric Co.
Thomson-Houston Electric Co.
Waddell-Entz Company.
Westinghouse Electric & Mfg Co.

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American Desk & Seating Co.
Andrews & Co., A. H.

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Gravity Purifier Co.

Pins and Brackets.
Central Electric Co.
Electrical Supply Co., The.
Lefmann, Julius.
Loud, H. M. & Sons' Lumber Co.
Railway Equipment Co.
Western Electric Co.

Platinum.
Siebert, G.

Poles.
Electrical Supply Co., The.
Lefmann, Julius.
Loud, H. M. & Sons' Lumber Co.
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Porcelain.
Empire China Works.
Wannopee Pottery Co.

Publishers, Electrical.
Electrician Publishing Co.

Push Buttons.
Detroit Electrical Works.
Central Electric Co.
Electrical Supply Co., The.
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Detroit Electrical Works.
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Railway Equipment Co.

Tapes, Insulating.
Andrae, Julius.
Central Electric Co.
Cushing, F. W.
Crescent Ins. Wire & Cable Co.
Eastern Electric Cable Co.
Edison General Electric Co.
Electrical Supply Co., The.
India Rubber & Gutta Percha Insulating Co.
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Central Electric Co.
Electric Secret Service Co.
Electrical Supply Co., The.
Greeley & Co., The E. S.
Knapp Electrical Works.
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Detroit Electrical Works.
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Central Electric Co.
Electrical Supply Co., The.
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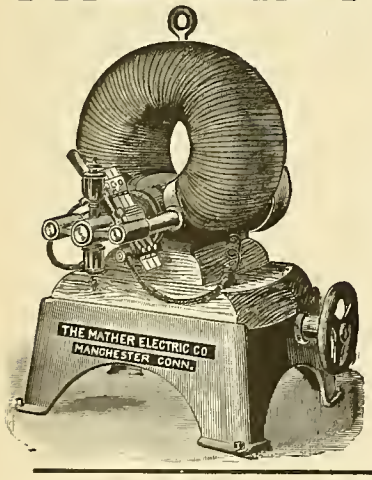

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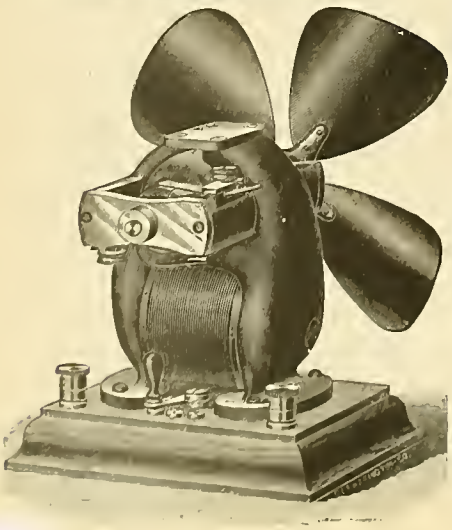

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When You Contemplate Purchasing Apparatus of Manufacturers Other Than the TRUST,

Do they threaten to enjoin you?
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Do they threaten to shut off your lamp supplies?
Do they threaten to put in an opposition plant?
Do they threaten to close us up?
Do they bring you a tale of woe concerning our apparatus?
Do they tell you about throwing out our apparatus, (not mentioning the fact that it is in stations where they have a controlling, or large interest)?
Do they ever tell you where we have replaced their apparatus, (where we have no interest)?
Do they ever try to sell their apparatus STRICTLY ON ITS MERITS?

It's all **"A COLD BLUFF."**

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It costs you nothing to have us bid against them, and you can save money by it.

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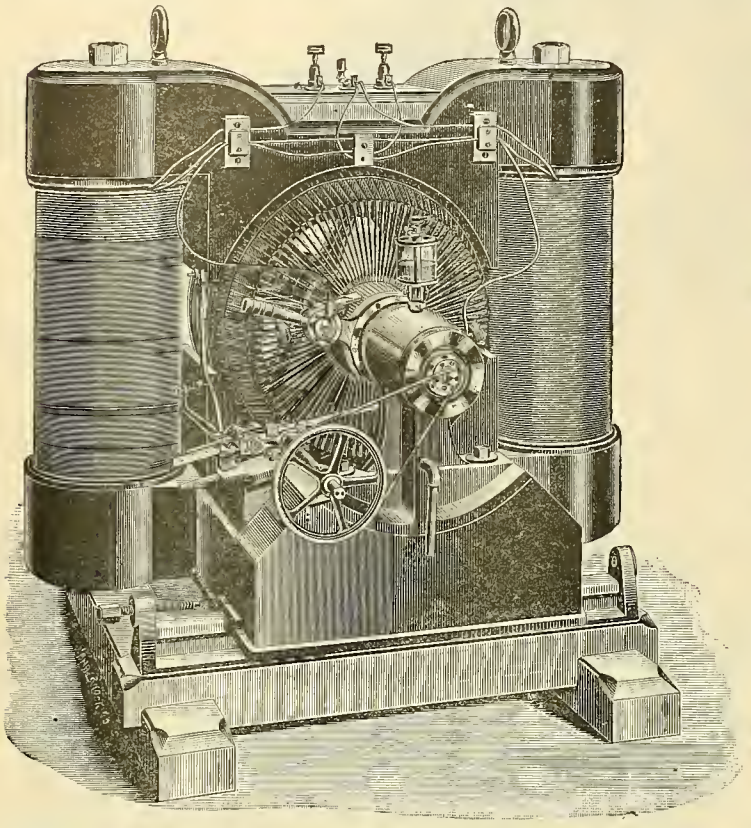

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We invite you to investigate. Get our prices before buying elsewhere, and

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Still remain the most satisfactory and cheapest in the market, unequaled for strength, durability, insulation and resistance to acids.

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The largest order ever given in this country for high grade insulated wire. The New York Central Railroad has just ordered

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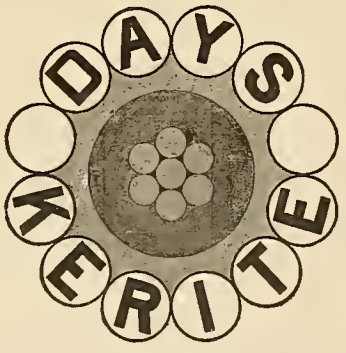

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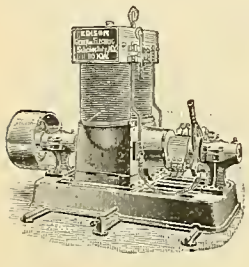

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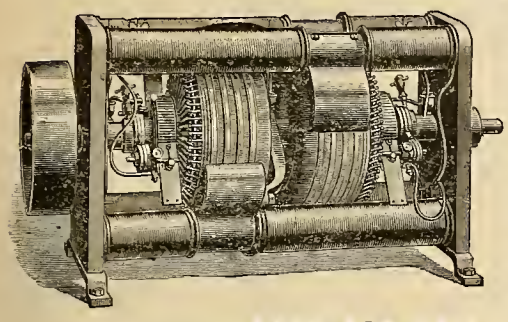
"IS NOT IN IT."



In what? In the preposterous **"Combine"** which has lately been formed to make legitimate business the cat's-paw of a stock-jobbing operation. The BALL ELECTRIC LIGHT COMPANY is opposed to any and every combination that seeks to do business upon other than a fair and straightforward basis. An enormous capitalization signifies excessive expenses and decreased dividends; and, invariably, the balance sheet must be against the public.

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BALL AUTOMATIC DYNAMO.

Beginning with the season now opening, we are placing on the market an AUTOMATIC DYNAMO. Do not think from this that we are offering in place of our celebrated dynamo any new and untried departure, or that we are offering our old dynamo with some external complicated mechanism called "an automatic regulator" of little merit save in name only.

We are placing the justly praised BALL **Dynamo**, as simple as of old, but containing **within itself** the power of self-action and adjustment to the varying conditions of the load that may be brought upon it.

The AUTOMATIC DYNAMO is as much superior to a dynamo with an automatic regulator as the modern automatic cut-off engine is superior to the old slide-valve with its external throttling governor.

We extend our thanks to our business rivals and their agents, who in the past have materially assisted us with the admissions that "the Ball was a good, or was the **best**, arc dynamo, **but it had no regulator**."

Its merits have been so generally recognized by the trade that it is not here for us to praise it now. We will only say that in the future, as in the past, we will have nothing in it to excuse or apologize for.

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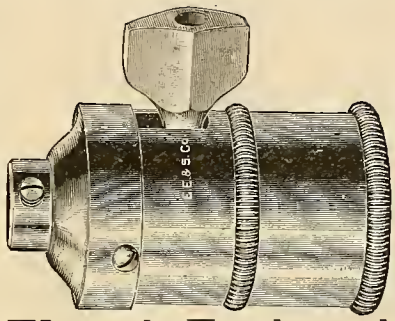

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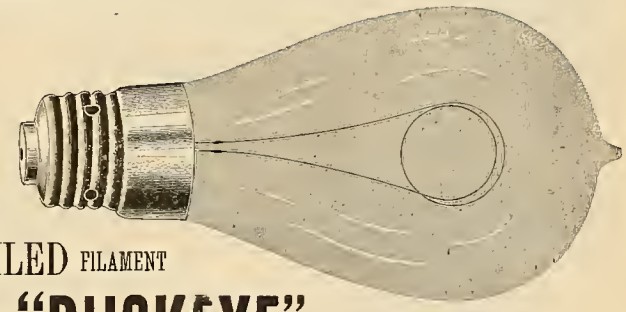

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of 90 volts and upward, can be placed at any angle, and in a life of **4,000** HOURS will not droop enough to touch the side of bulb, thereby destroying the lamp.

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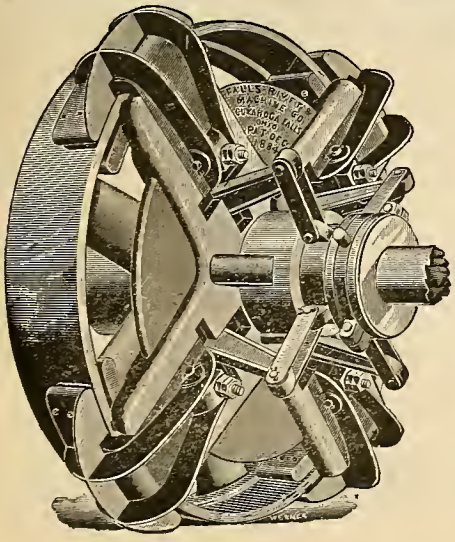

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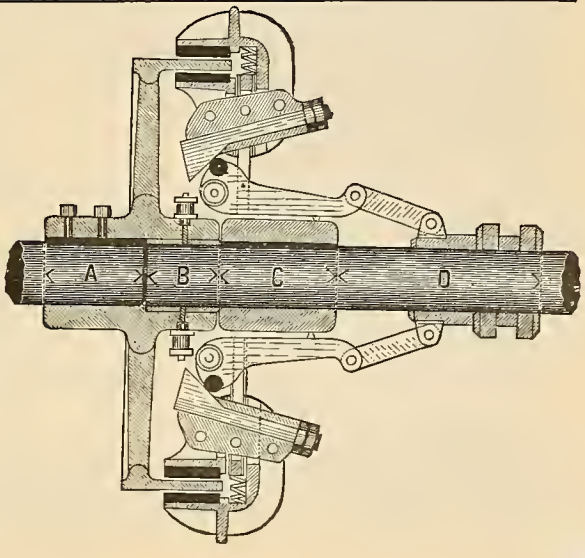

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FOR SALE CHEAP.

Two 300 Amp. Shuntwound U. S. Dynamos.
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Two 500 Lt. T. H. Dynamos, compound wound, with base, rheostat and ammeter.
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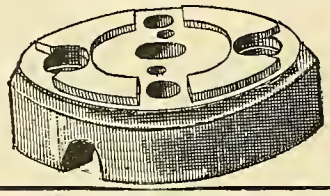
Our production is a dense body. The glazing and body of our ware are of same composition, and are baked alike, which are the features of True Hard Porcelain.



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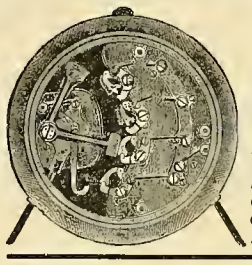

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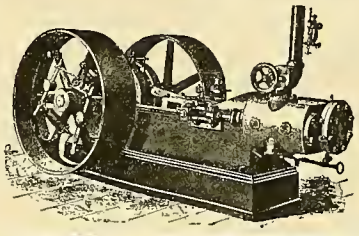

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Complete Steam Plants Installed.

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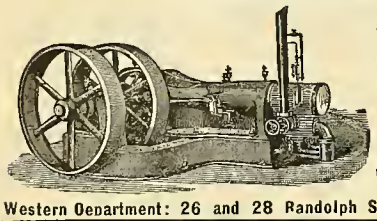

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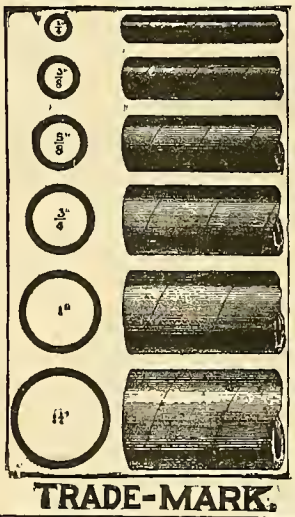

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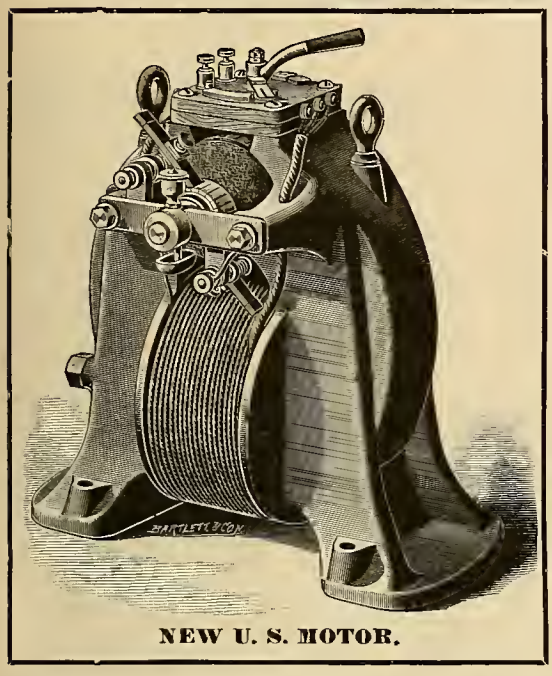

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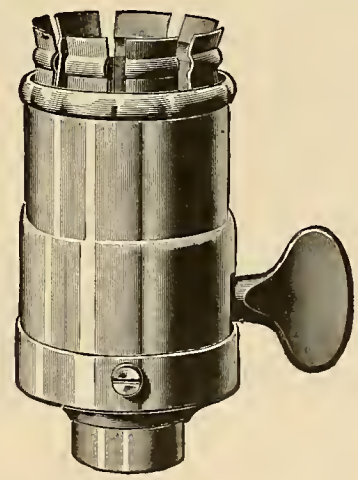

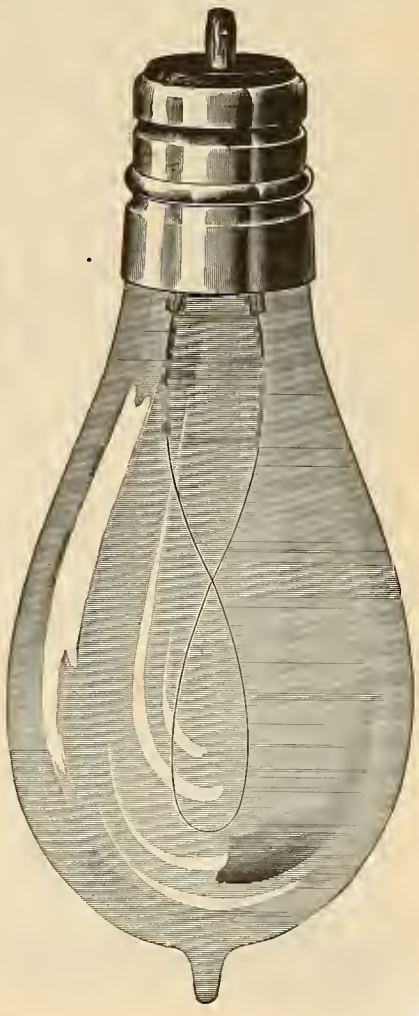

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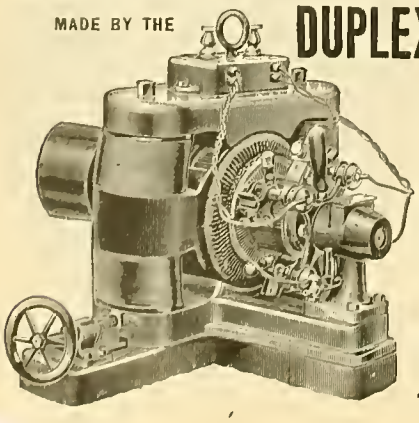

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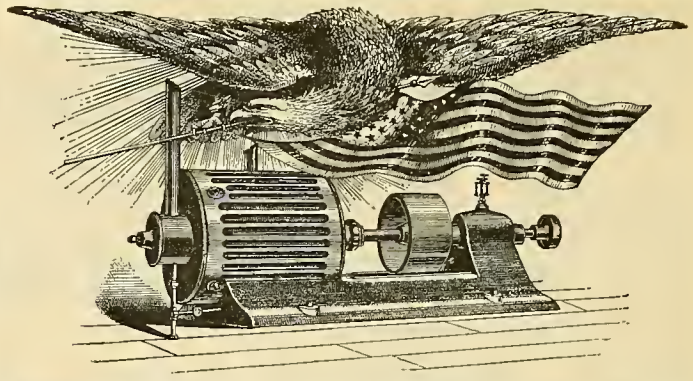

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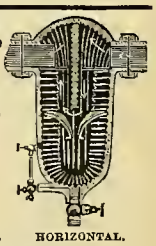

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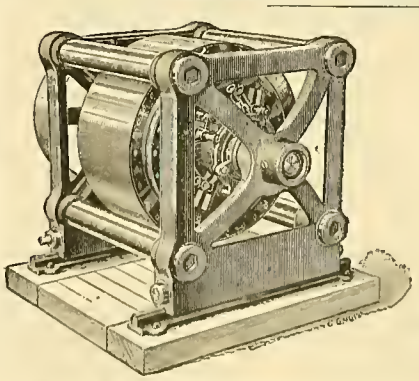

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MASSACHUSETTS INSTITUTE OF TECHNOLOGY. DEPARTMENT OF PHYSICS

The Electric Street Railway System of Little Rock, Ark.

It was in the early seventies that a street railway was first talked of in the city of Little Rock, Ark. At that time the city had a population of less than 10,000 people. Beyond the expressed desire of enterprising citizens to push their city to the front, nothing was done toward the practical realization of this desire until several years later, when the city had about 12,000 inhabitants. In January, 1877, John Cross and Chas. R. Diver, of Little Rock, and L. D. Cain, of Hot Springs, Ark., secured from the city council of Little Rock an ordinance authorizing the building of a street railway in the city through the most important streets. Only about two miles of track, however, was laid and operated, with small cars, and this system served the people for some years.

It was not until July 1, 1884, when the population had reached 25,000 and there was a demand for better service, that the city government closed a contract with the Little Rock Street Railway company, granting it the right to build a cross-town line.

Prominently identified with the new company were a number of the leading and most enterprising business men of Little Rock. The railways at the start were operated separately, but were at last operated under the same management. Three years later, as the city grew, there came a renewed demand for a more efficient service to open up the suburbs, which resulted in the granting of a franchise to the City Electric Street Railway company, the stock of which was owned largely by Philadelphia capitalists. This ordinance was passed December 6, 1887, and granted a perpetual franchise to the company with the right of way over valuable and important thoroughfares. This company immediately began operations and built about four miles of track over the western and southwestern part of the city to a point about a mile and a half beyond the city limits. The cars were propelled by steam dummy engines.

On April 1, 1890, H. G. Allis, president of the First National Bank of Little Rock, to whom the city, it may be said, is indebted for its present efficient electric street railway service, purchased a controlling interest in the Citizens' and Little Rock Street Railway companies and organized the Capital Street Railway company. On July 22d of the same year this company secured authority from the city council to propel its cars by electricity. A short time later Mr. Allis secured control of the City Electric Street Railway company, and the other lines were then leased to this company. The authority from the city government to lease these roads was obtained on February 16, 1891, and on the same date the Capital Street Railway company was granted additional rights.

In October, 1891, the company closed a contract with the Thomson-Houston Electric company to equip its lines for electric motive power, the local company building its own track and road-bed, under the superintendency of H. P. Bradford, general manager of the company. The Thomson-Houston company's contract work, consisting of the overhead construction and the installation of the electrical machinery, was supervised by E. E. Downs, one of the constructing engineers of that company.

FIG. 1. THE ELECTRIC STREET RAILWAY SYSTEM OF LITTLE ROCK, ARK.

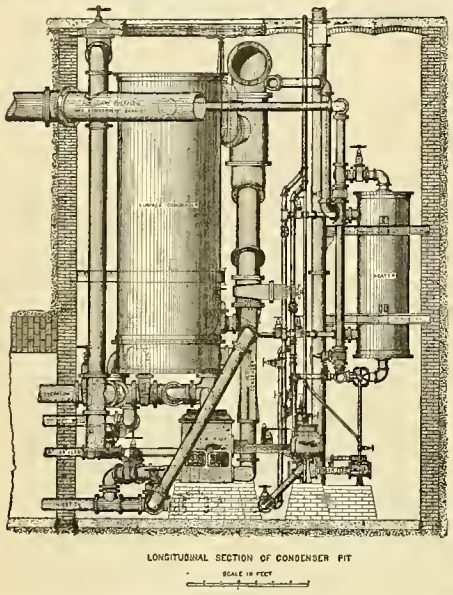
The engineering of the power station was placed in charge of B. J. Arnold, consulting engineer of the Chicago office of the Thomson-Houston Electric company, who designed the plant and superintended its construction. Mr. Arnold was assisted by Rickon & Thompson, architects, of Little Rock, to whom should be given the credit of the artistic front and details of the upper stories of the building.

The peculiar features of the Little Rock station distinguish it as a novelty in the line of electric power plant construction. The general idea of the building, extending up a hill side with the stories over-lapping each other, was suggested to the designer by the natural formation of the land. This construction appeared particularly advantageous, when it was taken into consideration that the level of the electric road to which the station was to furnish current was about 50 feet above the level of the steam railroad track from which the plant would receive its coal. After a personal inspection of this unique station it will be apparent to any practical railroad man that Mr. Arnold has adapted this plant to its peculiar situation in a manner that does credit to him for good engineering. A study of the plans, Figs. 2, 3, 4, 5, 9, 10, 11, will reveal that the designer's sole idea was to build a power station, taking every possible advantage of peculiarities in the site, that would not only operate at a minimum of running expenses and repairs but would stand hard service for years. Although most of the distinguishing features of the plant will be understood from the drawings, a few of the more important points should be referred to. It will be noticed that the line shafting is all set on top of the partitioning walls. This arrangement makes the walls serve a double purpose, and a most substantial foundation for the shafting is secured. Another good feature is the location of the car barn in the top of the power house on a level with the street. The utilization, too, of a short story in the structure under the car barn as a pit room permits the repairs and cleaning of cars to be made without switching; a washing pit under each track in the house is also a decided advantage. The placing of a summer theater on top of the power house and including the entire plant under one roof is another unique feature.

While the plans of the power station were being prepared the work of excavating for the foundations was done and the material was delivered for the construction of the track. The track laying was begun on the 3rd and the construction of the power house on the 15th of July, 1891. The work was pushed rapidly by the heads of the respective departments, and on the 22d day of November the trial trip was made in a blinding snow storm without accident or delay of any kind. On the following morning the road was formally and permanently opened for traffic, and it has been operated successfully up to the present date without an accident or delay of any kind that could be

attributed to imperfect construction of the power station or the electrical work.

During the period of 131 days that elapsed from the beginning of the construction work to the opening of the road, 32 days' work were lost on account of Sundays and rainy weather, leaving but 99 actual working days. During this time the entire system, about twenty miles of road, was either taken up and new rails and ties laid or the track narrowed from broad to standard guage, involving the use of about 1,400 poles, forty-one miles of No. 0 bare copper wire for trolley and return circuits, and 40,000 feet of No. 000 insulated wire for feeders. At the power station there were 1,000 cubic yards of solid slate excavated, over 1,000,000 brick laid, 330,000 feet of lumber erected on the structure, and 1,000 horse power of engines, boilers and condensing machinery put in place during this



LONGITUDINAL SECTION OF CONDENSER PIT

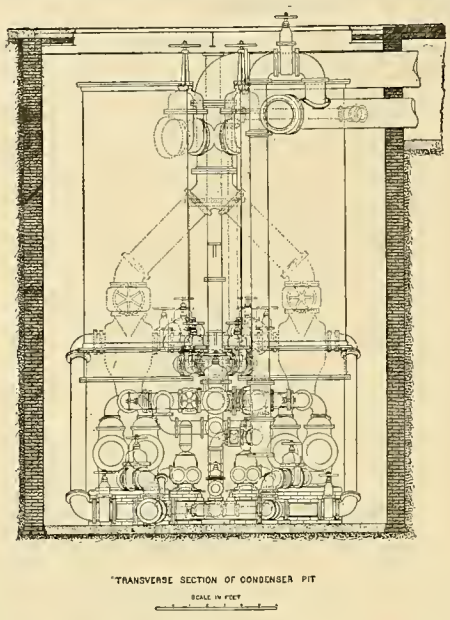
SCALE IN FEET

FIG. 2. THE ELECTRIC STREET RAILWAY SYSTEM OF LITTLE ROCK, ARK.

period. After the road had been started the front of the car barn and offices were completed as rapidly as possible.

To H. G. Allis, who owns the controlling interest, is due the credit of financiering the road and getting it to a practical completion.

The company is now operating twenty 30 horse power motor cars and six trailers and is doing it upon twelve tons of slack coal per day of twenty-four hours run, or less than one-half ton of slack coal per car per day. The cars are operated eighteen hours per day, but the small electric light engine, running eighteen arc lamps for lighting the car barns and summer theater, is run all night, and this fuel consumption is included in the above amount. There has been no thoroughly scientific test made as yet to ascertain the economy of the plant, but the above figures were taken from the coal bills themselves, showing the actual amount of coal purchased and consumed throughout a period of some months, so that practically they are of more value than a scientific test would be, as they show the actual consumption of the plant. These records, it should be stated, were taken before the steam piping had been covered or the live steam purifiers



TRANSVERSE SECTION OF CONDENSER PIT

SCALE IN FEET

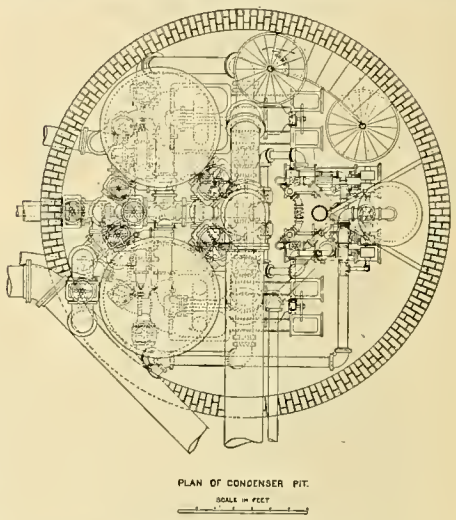
FIG. 3. THE ELECTRIC STREET RAILWAY SYSTEM OF LITTLE ROCK, ARK.

put in operation, so they do not show as great an economy in operation as the plant is capable of. From figures made during the short time the above improvements have been in operation, it is not unfair to believe that the plant is now driving its load on less than ten tons of slack coal per day, but it is not thought best to claim this economy until a longer period of time has elapsed and the present indications are verified.

There are in all about twenty miles of road now laid, Fig. 1. This track is for the most part of 35 pound steel T rail, while through the business portion of the city the lines are of 52 pound Johnson girder rails placed on chairs. The ties are spaced 2½ feet apart from center to center, and are mostly of sawed oak. There are in the system one double track and thirty-five single curves, six turn-outs and one cross-over.

The track is bonded throughout with No. 6 bond wire joined to the rails with the Wheeler channel pins. These bond wires are attached to a No. 0 copper ground wire running the entire length of the track and returning to the power station. To secure as perfect a ground as possible the ground wires are attached to old car wheels and other metal plates which are sunk in old wells and ravines at suitable intervals along the road. The return wires also are attached to the water pipes of the city wherever it is convenient. There are also heavy copper wires running from the switch board in the dynamo room to the Arkansas River, in the rear of the power house, where the terminals are attached to old car wheels sunk in the river. It will thus be noticed that the rail return circuit of the entire system is as thoroughly grounded as it was practicable to make it.

As to the overhead construction: There are about twenty miles of No. 0 hard drawn copper wire for the trolley wires in addition to about 40,000 feet of No. 000 insulated wire for feeders. The conductors are supported upon about 1,400 poles, 100 of which are of the Milliken latticed iron type, through the business portion of the city. Special insulators are used on the arms of the iron poles to prevent ordinary leakage, and also in cases where there is excessive strain caused by curves or turn-outs. The cross



PLAN OF CONDENSER PIT.

SCALE IN FEET

FIG. 4. THE ELECTRIC STREET RAILWAY SYSTEM OF LITTLE ROCK, ARK.

suspension method of overhead construction is used throughout and the poles set with a small amount of rake, so that when drawn up with the steel span wires they stand perfectly straight and in almost absolute line. The thoroughness of the electrical work will be appreciated when it is known that the first time the current was sent out over the line not a ground was discovered or any defect in the electrical construction noticed. This excellent showing, of course, redounds greatly to the credit of E. E. Downs, the contracting engineer.

The location of the power house, as before stated, was selected for its natural advantages. It is on the Arkansas River, on the site where formerly stood the water works, which supplied the city for a number of years. The wells formerly used had been abandoned, owing to the in

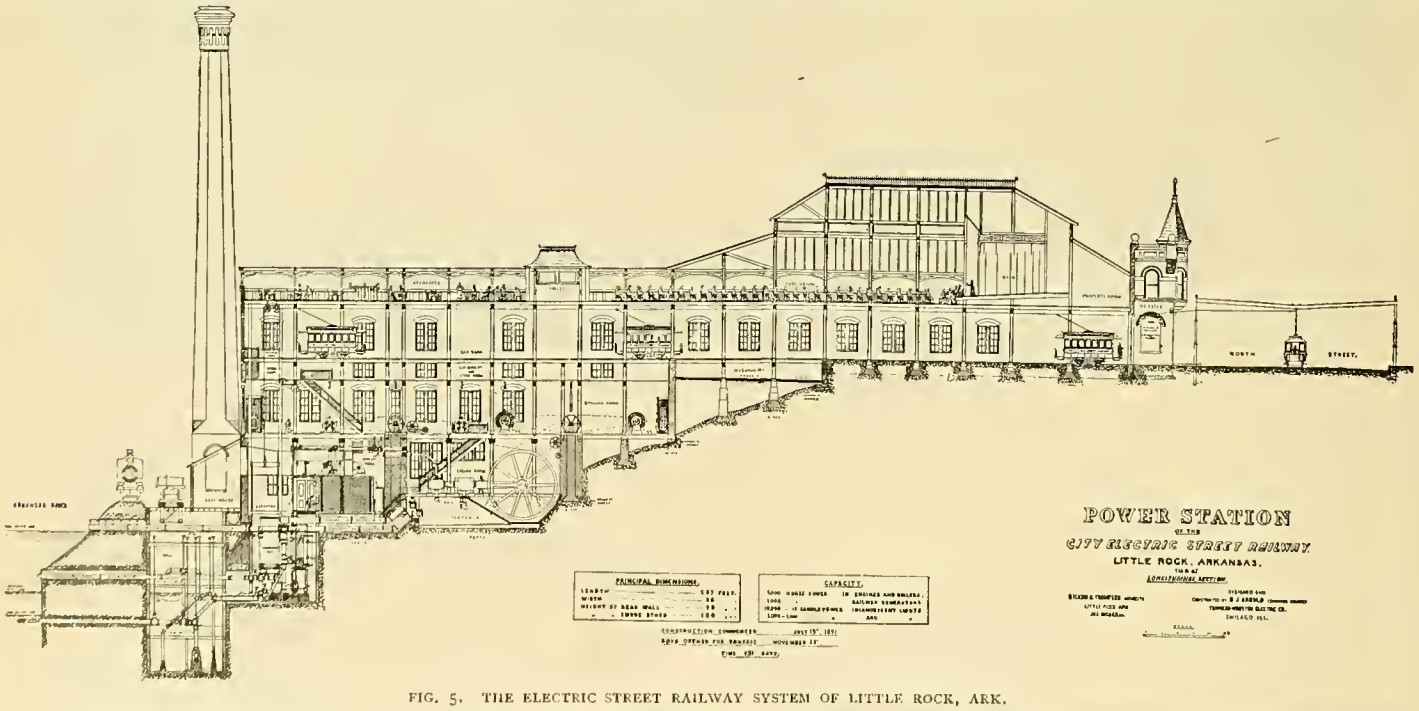


FIG. 5. THE ELECTRIC STREET RAILWAY SYSTEM OF LITTLE ROCK, ARK.

ability of the water company to filter its water sufficiently for city use. The wells, upon which had been spent about $15,000, were thus practically completed, hence the water question for the new power plant was partially solved. The property that went with these wells consisted of a lot 100 feet wide by 350 feet deep, extending south to North street, over which runs the principal line of the road, extending from the depot to the city. This location would bring most of the cars by the power station every trip. Again, there was a solid slate sub-structure, which would give a good foundation, and the profile of the lot was such that it enabled a building to be designed which brought the entire power station, car barn, repair shops, offices, etc., under one roof and on one set of foundations, making it thereby cheaper to construct than would have been the case had two pieces of real estate been purchased and two distinct buildings constructed. The main line of the St. Louis, Iron Mountain and Southern railway runs along the river bank in the rear of the building, permitting a side track to be built cheaply and fuel delivered directly into the coal house with but one handling. To those not familiar with the location of this plant the idea of a theater on top of the power station may seem absurd, but when it is remembered that the roof of this building has an area of over six-tenths of an acre and is located about 100 feet above the river, entirely removed from the noise of the machinery, and that there is presented to the observer on the roof one of the most beautiful views that can be obtained in the Ozark Mountains, the idea may not seem so peculiar. An idea of these views may be obtained from Fig. 8. The power station is located on the main line of the street railway and the theater produces a source of revenue to the road that makes it quite an important factor.

It should be understood that the rise of the water in the river is 33 feet from low to high water, and that during certain seasons of the year the water contains over 30 per cent. of solid matter, consisting mostly of sand and vegetable substances. As a consequence of this, the means for handling the water is of necessity somewhat complicated. Before starting upon the plans of this plant, the designer secured the government records of the river, extending back to 1844, thereby ascertaining the extreme high and low water marks. A 14-inch pipe, which the water company had used, was found in place, running from the river into the outside well. This pipe, as laid two feet below low water line, so that the water supply in the well is always insured. Below this pipe it will be noticed on the sectional drawing, Fig. 5, there is a low water filter, composed of a wooden frame-work supporting layers of charcoal, coke and pressed hay, through which the water filters by gravity into the lower portion of the well. From the bottom of this well, where the filtered water remains, the suction pipes extend to the condenser pumps and other pumping machinery used in the plant. These pumps are placed on brick foundations in the condenser pit located in the boiler room, as shown by Fig. 11. This pit, Figs. 2, 3 and 4, is 20 feet in diameter and 30 feet deep, and in it will be placed 3,000 horse power of condensers and pumping machinery, arranged for either jet or surface condensing from the same system of pumps, the details of which will be referred to later. One thousand horse power of this machinery is now in place.

On a level with the main track of the railroad is the side track shown on the longitudinal section, Fig. 5. This track is carried across the outside well on trusses. Next to the side track comes the coal house, which is 20 feet wide and extends the entire length of the building, and is capable of storing 300 tons of coal. That portion of the coal house which extends over the outside well is carried on iron I beams and concrete construction.

Passing through the coal house, the boiler house is next encountered. This, as shown on the plan, Fig. 9, is a room 44 feet by 89 feet, 25 feet high. In it will be placed, when the plant is completed, eight 250 horse power water tube boilers. Three of these are at present installed. Over the top of these boilers is a sheet iron breeching, extending to the space between the center row of columns, where they join the main trunk breeching leading to the smoke-stack, located outside the main building. The plant is at present operated from an iron stack, 5 feet 6 inches in diameter and 180 feet high, set off to one side, so that the permanent brick stack can be constructed in its proper position without interrupting the operation of the plant. The permanent stack will be built of brick, and will be 84 inches in diameter by 180 feet high.

FIG. 6. THE ELECTRIC STREET RAILWAY SYSTEM OF LITTLE ROCK, ARK.

FIG. 7. THE ELECTRIC STREET RAILWAY SYSTEM OF LITTLE ROCK, ARK.

Just south of the boiler room is the engine room, with its floor located 6 feet higher than that of the boiler room, thereby providing for the exhaust piping system to be located under the floor. This room is 49 feet by 89 feet, and will contain when completed 3 000 horse power of engines, three of these, aggregating 1,000 horse power, being at present installed.

Leading upward from the engine room into the dynamo room, 133 feet long by 88 feet 6 inches wide, are stairways, located one on each side of the engine room. In the dynamo room will be located two distinct line shafts, resting upon the tops of the partition walls of the building. From the north line shaft, which is at present installed, there will be belted eight 110 horse-power Thomson-Houston railway generators, five of which are now in use. There will also be an additional 110 horse railway generator belted directly from a high-speed engine, located below in the engine room, for the operation of the "owl trains" after the main railroad part of the plant is shut down for the night. The other line shaft is to be located on the top of the wall at the south end of the engine room, and from it will be driven the lighting machinery. The two shafts will be cross-connected at their centers with a 54-inch belt, thereby enabling any generator in the house to be driven from any engine in case of accident to any one of the engines. The railroad switch-board is located in the north end of the building, as shown on the plan of the dynamo room, Fig. 10, and the lighting switch-board is in the south end, so that the leads from the dynamo to the switch-board may be as short as possible,

FIG. 8. THE ELECTRIC STREET RAILWAY SYSTEM OF LITTLE ROCK, ARK.

and also for the purpose of keeping the railway and lighting plants distinctly separate. Over each row of generators and the line shafting extends an overhead single track railroad, with the necessary differential pulleys, etc.,

for lifting out an armature or box caps. This overhead railway runs to the elevator shaft, so that the heavy part may be delivered directly into the elevator and transferred to the machine shop above with but little labor. Glimpses of the boiler, engine and dynamo rooms are shown in Figs. 6 and 7.

On each side of the dynamo room are stairways extending up to the pit room above. This room was placed in the plant to provide for easy access to the motors and cars, to make repairs at all times without necessitating the changing of the location of the cars. In the rear of this room, on the river end, is a machine shop, a portion of which is partitioned off for a supply room. The heavy portions of the car machinery can be dropped down into the pit room, placed on hand trucks, and drawn to the machine shop for repairs, with but very little physical exertion on the part of the mechanics; it also provides an easy means for wiping the cars.

Extending fifty feet south of this pit room is the washing pit, Fig. 13, having a tar concrete floor sloping to the south, so the drainage will run into the sewer connection at that end, and prevent the water from flowing over the dynamo room. This washing pit extends the entire width of the building under all of the tracks, so that the cars from either track can be run over the pit, washed, drained and run back to their place without any transferring.

On each side of the pit room stairs extend upward into the car barn, Fig. 12. This room is 88 feet 6 inches wide by 297 feet long, and contains eight tracks of 4 feet 8½ inch gauge. This barn is capable of storing 96 motor cars. In the rear on the river side are located the small benches and stands for the head-lights and other small parts of the cars. The floor of this room has a slight slope from the rear of the building to the front, so that in case of fire the cars can be gotten out of the house rapidly. This is an important feature. The eight tracks swing into the main line of the road by curves, thus making a transfer table unnecessary. The transfer table pit in case of fire would greatly hinder the removal of cars.

On top of the car barn roof is located the summer theater and pleasure garden, already mentioned. This theater is capable of seating an audience of 1,000 people in the auditory proper and about 400 around the tables and places of amusement in the belvedere. The entrance to the theater is from the front of the building up one flight of stairs, having a total rise of but 16 feet. In the rear of the stage there are dressing rooms for the actors, while the offices of the railroad company are located immediately over the front of the power house and one story above the ground. The conductors' and motor men's room is on the ground floor under the offices.

As was before stated, this station stands upon a formation of solid black slate, which is as hard as ordinary limestone. The formation of slate, however, is on an angle of about 45°. Inasmuch as the slate was fractured in diferent places, it was not thought best to trust it to hold the foundation bolts for the engines, consequently holes were excavated in the slate and the concrete foundations for the engines were built and capped with several courses of brick, and upon these the stone foundation caps for the engines were set. These foundations have proven most satisfactory, as no vibration whatever can be detected when the engines are doing the heaviest work. The first story of the building, from the foundation up to the level of the dynamo room floor, is laid in Louisville cement and sand, while from the dynamo room floor to the top of the building the walls are laid in lime mortar.

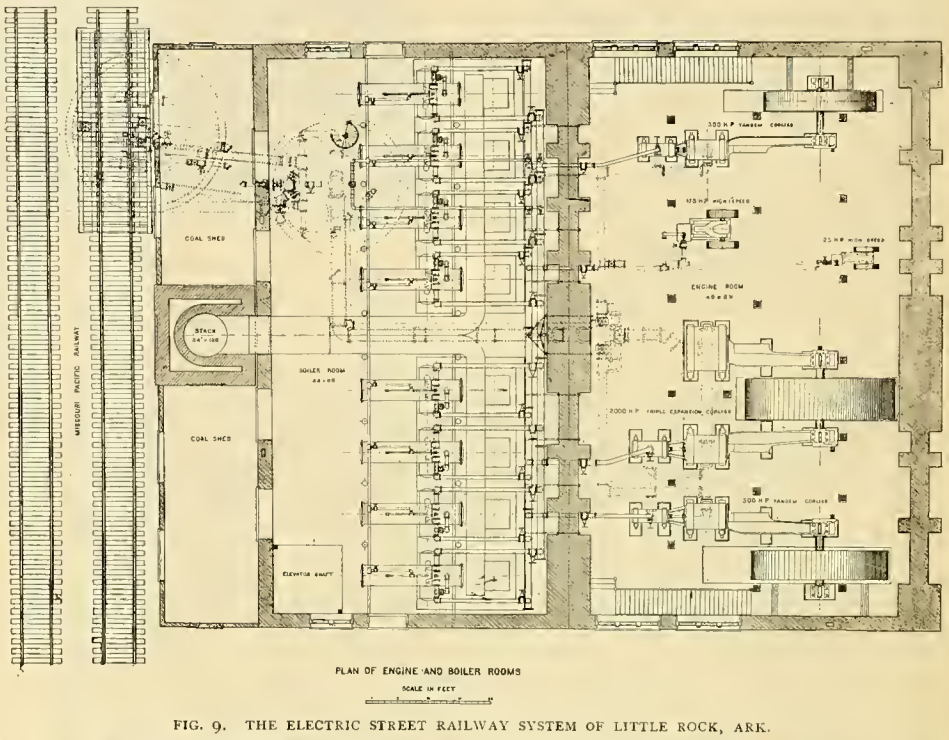


FIG. 9. THE ELECTRIC STREET RAILWAY SYSTEM OF LITTLE ROCK, ARK.

The present electrical equipment consists of 28 Thomson-Houston double 15 horse power motor cars and five 110 horse power multipolar railway generators, with the necessary switch-board and overhead construction appliances. Provisions are made also for the addition of four more generators and other cars without any additional expense except the cost of the additional machinery. The plant is designed for the addition of an electric lighting plant having a capacity of 10,000 16 candle power incandescent lamps and 1,000 2,000 candle power arc lamps, a portion of which will be added as soon as the necessary business arrangements can be made.

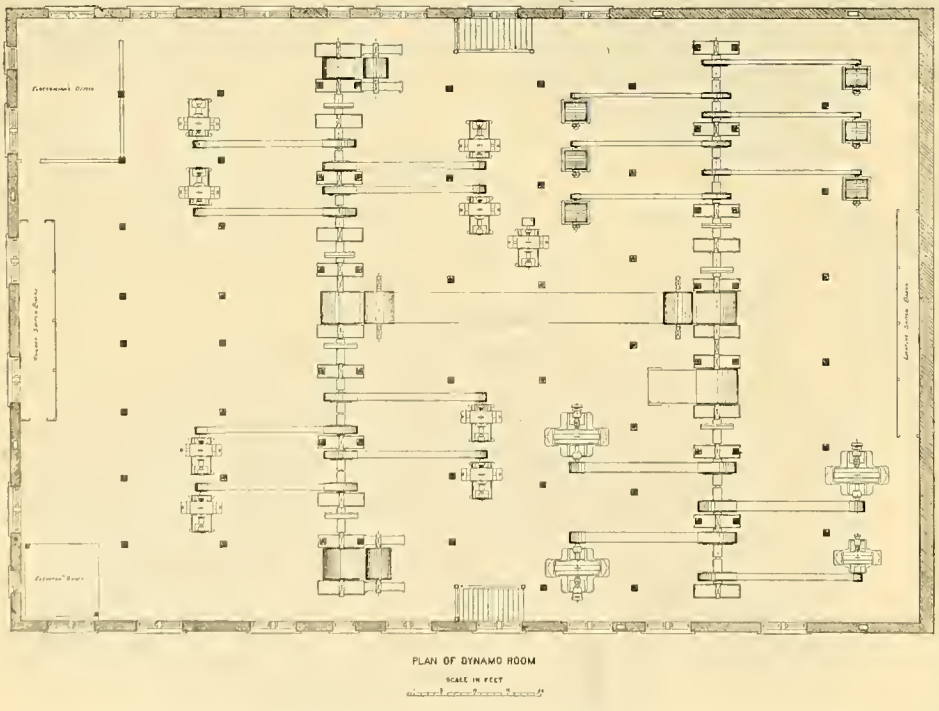


FIG. 10. THE ELECTRIC STREET RAILWAY SYSTEM OF LITTLE ROCK, ARK.

The present steam power equipment consists of Hamilton-Corliss tandem compound condensing engines having cylinders 20x36x48 and 16x30x48 respectively; also one 8x10 "Ideal" high speed engine for operating 18 arc lights now in operation in the building. The engine room is designed for an additional 2,000 horse power triple expansion Corliss engine, which will drive the lighting plant when installed, and one 175 horse-power high speed engine for driving the railway generators to operate the "owl trains," or any trains that run at night after the main plant is shut down.

There are now three 250 horse power Heine boilers installed and provision is made in the boiler room for the addition of five similar boilers when the plant is extended. The connections for the steam piping are now in and ready for the boilers.

There is at present installed one 1,000 horse power Smith-Vaile duplex condenser and also two Gordon steam pumps for the boiler feeders. Each one of these pumps is capable of supplying the entire plant. Provision is made for an additional 2,000 horse power condenser.

The shafting now running consists of about 80 feet of 6½ inch hammered iron shafting with five 62 inch by 15 inch friction clutch pulleys, with the necessary plain pulleys, tighteners and clutches, to receive the power from the two large engines now installed. The shaft is divided near the center so that one portion of it can be kept going in case of a hot journal on either part. The cap stones are set and the belt holes made in the foundation for the other line shaft, which will drive the electric lighting machinery when the time comes for placing it.

There are at present two main belts in the plant, one of which is 54 inches wide and 135 feet long, and the other 36 inches wide and 125 feet long. These belts transmit the power from the engines to the line shaft. There are five 14-inch belts which transmit the power from the line shafting to the railway generators.

The piping of this plant is arranged in duplicate throughout, so that it is unnecessary to shut the plant down on account of a break in the piping. There are two water connections from the river to the outside well, and two suction pipes from the outer well to the boiler feed pumps. There are also two risers from the boiler feed pumps to the main headers extending across the boiler room, for supplying feed water to the boilers. These risers are arranged with suitable valves and cross connections, so that either pump will deliver water up either riser, through either header, to the boilers, either through the live steam purifiers or directly in the boilers, as the engineer desires. The suction pipes to the pumps are arranged so that the water can be taken from the hot wells of either the surface or the jet condensers, the outside well or directly from the river. The condenser pumps are so piped that the plant can be run either jet or surface condensing, or both, at the same time. The overflow pipe from the condenser is placed about 4 feet above the average water line in the river, and the air pumps low enough to permit the condensing water to flow into them when the river is at its normal stage, thereby saving the energy that would be required to lift the condensing water were the air pumps placed higher. The auxiliary overflow pipe is placed 2 feet above the extreme high water line, and the piping is so arranged that when

the water rises to the above overflow pipe the water from the condenser can be delivered through the auxiliary pipe. This pipe has already proved its usefulness, as the plant was operated successfully through the recent southern floods, which brought the water to the highest point since the extraordinary floods of 1844. Over each boiler is placed a live steam purifier, and the piping is arranged so that the boiler feed pumps deliver feed water through these purifiers into the boilers, or directly into the boilers, as desired. Arrangements are made whereby the steam and water valves for the condensing system and boiler feed pumps are all handled by valves placed on the level of the boiler room floor, so that it is unnecessary for the engineer to go

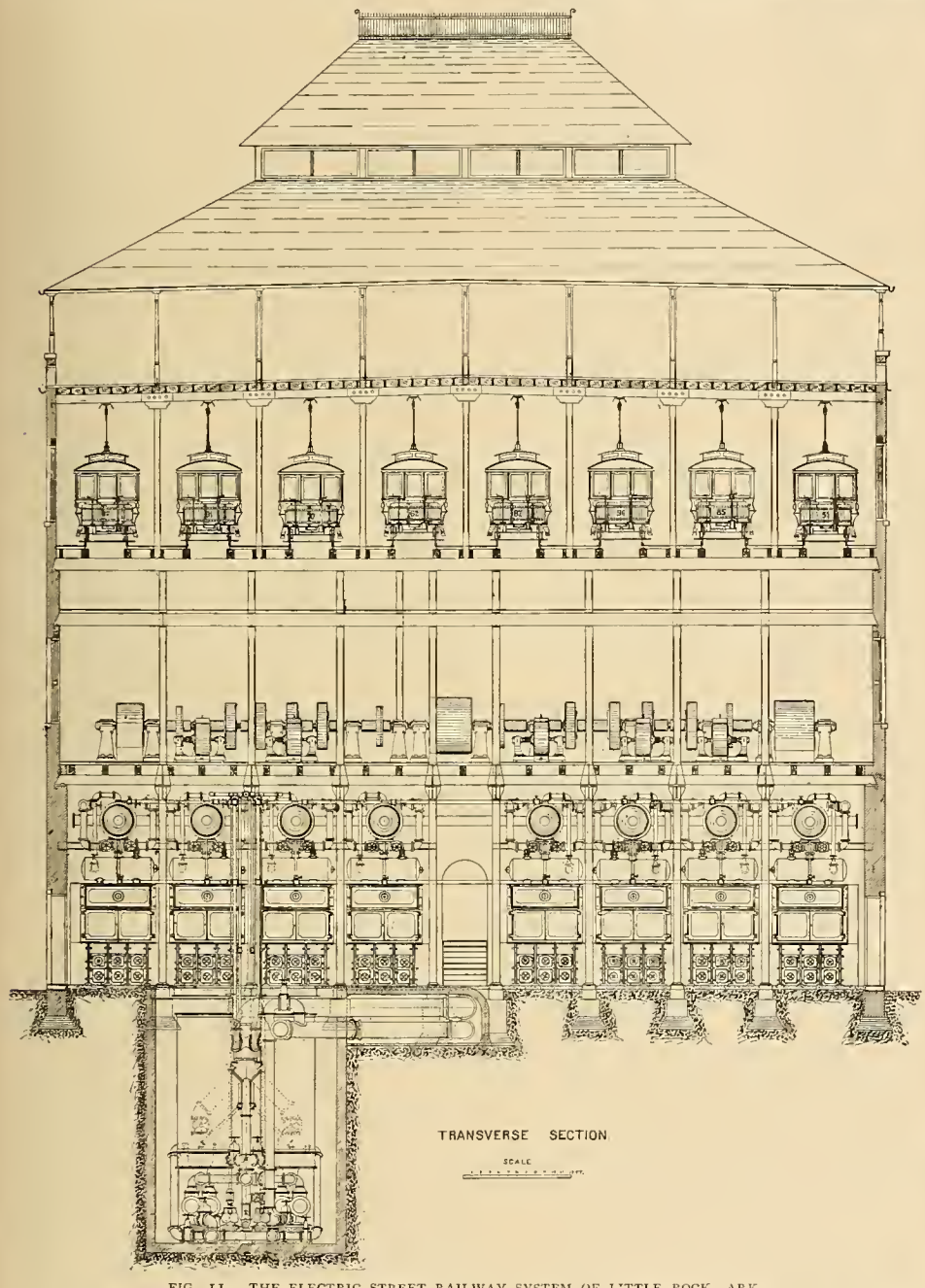


FIG. 11. THE ELECTRIC STREET RAILWAY SYSTEM OF LITTLE ROCK, ARK.

down into the condenser pit except for making repairs or for changing over from one system of condensing to the other. An iron spiral stairway extends to the bottom of the pit, Figs 2, 3, and 4, and the top of the pit is left open for ventilation, except in front of the boilers, where it is covered to allow firing space for the boilers immediately in front of it. The exhaust steam from the engines is led through pipes under the engine room floor and through a 24 inch pipe located in a tunnel under the boiler room to the condensers in the pit. The auxiliary 20 inch pipe is led out through the same tunnel through the building to the river, into which all drain pipes and auxiliary exhausts are led, so there is no waste steam visible about the plant. This pipe is used only for exhaust steam in case of accident to the condensers, and an automatic relief valve is placed between each engine and this pipe, which will open in case of accident to the condenser to permit the exhaust steam to go directly to the atmosphere without the attention of the engineer. On top of the dome of each boiler is placed a "T," out of which leads the main steam pipe from each boiler to the main header which extends entirely across the boiler room. From the other side of this "T" extends an auxiliary pipe running to the auxiliary header which also extends the entire width of the boiler room. It will be noticed that each boiler is piped independently to both the main and auxiliary steam headers, and suitable valves are placed for supplying either header, as the case demands. The steam pipes to each engine join to both headers, and the valves are so arranged that the steam can be taken from either pipe Chapman bronzed seated valves are used throughout the entire plant wherever high pressure steam or water comes in contact with them, and lighter valves are used on the exhaust connections. The exhaust steam from the steam cylinders of the condensers and boiler feed pumps is passed through a small tubular heater thence to the auxiliary exhaust pipe. The boiler feed pumps deliver the feed water through this heater to absorb whatever heat there is in this exhaust, which would ordinarily be wasted. Arrangements are provided so that the exhaust from the condensers and boiler feed pumps can be turned into the condensers to get the benefit of the vacuum in case the heater is not in use. By opening and closing certain valves the water can be shut out of the outside well so as to permit the cleaning of the filters. While this is being done the pumps draw their supply directly from the river.

From the boiler feed pumps there extends upward a vertical riser through all the stories to the top of the building. From this riser on each floor there extends a system of horizontal pipes with hydrants located at suitable places. These hydrants are provided with hose and reels and are always in readiness in case of fire. There is an electric bell system placed in the plant whereby the engineer can be signaled by any one in any portion of the building in case a fire breaks out. The pressure from the boiler feed pumps is always on the fire service pipes and an automatic arrangement is provided whereby the boiler feed pumps can be almost immediately turned into fire service pumps. It will be remembered that each one of these pumps is amply

FIG. 12. THE ELECTRIC STREET RAILWAY SYSTEM OF LITTLE ROCK, ARK.

large to supply the plant so that one pump is always in reserve for fire service. The water car for wetting the tracks of the road and also the water for sanitary service in the building is supplied from the fire service pipes, so there is no water consumed in the building from the city, although the system of piping is connected to the city mains as an extra precaution.

Located in the engine room, in plain view of the engineer, and immediately behind the boilers, there is a polished oak gauge-board, upon which is mounted an auxiliary steam gauge, glass water gauge and gauge cocks, for each boiler, beside the necessary vacuum gauges, clocks, recording steam gauges, etc. This arrangement enables the engineer on duty to keep a constant check upon his firemen, who handle the water and steam.

An elevator large enough to take a complete motor truck is to be located in the northwest corner of the building, and it will run from the boiler room to the car barn floor. By this means a cinder car can be lowered to the boiler room, loaded and returned to the car barn tracks, and out onto the line, where the cinders are distributed for surfacing the tracks. It also allows car trucks, supplies and heavy freight to be unloaded directly from the railroad onto the elevator and raised to the floor on which it is to be used. The work on the Little Rock station was executed by the following named contractors:

FIG. 13. THE ELECTRIC STREET RAILWAY SYSTEM OF LITTLE ROCK, ARK.

Building—Brick work, Noah Hamlet; wood work, W. D. Holtzman; iron work, D. R. Wing & Co. and E. C. Wehrfritz, all of Little Rock.

Machinery—Electrical equipment, Thomson-Houston Electric company, Chicago; engines, Hoovens, Owens & Rentschler company, Hamilton, O.; boilers, Heine Safety Boiler company, St. Louis, Mo.; shafting, Hill Clutch Works, Cleveland, O.; belting, Chicago Belting company, Chicago; condensers, Smith-Vail company, Dayton, O.; boiler feed pumps, Gordon Steam Pump company, Dayton, O; live steam purifiers, Hoppes Manufacturing company, Springfield, O; steam piping, Nick Peay & Co., Little Rock, Ark., and Crane company, Chicago; steam pipe covering, Chicago Fire Proof Covering company, Chicago; smokestack, D. R. Wing & Co., Little Rock, Ark.

In conclusion it may be said that the western department of the Thomson-Houston company has in the Little Rock system a work of which it may well feel proud; in fact, after a personal inspection of the plant, one is inclined to concur in opinion with the gentleman, who, after visiting the station, remarked, "The designer of this station has erected a monument for himself and his company."

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CORRESPONDENCE relating to electricity, or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

PAGE.

The Electric Street Railway System of Little Rock, Ark. Illustrated 97, 98, 99, 100, 101
Editorial 102
Electricity at the World's Fair 103
An Electrical Carriage on Chicago Streets 103
Convention of Edison Companies at Toronto 103
Electricity for Chicago Terminals 103
Electricity at Homestead 103
Combined Switch and Fuse Box for Railway Lighting Circuits. Illustrated 104
New Instantaneous Switches. Illustrated 104
Electrical Lightship 104
Wood's Trolley Wire Clamp. Illustrated 104
New Telephone Battery. Illustrated 104
Change-over Switch. Illustrated 104

DEPARTMENTS.

Correspondence 105, 106
New Incorporations 106, 107
Electric Lighting 107
Electric Railways 107
Electric Mining 107
Telegraph 107
Miscellaneous 107
Trade News 107, 108
Business 108
Electrical Patents 108

"NINETY per cent. of the farmers of this province don't know what electricity is," writes R. W. Turner, the United States consul at Cadiz, Spain, in response to a request for information from the government. This is not at all surprising. If Consul Turner will only explain "what electricity is," he will greatly benefit not only the the farmers of Spain, but also the scientists who have given so much time to the investigation of the subject.

No city seems to be more actively engaged in street railway projects at present than St. Louis, and a large batch of ordinances for new routes and extensions of electric lines is awaiting the attention of the local law-makers after the summer recess. It is strange that if the overhead trolley system is the dangerous, unsightly and abhorrent thing that the New York and Chicago papers assert, it should continue to exhibit such marked evidences of public favor as it does in Boston and St. Louis. These are large cities and great business centers and both have reputations rather above than below the average for the beauty of their streets, yet in both electric traction by overhead wires is the predominant system.

WE desire to direct the attention of our English electrical contemporaries who are wondering what English electrical manufacturers are to gain by exhibiting at the World's Fair to the case of the Sultan of Johore. We have the authority of a United States consul for the statement that this Oriental potentate is contemplating the erection of an electric lighting plant for his palace, but that he will make no decision until he has inspected the systems of electric lighting at the World's Fair. This is, of course, an isolated case, but it is only reasonable to presume that of the thousands of visitors from Canada, Mexico, South America, Australia, Japan, China and India, all interested in electricity will be similarly influenced. This being the case, can the English, German and French manufacturers of electrical apparatus afford to neglect this great opportunity to exploit their goods in competition with those of American production?

IT seems that the hare-brained scheme of holding an electrical exhibition at Milwaukee next year to surpass the display in the corresponding department of the World's Fair has been definitely abandoned. Since Manager Trumpff of the Milwaukee exposition turned a willing ear to the tale of Mr. Stewart, who represented that the electrical exhibits at Chicago would be practically a failure, owing to disaffection on the part of those who should make large exhibits, he has learned a thing or two about the feeling of the electrical fraternity of this country toward the World's Fair. That feeling is one of enthusiastic support, and in consequence the Milwaukee project received no encouragement and was given up. Chief Barrett's letter, which was published in this paper several weeks ago, helped materially in giving the Milwaukee people the correct idea. The little boomlet was interred without ceremony or regret and passed almost unobserved from a world where it had no place.

ACCORDING to the press dispatches it appears that Senator Hansbrough of North Dakota claims to have experienced some remarkable sensations during a recent electrical storm. He is reported to have described his condition as that of an "electrical paroxysm." Disinterested visitors to the House of Representatives have often remarked strange conduct on the part of members, but it is safe to say that the most learned and scientific observers of the proceedings in this branch have not attributed the contortions of representatives to this cause. It is true that there have been uncharitable critics who would lead the people to believe that many congressmen had succumbed to Jersey lightning, but in view of the recent investigating committee's report it would be presumptious to assume that such a state of affairs could exist. And if this be true of the lower branch, how can any one entertain suspicion of the dignified Senate? In the interest of science Congress should investigate Senator Hansbrough's case.

IT is probable that the time set for the convention of the American Street Railway association at Cleveland, O., will be changed owing to the fact that the dedicatory exercises at the World's Fair will be held October 19th, 20th and 21st, the time of meeting of the association according to the present arrangement. The necessity of changing the date is to be regretted inasmuch as it may entail some confusion, but as there is still plenty of time to rearrange matters, it is to be presumed that the change will be made. It would be impossible to hold the convention according to the present programme without seriously affecting the success of the meeting. The attendance would be diminished if the convention was held at the same time as the exercises at Jackson Park. There is really no good reason why the date of the meeting should not be postponed. The street railway men of the West, and particularly of Chicago, are deeply interested in all that pertains to the World's Fair, and it is quite probable that the eastern members would leave the meeting at Cleveland in order to attend the Chicago exercises. There seems to be a general inclination among street railway men and the supply companies to postpone the meeting until after the exposition exercises have been held.

ACCORDING to the press dispatches from New York last week, electricity will be called upon to solve the Chicago terminal freight yard problem, which has been giving the railroad companies so much trouble. It is announced that Frank J. Sprague has prepared plans providing for the use of electricity, which he believes will bring about the desired relief. The details of these plans have not yet been published, but an outline is suggested in an interview with Mr. Sprague, presented in another column. Lieut. Sprague calls attention to the peculiar requirements of the service, and concludes that, "while this is a large problem, it may be approached hopefully." The success which has recently been achieved in the building of large electric locomotives for handling freight, etc., leads Mr. Sprague to hope that little trouble will be experienced in securing 700 horse power electric locomotives for service in Chicago. "There is no doubt that they can be made," he says, "and that electricity can do everything done by steam, while removing entirely the nuisance of smoke and cinders that must attend the use of steam as a motor."

There are other features of the problem which will require as much attention and study as the building of huge electric locomotives, and these seem to have been thoroughly examined. Should it finally be decided to utilize electricity for handling Chicago freight, an entirely new field would be opened, that would present great opportunities to the electrical engineer.

THE idea of utilizing the water power of Niagara possesses great attractions for those who are interested in commercial affairs, but it is reserved for the visionary to picture "the possibilities" of this great water power. In an interview recently published in the Rochester, N. Y., *Herald*, Leonard Henkle, a resident of the Flower City, unfolded a tale that should secure for him enduring fame in the world of fiction. In the article referred to Col. Henkle describes his plans for building a mammoth power house at Niagara—"the largest building on earth"—which he says will cost not far from $35,000,000. Such an enormous investment might be considered a drawback by small-fry capitalists, but to the projector of this enterprise it is a mere bagatelle. The enterprise is predicted to pay six per cent. on an investment of $256,000,000. Another interesting feature of the project is the announcement that electricity generated at Niagara Falls "can be transmitted to Louisiana without appreciable loss." It might be thought from this that the colonel had found a new brand of electricity, but he modestly disclaims any such discovery. He asserts, however, that he has found a metal whose conductivity is perfect, and this metal, he says, can be cheaply produced.

AN electric railway power house on a side hill, with the car barn above the generating plant and a summer theater topping all, is certainly a novelty in electric railroading. Such an installation is that of the City Electric Street Railway company of Little Rock, Ark., which is described at length in this issue. The photographic reproductions that accompany the article show that the the claims made for the beauty of the scenery visible from the roof of the station are amply justified, and an evening's entertainment amid such surroundings should be doubly pleasant. No doubt the citizens of Little Rock will appreciate the advantages of this excellent innovation in the amusement line and the directors of the railway company will reap the increased revenue that their enterprise merits.

Mr. Arnold, the engineer in charge, appears to have turned the advantages of the location of the site to the greatest possible account, and the arrangement of the plant is entitled to cordial praise. The provisions for receiving fuel and water, transmitting the power and giving access to the car motors are all excellent. Many of the features of this fine station can only be reproduced in a power house alike favorably situated, but the plant will nevertheless repay the careful examination of all interested in electric railway work.

AT the time of his death Cyrus W. Field was comparatively poor He had amassed a considerable fortune, but had met reverses, and had been misled by supposed friends in business transactions, the result of which was disastrous to his once almost princely fortune. His son's transactions, which are still fresh in the public mind, reduced the great philanthropist almost to poverty. His collection of souvenirs and presents was about all that remained after the wreck, and now, by the provisions of his will, these are to be divided. One of the favorite reminders of the great work of his life was a set of paiotings, six in oil and forty-seven in water color, illustrating the principal scenes connected with the laying of the first cable. These have been bequeathed to the New York Historical Society. There were also preserved the American and English flags that were floated from the Niagara and Great Eastern in the cable laying expeditions. Another valuable reminder is the table on which was signed the contract for the laying of the cable. This was a dinner table, and has always been carefully preserved, together with the chairs and ornaments about the room in which the contract was executed. Numerous medals presented by Congress, legislatures and private individuals in this country, together with marks of distinction bestowed by foreign governments and scientific bodies, go to make up one of the most interesting collections of the kind in existence. Now it is proposed to distribute these mementoes among the members of the family. When once divided it is hardly possible that the collection will ever again be gotten together.

It is suggested that the World's Fair authorities take steps to secure the loan of these treasures for exhibition in the electricity building. They would make an unique and interesting display, and would add greatly to the value of the historical feature of the electrical exhibition.

Electricity at The World's Fair.

Preparations for the work of supplying the electric launches at the World's Fair are being made by the Electric Launch & Navigation company, although the contract has not yet been signed. It is said that the bond required of the company is $50,000, and that $10,000 has already been deposited with the Exposition company. The location of the charging station has not yet been determined.

E. E Keller, the superintendent of the Westinghouse incandescent installation at the World's Fair, left for a few days' stay in Pittsburg on Friday of last week.

English and other foreign manufacturers of electrical apparatus who are still hesitating about exhibiting at the World's Fair should heed the testimony of the United States consul at the Singapore Straits settlements, who calls the attention of the state department to the fact that the municipal council of that place is discussing the lighting of that city by electricity; also, that the Sultan of Johore will do the same for his palace and city at an early date. He continues: "At present there is but one small electric plant at Singapore consisting of Thomson-Houston dynamos. It lights the government house and the colonial secretary's house with incandescent lights. The cost of an installation of a plant of 250 arc lights in Singapore is put at $350,000 by the municipal engineer, whose figures are based on the result of diligent inquiries in the United States and Great Britain. His highness the Sultan of Johore, whose capital and palace are but fourteen miles from Singapore, is waiting until the Singapore authorities arrive at some definite conclusion in regard to the best methods of lighting, when he will adopt them for Johore, as he has told us that he intended to light his palace with electricity at an early date. Johore would probably require a plant of fifty arc lights. Whoever gets one contract will get both. His highness will do nothing, however, until he returns from the Chicago Exposition and has seen the best results of electric lighting in America."

Professor Elisha Gray, chairman of the World's Electrical Congress committee has returned from Europe. "If all who had the desire to come had the means to spare to bring them here the attendance from foreign countries would be a great surprise to the American people," said Professor Gray. "I explained to those I met in the various countries the plans and purposes of the various congresses proposed. It was my special mission to give information and make arrangements in relation to the electrical congress to be held next year. Many eminent electrician of different countries are expected to attend, including a large number from Great Britain. The work of the World's Congress auxiliary has been done so quietly that the general public is not aware of its extent and efficiency. There seems now to be no question that the world's congresses of 1893 will be very much more largely attended and will be conducted on a more imposing scale than those of any previous occasion in the world's history."

The New York state board of World's Fair managers has received 44 applications for space in the electrical department.

An Electrical Carriage on Chicago Streets.

Several months ago the WESTERN ELECTRICIAN presented an illustration and description of an electrically propelled carriage, equipped with Morrison–Plante storage cells, which had been successfully tested in Des Moines, Iowa. The batteries used are manufactured by the American Battery company of Chicago, and on Thursday of last week a trip was made in Chicago from 538 West Monroe street to Jackson boulevard and thence to the corner of La Salle and Monroe streets. The trial was under the auspices of the Battery company and was an entire success. The route as taken is about three miles in length, and with several stoppages the distance was covered in 22 minutes. Five persons were in the wagon, and with the entire 24 cells in use, with which this wagon is equipped, the ammeter indicated the use of from 30 to 40 amperes. Later the same evening the wagon, was run back to the starting point, at J. B. McDonald's residence, and from there to Garfield Park and return, making a trip of from 8 to 9 miles and then by no means discharging the cells. With the same batteries a day or two later the wagon was run from West Monroe street to Harold Sturges' residence north of Lincoln park, on the lake, and thence through the park, attracting much attention. The motor was built by William Morrison at Des Moines, and is said to be too light for the vehicle. The steering device is very ingenious, and is apparently just suited for the purpose. The Battery company will rebuild the motor and probably place the wagon on exhibition in some of the parks in Chicago or at the World's Fair.

Convention of Edison Companies at Toronto.

The eighth annual meeting and thirteenth convention of the Association of Edison Illuminating Companies met in Toronto, Ont., on Tuesday, August 9th.

The first session was called to order at 2:30 P. M. by John I. Beggs, who for six years has been president of the association. The following named members were present:

W. M. Brock, general manager Edison Electric Illuminating company, Paterson, N. J.; A. F. Walker, superintendent Electric Illuminating company, Grand Rapids, Mich.; W. S. Barstow, general superintendent Edison Electric Illuminating company, Brooklyn, N. Y.; Wilson S. Howell, treasurer of the association and honorary member; Frederic Nicholls, president Toronto Incandescent Electric Light company, Toronto, Ont.; C. L. Edgar, general manager Edison Electric Illuminating company, Boston; J. H. Vail, assistant engineer in-chief, General Electric company, New York; J. A. Colby, secretary and manager Edison Light company, Des Moines, Ia.; F. E. Jackson, Edison Lamp Works, Harrison, N. J.; W. L. Garrison, treasurer Edison Electric Illuminating company, Brockton, Mass.; George R. Stetson, president New Bedford Gas & Edison Light company, New Bedford, Mass.; Charles R. Price, treasurer New Bedford Gas & Edison Light company, New Bedford, Mass.; William D. Marks, Philadelphia, Pa.; J. H. McClement, president Edison Electric Light & Power company, Amsterdam, N. Y.; Winston Salem Railway & Electric company, Winston-Salem, Va; Arthur Williams, general inspector Edison Electric Illuminating company, New York; Arthur E. Kennelly, Edison laboratory, Orange, N. J.; A. L. Smith, president Appleton Edison Electric company, Appleton, Wis.; Charles Wustenfeld, manager Elgin City Railway company, Elgin, Ill.; Hoyt Post, director and attorney Edison Electric Illuminating company, Detroit, Mich.; C. P. Gilbert, secretary and manager Edison Electric Illuminating company, Detroit, Mich.; E. R. Weeks, general manager Edison Electric Light & Power company, Kansas City, Mo.; S. B. Eaton, general counsel Edison Electric Light company, New York; G. H. Van Etton, Edison Electric Light & Power company, Little Rock, Ark.; J. E. Sayles, general agent Edison Electric Illuminating company, New York; Charles H. Lindenberg, Columbus Edison Electric Light company, Columbus, O.; A. W. Field, secretary and manager Columbus Edison Electric Light company, Columbus, O.; Samuel Insull, president Chicago Edison company, Chicago, Ill.; W. J. Jenks, Edison Electric Light company, New York; George H. Finn, secretary, treasurer and manager St. Paul Edison company, St. Paul, Minn.; Maurice Hoopes, superintendent Edison Electric Illuminating company, West Chester, Pa.; W. E. Rundle, official stenographer, John I. Beggs, director Harrisburg Electric company, Harrisburg, Pa.; J. H. Sheddy, general manager Renovo Edison Light, Heat & Power company; A. D. Page, assistant manager Edison General Electric company lamp works, Harrison, N. J.; John R. Markle, director Edison Light company, Grand Rapids, Mich.; John Langton, Canadian Works Edison General Electric company; Henry W. Darling, vice-president Newport Illuminating company, Newport, R. I.; H. J. Smith, general operating superintendent Edison Electric Illuminating company, New York; M. D. Barr, district manager Edison General Electric company, Toronto, Ont.; Edwin W. Hammer, Edison Electric Light company, New York; C. R. Van Trump, engineer and manager Wilmington City Electric company, Wilmington, Del.; W. S. Andrews, general superintendent Canadian Works Edison General Electric company.

The standing committees of the association presented their reports, and upon these several discussions of practical subjects resulted. These included the importance of high insulation in the interior wiring of buildings and the improvement of safety fuses. On these questions the association was favored with a practical talk by Capt. William Brophy, who, by vote of the meeting, was specially invited to be present and participate in the discussion.

J. H. McClement raised some interesting questions relative to the possibilities of operating electric railway systems, and during the discussion William Lloyd Garrison of Boston gave in an exceedingly interesting manner some results of his pioneer incandescent electric light experience at Brockton, Mass. Addresses were made by Messrs. Barstow of Brooklyn and Stetson of New Bedford.

By invitation of the association M. J. Sullivan, for several years official stenographer of the association, read a paper entitled "The Central Station and Street Railways," which occasioned further discussion on the questions suggested

An interesting and valuable paper, illustrated by statistical tables and diagrams, was read by J. H. Vail on "The Application of New Apparatus and High Economy Engines in Central Engines to Secure Greater Commercial Efficiency and Economy of Coal."

SECOND SESSION.

Returning from a delightful drive through the suburbs of the city, in open carriages provided by the Edison company of Toronto, the association convened at 11 o'clock.

The courtesy of the Edison company in arranging for this early morning ride and the moonlight sail of the previous evening was suitably acknowledged by vote of the association.

The Canadian department of the General Electric company offered to the delegates the pleasure of an excursion to the Peterborough factories, but as the business engagements of the majority of the members of the association prevented any general attendance upon such an excursion, the invitation was declined with regrets and thanks.

The principal feature of the day's programme was a discussion of important questions of business policy.

In the afternoon the discussions of the morning were continued, C. A. Coffin, president of the General Electric company, and S. D. Eaton, general counsel of the Edison Electric Light company, being present and participating.

The following officers were chosen for the year: President, John I. Beggs; vice-president, Frederic Nicholls; secretary, W. J. Jenks; treasurer, Wilson S. Howell; executive committee, C. P. Gilbert, C. L. Edgar, E. R. Weeks, W. D. Marks, Samuel Insull.

The question of the place of holding the next annual meeting will be decided by the executive committee.

A statement regarding the work which had been done during the year by the fuel gas committee, was made by J. R. Markle. The committee was continued for another year, as were also the committees on lightning protection, dangers from systems of high pressure and grounding the neutral wire.

Electricity for Chicago Terminals.

A New York dispatch says that Frank J. Sprague, president of the American Institute of Electrical Engineers, has been intrusted by Henry Villard for the North American company with the solution of the terminal freight yard problem in Chicago. In applying himself to the work Mr. Sprague is convinced that the most feasible solution will be found in a system for interchanging freight by a six-track belt road, which shall form a common zone of transfer, either by itself or in combination with freight warehouses or storage yards. Electric traction will be recommended for the work proposed.

Mr. Sprague has satisfied himself, it is said, that the only way in which the current can be properly applied in any complicated system will be by an overhead conductor, practically rigid in character, following nearly the center line of all tracks and switches, with no movable overhead parts, and with return through the rail. In speaking of the outlook for the successful solution of the problem presented, Mr. Sprague is reported to have said:

There are three problems requiring solution in the application of electricity to propulsion on a large scale under conditions existing at the Chicago terminal. They are:

First—The development of an electric locomotive of ample power, which may be as readily controlled as the steam locomotive, which shall be reliable in operation and shall show high economy. Such a machine must have all the adjuncts which are necessary for train movement.

Second—A system of conductors and methods of supporting the same, which can be relied upon for ample supply of current and absolute certainty of continuous contact at all speeds on curves, switches, cross-overs and the multitudinous combinations which exist in yard tracks.

Third—A system of automatic block signals which, while effective for steam traffic, will not be thrown out of operation by the use of tracks as conductors of electricity.

This implies a change in existing signal systems. While this is a large problem it may be approached hopefully. The success of the General Electric company in equipping electric motors for the Baltimore and Ohio railroad furnishes conclusive demonstration of the practicability of efforts in this line. At Chicago locomotives of 700 horse power will be needed. There is no doubt that they can be made, and that electricity can do everything done by steam, while removing entirely the nuisance of smoke and cinders that must attend the use of steam as a motive power.

Electricity at Homestead.

Electricity figured to some extent in the great strike at the Homestead, Pa., steel mills. It is said that preparations were made to defend the works by stringing wires above the high board fence surrounding the mills, and connecting these with dynamos, so that intruders could receive a powerful intimation that their presence was not desired. After the Carnegie company had succeeded in getting some men to go to work, one of the officers said this: "The rate of pay for the new men will be increased in proportion as the number of hours is increased, so that no injustice will be done them. The old open-hearth mill may be abandoned altogether, and, in any event, at least fifty of those formerly employed there will find their places filled by automatic electric motors now being manufactured by the Westinghouse company." Thus it will be seen that electricity plays a part even in labor troubles.

The Jura-Simplon Railway company of Switzerland has entrusted to Lahmeyer & Co., of Frankfort, Germany, the execution of a project for electrically utilizing the water power available in the Scheuss-Teubinloch valley, Switzerland. Provisionally, 300 horse power will be used for driving the company's works at Bienne.

Combined Switch and Fuse Box for Railway Lighting Circuits.

The accompanying cuts illustrate a combination switch and fuse box for use on the lamp circuits of electric street railway cars. Fig. 1 shows the box complete with the switch handle in place; Fig. 2 the body of the box with the rotating ratchet switch in the lower compartment, and Fig. 3 the reverse side of the cover with the terminals and thumb screws for the metal fuse.

This box is compact, neat, and is made entirely of porcelain. The switch is of the latest type of rotating ratchet switch manufactured by the General Electric company and possesses the essential points of good contact and sudden break.

The fuse is placed on the inside of the cover, so that in replacing a blown out fuse the terminals are taken completely out of the circuit, and it is utterly impossible to receive a shock in any way. The brass clips on the cover fit over the two contact posts in the box and serve the double

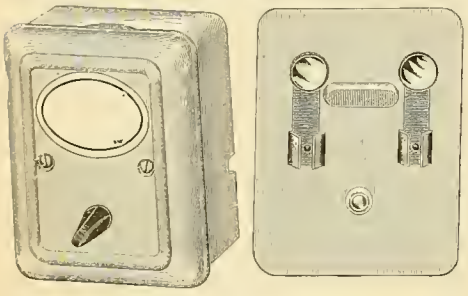


FIG. 1 AND 3. COMBINED SWITCH AND FUSE BOX FOR RAILWAY LIGHTING CIRCUITS.

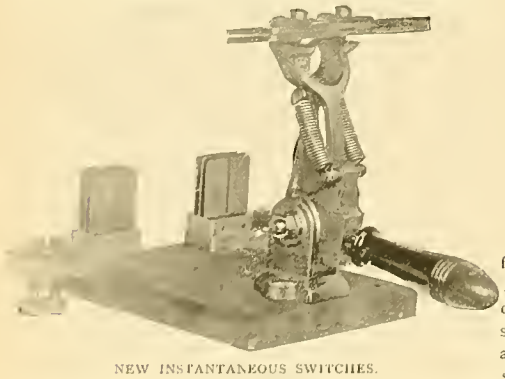
purpose of holding the cover in place and forming part of the circuit.

As will be seen by reference to Fig. 2, the box is divided into two parts, the lower holding the switch and the terminals for the wire, and the upper part consisting of a shallow recess into which the thumb screws on the inside of the lever project. In the back of the box, behind this upper recess, is a magnetic blow-out, which breaks the arc formed when the fuse is blown.

New Instantaneous Switches.

The accompanying cuts illustrate a switch for use on railway and high tension circuits.

The cross bar instantaneous switch of the General Electric company is the latest high voltage instantaneous device and has its contact blade at right angles to the actuating lever. The terminal clips are placed opposite to each other, but widely separated, and the circuit closes as soon as the cross bar simultaneously enters both clips. This cross bar is loosely supported in the paws of the lever by two steel pins, and a small steel spring serves to press the bar against the lever so that it will enter the clips truly, and make full and easy contact with both inside faces of the clips. The snap or instantaneous action of the switch is obtained by means of two strong spiral springs, which are attached both to the handle and the lever. The movement downward of the handle distends the springs to that point of tension which compels the obedience of the lever, and the cross bar flies out from the clips breaking the circuit at two points, and reducing the possibility of arcing to a minimum. When the switch is fully opened



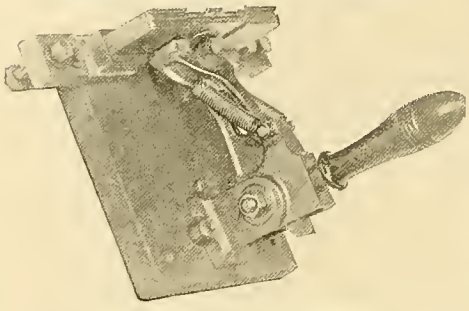
NEW INSTANTANEOUS SWITCHES.

a catch spring retains it in position, and an accidental closing of the circuit is rendered impossible; this small spring also serves to give a snap action to the switch when the circuit is made.

The principal novel points in this switch are considerable distance between the clips, an absolutely instantaneous breaking of the circuit and a perfect, flexible and frictional contact. The smaller sizes have the cross bar in a single piece; those of larger capacity are provided with a double bar as shown in the cut.

Electrical Lightship.

A new lightship of a novel construction has arrived at the Light House Department docks, Thompkinsville, S.

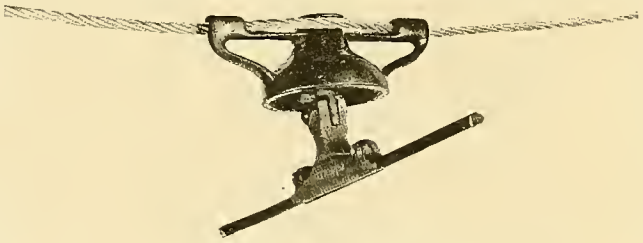


NEW INSTANTANEOUS SWITCHES

I., from West Bay City, Michigan, where she was built, says the *New York Herald*. The new vessel is known as Lightship No. 51. She is the first of the four for which the government has contracted. She will be stationed on Cornfield Point. She is 118 feet long, 13½ feet depth and has a displacement of 350 tons. The lights throughout will be generated by electricity. The flash signals will be regulated automatically from the engine room. She has also a fresh water distilling machinery of a capacity of 1,000 gallons per day, and has five water tight compartments. The peculiarity of the new vessel is a 16-inch hawser pipe through the center of the stem at an angle of forty degrees, which enables the vessel to ride at anchor more easily and also reduces the strain. She is fitted with propeller and machinery and is capable of steaming about nine knots an hour.

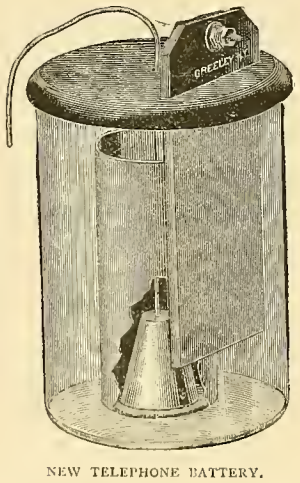
Wood's Trolley Wire Clamp.

No little difficulty has been experienced by electric railway builders in securing the numerous small devices needed



WOOD'S TROLLEY WIRE CLAMP.

in first class construction of a sufficiently perfect model to eliminate aggravating annoyance. The larger matters have received the careful attention of expert designers, while too often the little details have in a manner shifted



NEW TELEPHONE BATTERY.

for themselves, not infrequently finding a common level in the scrap pile after a brief use. Time and experience is changing this, however, and such things as pole-rachets, strain-insulators and trolley-hangers are getting their share of attention. A recent improvement in the last named class is shown in the illustration of Wood's trolley wire clamp. It is of the simplest possible construction and seems to have been planned with the purpose of making it a universal clamp; it will hold any size of trolley wire and can be used in connection with any of the usual insulating bells. It offers no projections or blunt corners to cut and wear the trolley wheel. It is made by the Electrical Supply company, Chicago.

New Telephone Battery.

The accompanying cut illustrates a telephone battery especially adapted for use in cities where telephones are almost constantly in use and on long distance lines, over which extended conversations are held. The main features which place this type of Fuller battery in the front rank are its high efficiency, durability and uniformity of strength. The E. S. Greeley & Co., New York, are exploiting this battery.

Change-over Switch.

The switch shown in the cut has been devised for use as a main switch on installations provided with independent or isolated dynamos and at the same time connected with the street service.

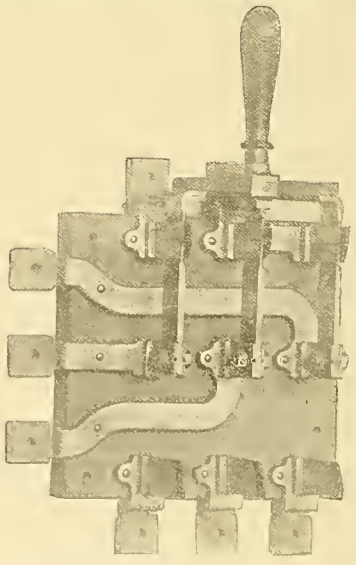
The switch is mounted upon a slate base. Three connecting wires are arranged crosswise between the two sets of side contact clips. To these bars are hinged three switch blades, having a common handle, which can be

FIG 2. COMBINED SWITCH AND FUSE BOX FOR RAILWAY LIGHTING CIRCUITS.

thrown into either set of contact clips. Two of the clips on one side are connected, and it is on this side that connection is made with the main wires of the isolated plant, which must be wired according to the three wire system.

It is necessary that the neutral wire which is brought to the central connecting bar of the switch should be of larger sectional area than usual. When the lights are being run from their own isolated plant the neutral wire acts as the positive conductor, the two outside wires serving as the negative. Thus, when the isolated plant is shut down and the street service thrown on, the building is lighted on a true three-wire system.

The advantageous uses to which this switch can be put are numerous. In factories having isolated electric plants the operation of the boilers, engines and dynamos after whistle-blow, when part of the force is working overtime, would be extremely costly. Connection with the street service is therefore made, the switch illustrated thrown over from the isolated surface, and the factory lighted on an economical basis. The switch can also be used as an emergency or break-down



CHANGE-OVER SWITCH.

switch in case of injury to the isolated plant. In theaters and other public institutions where a sudden extinction of light would inevitably cause a panic, it is a moment's work only to switch on the current from the street and avert disaster. The device is placed on the market by the General Electric company.

The first electric car in Bozeman, Mont., was run last month.

CORRESPONDENCE.

New York Notes.

NEW YORK, Aug. 13.—It is now asserted that the Broadway cable line will be in full operation by January 1st. The track from Central Park to Bowling Green is practically completed, there being only a few unfinished stretches here and there, that all together do not amount to 100 yards. The power house at the eastern end of the company's property, at Sixth avenue and Fiftieth street, is finished outside and the boilers are now being set. The interior work and the setting up of the engines may be accomplished in a few weeks. At Houston street the first floor is already laid, and as far as the operation of the cables is concerned, this is sufficient, as the basement of the buildings alone will be required for the engines and boilers. The auxiliary power house at No. 11 Front street, which will drive the cable around Battery Park, will not be needed until the others are completed, and consequently will be finished last. President Crimmins, who is the contractor for the work as well as president of the company, in speaking of the trouble and care expended in building the road, said that when finished it would undoubtedly be the best system of its kind in the country. At all of the power stations double the number of boilers needed will be put in, and duplicate engines will be set up side by side. It is not the intention of the Broadway Syndicate to wait until the whole road is completed before operating any of the new cars. Between Thirty-seventh street and the park the cable will be used as soon as the Fiftieth street power house can be finished and the cable laid. This will be some time in the fall and will be a training ground for drivers. Passengers will be transferred at the corner of Thirty-seventh street. President Crimmins lays great stress on the fact that the power house machinery is supplied in duplicate, but does not explain of what assistance that would be should the cable break or a grip become jammed in the slot.

Notwithstanding the claim of excellence there is no indication that New Yorkers are waxing enthusiastic over the new cable line. In an editorial on the "Propulsion of Street Cars" the *Times* says: "It is almost as evident that the coming motive power for street cars is to be electricity as it is that horses are to be superseded. The application of electricity to propulsion is in its infancy, and improvements are being made constantly. It has been our opinion that the adoption of the cable system in this city was a mistake, but on the lines that have adopted or decided upon it it will hold its ground probably for many years, because the plant and equipment are costly, and the operating expenses after it is once established comparatively light." If the *Times* means to intimate that the operating expenses of cable lines are light as compared with those of electric railways, it would be interesting to know where it procured the data on which the assertion is based. Farther on in the same article the *Times* practically admits that the only "insuperable" objection to the overhead system is its unsightliness. The relegation of the "danger" cry to the background is encouraging, and there is hope that the press of New York will yet discuss the one question involved fairly. That question is whether the people of New York shall be deprived of the best known system of rapid transit for surface railways in cities in deference to an esthetic sentiment.

A number of men were injured at Ogden, N. J., yesterday by the collapse of a large building under process of construction for the New Jersey & Pennsylvania Ore Concentrating company. This company, whose central office is in New York, was organized two years ago by Thomas A. Edison, and a plant was erected on the site of an abandoned mine in Ogden, where the Edison magnetic ore separator was put to work. The ore as taken from the mine is run through enormous crushing machines and then into the separator, where immense magnets extract the metal. It was for the crushing operation that the collapsed building was being erected. Mr. Edison, who spends much of his time at the works, personally superintended the work of rescue.

Recent thunder-storms did much damage in the southeastern portion of New York state and in northern New Jersey.

From Wall street it is reported that Western Union stock has gone quietly up to 99, the highest price the stock has ever sold at since the company passed from the control of the Vanderbilts to Mr. Gould and his American Union was consolidated with it. If the company increases its dividend, as there is some talk of its doing, it will sell some points above par. General Electric stock has also advanced.

W. F. O.

Milwaukee, Wis.

MILWAUKEE, Aug. 13.—The trouble between the city of Racine and the Wisconsin Telephone company in regard to telephones to be furnished to the city has been settled. A. B. Ferdinand, of Oshkosh, the new manager of the Racine exchange, has taken charge of the office. The system has been thoroughly rebuilt and a new office on Main street leased. The improvements at Racine cost $20,000.

The plans for the mammoth packing house plant which Cudahy Brothers intend to build at Cudahy, formerly Buckhorn, a few miles south of Milwaukee, include an electric light plant that will supply 2,000 incandescent lamps for inside illumination and 20 arc lamps for outside use.

The Board of Public Works found that the West Side Railway company's track on Wells street did not conform to the established grade in many places. The street is being paved. An exact profile of the road was made and the company was ordered to conform to the grade.

The Western Union Telegraph company has about completed the work of putting up aerial cables in the alleys throughout the business portion of the city. As rapidly as the cables were strung and the connections were made, workmen removed the old wires and the poles were cut down for use elsewhere. The telephone, police and fire alarm wires were put underground some time ago, in the business section, where there are now very few wires in the air.

The Sheboygan City Railway company has laid additional tracks so that its system now consists of about six miles of road. In the near future, it is anticipated, electricity will supersede the horses.

It is promised that the new electric railway at Racine will be ready for use by September 1st.

As might have been expected, the plan of holding an electrical exhibit in Milwaukee next year, as a World's Fair attraction, has fallen through. Mr. Stewart of this city, suggested the matter, claiming that electricians were dissatisfied with the space allotted to them at Chicago and that an exhibit might be arranged at the exposition here that would excel the World's Fair exhibit. Manager Trumpff, of the exposition wrote to some twenty manufacturers throughout the country and received only three responses, which, moreover, stated that there was no serious discontent with the World's Fair management. A letter from Chief Barrett helped to give the Stewart plan its quietus.

The Common Council has granted the Milwaukee Street Railway company the privilege of extending its tracks on Sixth avenue, in the Eighth ward, the Fourth avenue tracks to be taken up when the extension is built. The council has ordered the Chicago & Millwaukee Telegraph company to remove its wires and poles on Broadway, south of Michigan street and has directed the Milwaukee Street Railway company to tear up its unused tracks from the corner of Huron and East Water streets to the Union Depot and on First avenue from National avenue to Florida street.

The Superior Street Railway company has announced its intention to build ten miles of electric railway in that city this season. Six miles will be laid on Tower avenue, one and one half miles on Broadway as well as to the steel plant, and a mile of double track from the West Superior Hotel to Twenty-seventh street.

Hans Jacobson, a member of the fire department, was seriously injured recently. In jumping off an electric car, he struck a pile of dirt and rolled under the car.

The Milwaukee & Wauwatosa Motor line, which is now in operation, will be extended to the state fair grounds at once. Cars will be running on the extension by the time of the fair next fall.

A new electric light plant is talked of at Neenah and Menasha—the Twin Cities.

The Milwaukee & Layton Park Street Railway company has filed articles of incorporation in the office of the register of deeds. The incorporators are F. T. Day, president of the Plankinton Bank; William Sanderson, of the Sanderson flour mills, and Charles L. Clason. The capital stock is $10,000. The company proposes to build an electric railway from the terminus of the Villard system to Layton Park. The distance is about a mile. Although an independent line, the cars of the Villard syndicate will run over it. Layton Park is a populous and growing suburb and the new line will connect it directly with the city. Cars will be running on the new line, it is expected, by October. The incorporators own property at Layton Park and are men of wealth.

After several weeks delay the West Side Railway company and Contractor James O'Donnell submitted their dispute about the work on Wells street to arbitration and it was promptly settled. It was in this case, it will be remembered, that the railway company secured an injunction restraining the contractor from "unnecessarily interfering" with the running of its cars. The contractor promptly stopped work altogether and there the matter rested for some time. The arbitrators finally elected were Isaac Ellsworth, formerly owner of the old Milwaukee City railway, and Major George P. Troemner, ex commissioner of public works. They decided that the company should pave the street inside and a foot outside of its tracks, the contractor to furnish the blocks. Both parties accepted the decision of the arbitrators, the suit instituted by the company was discontinued and work was resumed last Monday morning.

The Milwaukee Street Railway company has completed the construction of a double track at the intersection of North, Murray and Farwell avenues. Some months ago, when the company attempted to put down a double track at that point, Cornelius Dean, who keeps a saloon on the corner, secured an injunction. The company agreed to pay him a stipulated sum, in case its track would encroach on his property. Instead of putting a double track then, however, the company put down a single track past the property and provided it with switches so that the cars going either way could get on to their respective tracks without difficulty. A double track was found to be desirable, in the end, and the company has just paid Dean $800 for the privilege.

Electric cars are now running on the Bay View line proper, via East Water street bridge. On this line the Forest Home cars are being hauled as trailers by the Bay View electric cars between Mitchell street and the intersection of Pleasant and East Water streets. The Forrest Home cars are hauled by animals only on Mitchell street and Forrest Home avenue and Brady and Racine streets. The electric road on Reed street and Greenfield avenue, from National avenue to Twenty-second avenue, has been opened, so that cars are now running the entire length of the Third street and Greenfield avenue line. The work on Brady street is to be completed as soon as possible and cars will soon be running from Forrest Home to the terminus of the Whitefish Bay Dummy line, via Cambridge and North avenues.

Children, especially boys, court the danger which the electric cars threaten. On Third street a motorman found a little boy, who had climbed an electric railway pole and was climbing out toward the trolley arm, with another boy following him. The motor man stopped his car and compelled the boy to climb down at the same time threatening to chastise him. The boy's mother, turned on the motorman and threatened to have him arrested if he touched her son. On the Russell avenue line, at the North-Western Railway viaduct, small boys have been amusing themselves by standing on the track and seeing how near the cars would come and yet allow them to escape. Some of the cars had to be stopped, while a slip or the breaking of a rod might have caused death, as there is quite a grade at that point.

C.

St. Louis, Mo.

ST. LOUIS, Aug. 13.—Ernest D. Martin, mayor of Marshall, Mo., advertises that the city is ready to receive proposals for electric lighting. A franchise will be granted for a term of five years, and a city lighting contract for one year.

Over 75,000 gas and incandescent electric lamps will be used on the streets of St. Louis in connection with the extensive plan of ornamental illumination now being prepared by the Autumnal Festivities association.

For some time the city authorites in St. Louis have had great difficulty in getting the Municipal Electric Light & Power company to erect and maintain additional arc lamps under its contract of $74.50 per year for all night and every night lighting. Particularly has this been the case in remote districts where new circuits were required. It now appears that efforts in that direction have been abandoned as the supervisor of city lighting has recently ordered incandescent lamps of 30 candle power erected on the streets. These are furnished by the Laclede Gas Light company, using the Heisler system, and the Missouri Electric Light & Power company, using the Westinghouse. These companies now light all the alleys in the city.

At Greenville, Ill., the recently formed local company, has a large force of men at work erecting pole lines.

The Claytoo & Forest Railway company has been granted its revised franchise by the county court of St. Louis county. The city council of St. Louis has approved its bond for $15,000. It is therefore in shape to begin work at once.

William J. Phelps, of the Chicago office of the Brush Electric company spent several days last week in St. Louis, and Southern Illinois.

The Alton & Surburban Street Railway company which

proposes to build an electric street railway at Altoo, is making efforts to have the $5,000 bonus renewed for placing its lines on State street. It is proposed to have the line in operation by January 1st. The company has purchased the Wise tract of land, and has notified the present occupants to leave at once, as it proposes to erect dwellings on the property.

The Edward Thomas Electric Railway company which has a franchise for operating on the principal streets in Belleville, Ills., and which proposes to extend its lines to East St. Louis, now has a force of men doing preparatory work near the glass works.

The Chicago & St. Louis Electric Railroad company has purchased, for the sum of $80,000, the coal shaft at Edinburg, Ill., and the surrounding land. It is said that one of the two power stations will be located at this point.

The ordinance now in effect granting the Jefferson Avenue Street Railway company the right to change its motive power to electricity, or, as it has been expressed, "from, mule to fuel," is evidently not satisfactory. A new bill has been introduced into the assembly, granting it this right and also the privilege of building new lines on certain streets in the northwestern section of the city.

E. Sweeney of the City Central Railway company, which is before the Municipal Assembly asking for a franchise to build an electric railway over a number of busy streets, has offered to pay to the city the entire cost of the Eighteenth street bridge over the railway tracks in the Mill Creek Valley. He further offers to deposit at once with the city treasurer $10,000 as evidence of good faith, the amount to be forfeited if a good bond is not given within sixty days from the passage of the ordinance. The franchise is considered a very valuable one.

Active work is in progress on the consolidated Cass avenue lines preparatory to changing them to electricity. Several hundred men are at work relaying the tracks of the Union line. Rails, ties, fastenings, wire and other material are coming in large quanties, and are being distributed over the line. No definite electrical system, or plan of power plant, has yet been adopted.

East St. Louis, is rapidly coming to the front as an electric railway city, and bids fair to soon occupy as prominent a place in this respect, relative to population, as its big namesake across the bridge. The roadbed of the Edward Thomas railway has already been graded to Belleville, a distance of fourteen miles, and it is expected that the road will be completed next spring. A branch of the present East St. Louis line will connect with the Thomas road near the Little rolling mill. Senator Stephenson, president of the St. Clair County Turnpike association, also talks seriously of building an electric railway between East St. Louis and Belleville. This company owns the most desirable route, viewed from the point of prospective patronage. Still another electric line for which active preparations are being made will extend from St. Clair avenue to Lansdowne Heights.

The Detroit Electrical Works have begun suit at Galveston, Texas, against the Galveston City Railway company, which recently adopted the Detroit company's system of electrical propulsion, for $38,002.91, for obligations alleged to have been entered into by the street car company. The latter claims that the Detroit company, erected an inferior plant instead of a first-class one, as provided in the contract.

The following new bills for electric railways in St. Louis, were introduced into the Municipal Assembly during its closing meetings: The Independent Loop Railway company wants to build a single track line from Sixth and Lucas avenues, south to Chestnut, east to Third, north to Lucas, and thence west to the point of starting. The bill authorizes any other line to use the same tracks on payment of a fair proportion of the cost of interest and maintenance. This line would no doubt prove a profitable one as it traverses the most thickly populated parts of the city.

The Forest Park & Bridge Railway company desires to construct a double track line from Third and Cass; south to Washington avenue; west over the Lindell electric tracks to Grand avenue, north to Delmar, west to King's Highway and Manchester road; also a branch north on Newstead avenue, from Delman to Pope, on Pope from Newstead avenue to Florrisant avenue, thence northwest to the cemeteries. This bill was vigorously opposed in the council on account of the apprehension of damage to the boulevards which the line crosses.

The Sportsman's Park, Cemeteries and Madison Railway company desire to construct a double track road from Tenth and Washington avenue; north to Lucas, West to Twelfth, north to Mullanphy; west to Twenty-second; north to Dodier, west to Jefferson avenue, north to Herbert; west to Prairie. A branch from twentieth and Herbert runs north to Florrisant avenue, thence to Terry to Grand, to Guy, to Rosalie, to Newstead. Another branch from Florrisant and Angelica runs east to Second, to Terry to water works reservoir, where there will be a 400 foot loop.

All these measures, together with those already before the assembly, and referred to in this correspondence heretofore, will be taken up for final consideration immediately on the re-assembling in September. They indicate great activity in the direction of increased electric railway facilities in and around St. Louis.

B.

Kansas City, Mo.

KANSAS CITY, Aug. 13.—The city council of Argentine has adopted a resolution to appoint a committee to investigate the affairs of the Argentine Water & Electric Light company, and determine if the company has complied with the terms of its franchise, by which it agreed to spend a certain sum of money in improving its service.

A suit was filed yesterday in the District Court of Kansas City, Kan., which brings to public notice the troubles that have long been brewing in the West Side Electric Street Railway company. The suit is entitled W. S. Nelson against W. N. Coler and others, and is brought for the specific performance of a contract bearing date of May 20, 1891. A certified copy of the contract is attached to the petition. By this contract W. N. Coler & Co. agreed to convey to W. S. Nelson one-fifth interest in the lands received from E. M. Lambkin, the contractor who built the electric road, also to transfer to Nelson $25,000 in shares of the stock of the Electric company, as well as to surrender a note for $1,000 held against Nelson. In return for this Nelson was to release Coler & Co. from all claims for past services performed and deliver to the company the West Side electric street railway.

Nelson claims that his work has been performed, that he secured the resignation of all the directors of the West Side Electric Railway company who were unfriendly to Coler & Co., and secured a board satisfactory to them, and also secured the election of W. N. Coler, Jr., as president of the company. The land in question is a tract of twenty-eight acres called Brown's Park, established to bring revenue to the street railway company. W. S. Nelson is the largest individual holder of original stock in the company, but his relations with the new directory have been unpleasant. This lack of harmony in the company has three times prevented sales of the electric road. If the present suit brings the troubles to an end, the company will probably be reorganized, and the West Side electric street railway will pass into other hands.

The mayor has just approved an ordinance requiring electric light companies furnishing arc street lights to the city to suspend each lamp from a mast arm, projecting twelve feet from the post. The ordinance met with considerable objection from the Kansas City Electric Light company, which furnishes the city with about 190 arc lights. The company made the claim that a safe and reliable mast arm had not been devised, and that the erection of mast arms on all street posts would greatly increase the danger of accidents. The company will probably comply with the ordinance, however, and erect the mast arms on all posts as soon as possible.

R. E. T.

Concord, N. H.

CONCORD, Aug. 13.—At last the long talked of plans for the development of the water power at Sewall's Falls near this city have materialized, and contracts have been signed for the hydraulic work. The construction is to be completed by November 1st. Ground has already been broken. The power will be transmitted to the city electrically. It is intended to have the station ready to start when the water power is ready. Contracts are being made to furnish current for light, heat and power, from November 1st.

The street railway company has added several new open cars to its summer equipment and has also purchased a beautiful park and base ball grounds in the suburbs.

The Northern Electrical Supply company has lately been incorporated with the following officers: President, T. L. Hoitt; treasurer, N. E. Martin; manager, Wm. B. Ross; agent, H. J. Lowell; superintendent, G. P. Warde. This concern will handle all kinds of electrical goods for house and station use.

A. B. C.

Among the indictments returned by the recent grand jury in Chicago was one against James O'Rourk and William Duffy for the alleged tapping of the wires of the Western Union company. The men were linemen for the Telephone company, and, it is said, tapped the Garfield Park wire on Kinzie street and ran a connection into a house at No. 102 North Francisco street.

PERSONAL.

W. A. Childs, president of the Law Telephone company, of New York, left last week for a three weeks' vacation at the Thousand Islands.

F. A. Baux, Chicago agent of the Mather Electric company, returned on Monday last from a very successful business trip to Minneapolis and St. Paul.

G. Siebert, of New York, left last week for Hanau, Germany, where his platinum works are located. Mr. Siebert expects to be gone about five weeks.

J. A. Wright, late manager of the Federal Telephone company of Montreal, was in New York last week, during which time he visited a number of his friends.

John M. Palmer, U. S. senator from Illinois, has been elected president of the Inter-Ocean Electric company, Chicago, an organization formed to exploit a writing telegraph system.

General Manager E. L. Smith, of the Crown Electric Manufacturing company of Bridgeport, Conn., was a visitor at the New York office of the WESTERN ELECTRICIAN last week.

Geo. A. Redman, formerly superintendent of the Brush Electric Light company of Rochester, N. Y., has been appointed general superintendent of the Rochester Gas & Electric company, which is the name adopted by the consolidated electric light and gas interests of the city.

NEW INCORPORATIONS.

E. G. Bernard company, Troy, N. Y.; capital stock, $15,000; to manufacture and use electrical and other machinery.

Oak Cliff Water, Light & Power company, Oak Cliff, Tex.; capital stock, $100,000; to supply light and power by means of electricity.

Maroon Water, Light & Power company, Aspen, Colo.; capital stock, $250,000; to furnish light, heat, water and power to the people of Aspen, Colo.

California Land & Stock company, Seattle, Wash.; capital stock, $300,000; to operate water, gas and electric works, etc.; First National Bank, Olympia, Wash.

Commandoer Water Power Electric company, Milwaukee, Wis.; capital stock, $10,000; to purchase and control certain United States patents; C. K. Pier, Milwaukee, Wis.

Sperry Electric Railway company, Cleveland, O.; capital stock, $250,000; managing electric street railways and manufacturing electrical supplies; J. H. Hough, Cleveland, O.

Electric Current Regulator company, Manchester, N. H.; capital stock, $9,000; to manufacture and sell devices for regulating electric currents; F. C. Trombly, Manchester, N. H.

Red Cloud Power company, Red Cloud, Neb.; capital stock, $60,000; to purchase and erect elevators, mills and manufactories, and sell water and steam power and electric current.

Campania de Tranvias Electricas de Monterey, Mexico, Jersey City, N. J.; capital stock, $1,000,000; to construct and operate electric railways, etc.; G. O. Vanderbilt, Princeton, N. J.

Citizens' Electric Light & Power company, Newark, N. J.; capital stock, $1,500,000; to manufacture, use and sell electrical appliances of every kind; Leon Abbett, Jr., Hoboken, N. J.

People's Electric Light & Power company, Jersey City, N. J.; capital stock, $1,000,000; to manufacture, use and distribute electricity for electric light, etc.; Leon Abbett, Jr., Hoboken, N. J.

Portland General Electric company; capital stock, $4,250,000; generating, making, transmitting, furnishing and selling electricity for the purpose of lighting and power; P. F. Morey, Portland, Ore.

Ice, Light & Water company, Marble Falls, Tex.; capital stock, $25,000; supplying water to the public; to manufacture and supply electricity for all purposes, etc.; A. R. Johnson, Marble Falls, Texas.

Point Marion Electric Light & Power company, Point Marion, Pa.; capital stock, $10,000; supplying light, heat and power by electricity to the town of Point Marion, Fayette County, Pa.; S. L. Mestrezat, Uniontown, Pa.

Missouri Water & Light company, Kansas City, Mo.; capital stock, $2 000; to furnish the city and citizens of Carrolton, Mo., with water, gas and electricity; Trimble & Braley, Seventh and Wyandotte streets, Kansas City, Mo.

Rochester Gas & Electric company, Rochester, N. Y; capital stock, $4,300,000; this is a consolidation of the Rochester Gas company and the Edison Electric Illuminating company of the city of Rochester, N. Y., with the Rochester Electric Light company, adopting the above name.

Acme Storage Battery & Manufacturing company, Jersey City, N. J.; capital stock, $5 000,000; to lease and sell the patents, patent rights, applications for inventions and improvements applicable to storage or other electric batteries; Waller, Cook & Wagner, 15 Wall street, New York, N. Y.

Municipal Engineering & Construction company, Orange, West Haven postoffice, Conn.; capital stock, $3,000; to build, equip, develop, own and operate all kinds of works of internal improvements public or private; water,

gas and electric works, railways, bridges, etc.; H. Hungerford, Secretary, West Haven, Conn.

American Electro Enamelite company, Chicago, Ill.; capital stock, $250,000; to manufacture, buy, sell and lease electric heating apparatus, devices, etc., using enameled conductors, etc.; James S. Cummins, 173 Adams street, Chicago, Ill.

Union Railway & Electric company, Everett, Wash.; capital stock, $200,000; manufacturing, producing and selling electricity, steam, gas, compressed air, etc., furnishing light, heat and power; owning and operating street railways, and dealing in railway equipment of whatever nature; Brown & Brownell, Everett, Wash.

ELECTRIC LIGHTING.

An effort is being made to secure an electric light plant for Shell Lake, Wis.

The Chicago Edison company has certified to increase of $500,000 in its capital stock.

The Asheville Street Railway company and the Asheville Light & Power company, of Asheville, N. C., have purchased the Reem creek water power near Asheville, and will utilize it for operating their electric light and power plants.

The Providence, R. I., common council has indefinitely postponed a resolution introduced in that body, asserting "that it is expedient for the city of Providence to produce and distribute electricity for lighting all of its street and highways."

The proposal to light Rome by electricity generated by the Falls of Tivoli has at last been carried into effect. Six turbines of 2,000 horse power have been erected, which are capable of driving dynamos of sufficient capacity to light the streets and public buildings. The current is carried across the Campagna for fifteen miles and through step-down transformers at a loss, it is said, of only twenty per cent. of the electromotive force.

The Australian *Building and Engineering Journal* says that the poll on the electric light for Launceston was supported by the municipal council and opposed by the gas company, both sides canvassing vigorously. The scheme had to secure a two-thirds majority before being undertaken. The result was—for the scheme 2,172, and against it 690. The council will immediately carry out K. L. Murray's scheme, the requisite £45,000 being borrowed locally.

The new station of the Pawtucket, R. I., Gas & Electric Light company has eight boilers of 150 horse power each, one 600 horse power engine, one 800 horse power engine, two high speed engines of 100 horse power each, ten 50 light dynamos for arc lighting, two generators of 130 horse power each for street railway work, one 1,350 light and one 600 light alternator, one 130 horse power generator for motors, and one 400 and one 200 light dynamo for direct current incandescent lighting.

As a result of the recent contest for the Minneapolis electric street lighting contract, B. L. Ames, of the Western Electric company, sent a communication stating that his company was unable to bid on the original specifications for electric lighting, but if allowed to submit a bid, would guarantee to furnish 1,000 lights of 2 000 candle power, to burn all night and every night for five years, at a cost not to exceed $185 per light per year, and at the end of that time would turn over the entire plant to the city for a consideration of $1.

ELECTRIC RAILWAYS.

The Bristol, Tenn., Belt Line Railway company will expend $50,000 on extending and improving its electric railroad.

The Tampa, Fla., Street Railway & Power company has applied to the city council for permission to extend its tracks. It contemplates changing from steam to electric power some time during the coming year.

The Detroit Electrical Works is seeking a franchise for an electric road in Oshkosh, Wis., but the Wisconsin Telephone company is opposing the project, alleging that its service will be impaired.

An ordinance has been introduced in the Oakland, Cal., council to provide for the substitution of electric power for horses or mules in running street cars on Webster, Water and Broadway streets, under franchise for a street railroad granted to the Alameda, Oakland & Piedmont Railroad company.

A German company has asked the minister of commerce for a concession to convert the Baden steam tramway into an electric line. It is proposed to extend the line, and also to connect the stations of Baden and Voslau. The generating stations would also be arranged so as to supply current for the electric lighting of the town.

The El Paso, Tex., Street Railway company is said to be completing arrangements for equipping its lines with electricity, and the Santa Fe Street Railroad company of the same town has been granted permission to operate its lines by electricity. This, with the road to be built by the El Paso Electric company, will give the city three electric railroads.

In consequence of the bad condition of the road bed, the cars of the electric railroad between Newark and Orange, N. J., are continually running off the tracks, and great inconvenience is experienced in consequence. The road is being rebuilt in East Orange, and it is hoped that the annoyance will cease as soon as the work is completed. There is, however, a great lack of cars on the road, and in the busy hours of the day it is said that the accommodations are inadequate.

A resolution is pending in the Mount Clemens, Mich., city council to grant a franchise for a street railway on Gratiot street, conditioned on connecting Mt. Clemens with Detroit within six months. The Gratiot Street Railway company asks for the franchise.

About midnight on August 11th an Eighth avenue electric car and a Circle railroad train came into collision at South Water street, Denver, Colo. The motor man of the electric car, W. C. Seizinger, was the only one injured. He had both legs torn off and will die. The collision was caused by the motor man disobeying instructions.

"The new electric cars have awakened a new interest in electricity," says the Fairfield, Me., *Journal*, "and the whys and wherefores are discussed more than ever. No one has yet been found who can explain why the car moves when the juice is turned on at the front end of the car. 'Because it does,' is the safest and most satisfactory explanation to make if any one asks you."

It is reported that all the employes of the New Haven & West Haven, Conn., Electric Street Car company are likely to strike for shorter hours. The company was the first to introduce electricity as a motive power in New Haven and employs about eighty men. Some of the men are working sixteen hours a day at present, but the officials claim that this is due to the fact that the road is not yet thoroughly organized since putting in electricity.

The Board of Electrical Subway Commissioners of New Jersey held a meeting on August 2d, and received a number of petitions for permission to erect poles. The commissioners granted permission to the North Hudson Railway company to operate its elevated railroad from Hoboken to Jersey City by electricity. The Newark Plank Road company asked for permission to erect poles and string wires on its road between Newark and Jersey City. Permission was granted to the Trenton Horse Railway company to erect poles from Trenton to the Inter-State Fair Grounds.

ELECTRIC MINING.

A Newcastle, England, firm has recently completed a powerful electric pumping plant for the North Seaton colliery. The pumps are capable of delivering 250 gallons of water per minute through 1,300 yards of 8 inch pipe against a head of 50 feet, and are driven by an electric motor, the dynamo and engine for supplying the current being placed on the bank. The dynamo can be used for supplying current to electric lamps in the colliery when not required for pumping purposes.

TELEGRAPH.

The threatened strike of railway telegraphers on the Union Pacific railway has been averted, General Manager Dickinson having acceded to the demands of the men.

It is reported from London that there is no foundation for the report circulated in New York that the French Atlantic Cable company had made overtures to rejoin the cable pool, which it left some years ago, and cable rates were to be raised from 25 to 50 cents.

MISCELLANEOUS.

The valuable technical index of periodical literature published in the *Engineering Magazine* is now issued in separate form every month.

The Canadian Electrical Association has published the proceedings of its first convention, held in Hamilton in June, in a neat pamphlet.

The new sub-treasury building at San Francisco has an electric burglar alarm installed between the rows of bricks so that any interference with the cement or bricks will complete an electric circuit and sound an alarm.

"There is nothing so fatal to crawfish as a thunder storm," said a Washington, D. C., fish dealer to a reporter. "When I make a shipment of them to any place at a distance I always make sure the weather promises well. On more than one occasion I have had entire consignments killed on a journey by a small electrical disturbance."

The Bradley-Martins are going to have some exceedingly fine electrical attractions in their home when they get it to rights again, says the *New York Recorder*. It has been carefully estimated that about $10,000 will be the cost of the electrical apparatus and appliances which will be devoted to decorative as well as illuminating purposes in this residence.

Lebanon, Pa., was visited by a severe electrical storm on July 26th, and large number of persons felt the effects of the lightning. The *News* says that: "At the C. & L. round house two bolts, or what appeared to be a double bolt, entered the open door, flashed across the room, and crashed against the stone wall on the opposite side, throwing the sparks in all directions. James Wagner stood within five feet of the course of the bolt and was considerably shocked."

Under date of Denver, July 29th, a United Press dispatch says: At 6 p. m. last Sunday I. Hough, a laborer at Castle Rock, was driving a pin in the ground with a hatchet. The sky was clear, but a bolt of lightning rushed down from it and struck Hough. The top was taken off his hat and consumed, and the rim of his hat was split. His hair was singed all over his head, and upon the crown it was burned in the shape of a tonsure, a piece about the size of a quarter being wholly bare. A livid mark is left across his breast from shoulder to shoulder, and directly above his heart a hole was burned in his shirt. Hough did not know what struck him. He remained unconscious till 10 p. m., but then quite recovered his senses and is still alive.

A jury in Findlay, O., recently inspected a dynamo. Suit was brought by the Excelsior company against the Findlay Electric Light & Power company for the value of a dynamo sold by the former company. The defense was that the machine was unsatisfactory, and the jury was taken to look at it.

A novel experiment has been tried by the London police force in the substitution of small electric lamps for the ordinary oil bullseye lantern. The new venture is said to have proved highly satisfactory. The electric lamp weighs four pounds, and is guaranteed to give a continuous light for seven hours.

The *Chicago Tribune* reports that all the electrically regulated clocks in the down-town district of Chicago stopped at 4 P. M. on a recent Sunday. The pendulums kept on swinging and the clocks continued ticking, but the hands remained at 4 P. M. The clocks are wound up by electricity and are regulated at the end of each hour from the Western Union office. The trouble was caused by a ground on the line.

In his new book on the English factory system, Cook Taylor, the English factory inspector, expresses the opinion that a great change in the distribution of trade and industry is impending. He thinks by the use of electric motors, power is destined to be distributed in workingmen's homes and in isolated communities, which will result in the return of the laborer to his cottage and his family.

William Cassell and Solomon Richardson, colored, were killed by lightning in Highland Park, Pittsburg, recently. When the clothing was removed from Cassell's body a perfect photograph of the foliage of the tree under which the men were standing was found on his breast. Three hours later the picture began to slowly fade away. Another curious circumstance was that Cassell's legs had turned to an ashen white.

No stronger evidence of the safety of electric lighting installations can be afforded than by the fact that many gunpowder factories are now being lighted by electricity. It is obvious that in a building wherein the preparation of inflammable or highly explosive substances is carried on very special care should be taken in order to avoid even the smallest risk, and powder manufacturers now find that the electric light adds a considerable percentage over gas to the chances of safe operation.

Russia has long been the source of supply of platinum for electrical purchases. Canadian platinum has now made its way into the market, and the product promises to be large in time. It comes from British Columbia and is met with in association with alluvial gold. The Tulameen district yields it in grains and nuggets. One firm in the United States is reported to have bought 2,000 ounces within the last year or two, and another portion of the yield has been marketed in England.

Writing to the *Post-Express* of Rochester, N. Y., of recent date a correspondent says: "About 10:30 o'clock last night a tremendous explosion, which was heard all over the city, occurred at the rear of the Fraser Shorthand school, 19 Clifton street. William Fraser, who witnessed the explosion, said that a solid ball of fire seemed to leap out of the sky, and as it reached the earth, exploded with a noise like several Fourth of Julys rolled into one. Beyond frightening everybody in that neighborhood, and burning out the insulation on the electric light wires, no further damage was done."

At a recent meeting of the common council of Rochester, N. Y., a communication from John N. Beckley was read inviting a conference on the subject of placing underground conduits for electric wires in several of the principal streets. Mr. Beckley said that if the franchise was granted and assurance of patronage was obtained from the city and companies operating electric wires he and his associates would undertake to place subway conduits on part of State street, Main street, Plymouth avenue, North avenue and University avenue. The matter was referred to the electric committee.

Applied electricity is not in an advanced stage of development in rural Spain. In response to a request for information from the United States government Consul R. W. Turner, who is stationed at Cadiz, says: "Electricity is not used in Spain as a power for the propulsion of farm machinery or implements. Ninety per cent. of the farmers of this province don't know what electricity is, and not one has ever thought of using it as a force for the propagation and growth of plants, is the answer given me by the officers in charge of the agricultural interests of the province. Agricultural conditions existing here are almost the same as those of the times of Ruth and Boaz. A stick sharpened at one end serves for a plow."

TRADE NEWS.

Pepper & Register of Philadelphia report that they have recently been given several large contracts in the East for the installation of electric light plants.

The Otto Gas Engine company of Philadelphia since January 1st has placed four more engines for electrical purposes than during the previous year.

A new company to be known as the Electric Specialty company has been organized in Chicago, with office and factory at 85 Fifth avenue, for the purpose of manufactur-

ing electro-medical, dental, and surgical apparatus. Attention will be given to experimental and special work in the above lines.

California, Oregon, New Mexico and Michigan have contributed some fine orders to the Chicago office of the Buckeye Electric company, during the past week.

The Cutter Electrical & Manufacturing company of Philadelphia is compelled to run its factory overtime to fill orders for the new C. S. reflector shade and portable lamp stand.

The Novelty Electric company of Philadelphia is having a large sale of improved desk fan motors. They are full nickel plated and consist of two blades 8 1-4 inches in diameter, the height to top of guard being 15 inches.

Chas. Bockmeyer, manager of the Commonwealth Electric company, announces that his concern is in receipt of large orders for its continuous current fan motors, and is about to add new machinery to meet the increasing trade.

The Pennsylvania Electric Engineering company of Philadelphia is sending to the trade a neat little price list and a few important facts regarding the Pennsylvania lamp in the form of a little pamphlet which will be found very useful to central station men and the trade in general. The company also makes mention of its dynamos, motors and power generators, electric light and power supplies.

The Consolidated Temperature Controlling company of Minneapolis is a thing of the past, a reorganization having recently been effected, and the name changed to the Electric Thermostat company. A very handsome new catalogue has been issued, showing, in a series of illustrations, the appliances manufactured by this company for the automatic regulation of temperature in connection with any kind of heating or ventilating apparatus.

The following sales have been reported by Milton Thomas from the Chicago office of the New York Safety Steam Power company during the first ten days in August. C. J. Warren, Plaza apartment house, Chicago, 50 horse power engine; Pittsfield Electric Light company, Pittsfield, Ills., 80 horse power engine and 100 horse power boiler pumps and heaters; Thomson-Houston Electric Light company, Charleston, Ill., 80 horse power boiler. In addition to these sales estimates have been made on a large number of plants for electrical purposes, and the outlook for fall trade is reported as being exceedingly good.

The Packard Lamp company, limited, of Canada, has fitted up a commodious and complete incandescent lamp factory at 96 to 100 King street, Montreal, and is manufacturing lamps to supply the trade in Canada. The lamps manufactured are the latest type of "Packard High Grade," in all respects similar to those made by the New York & Ohio company, at Warren, O., the factory being under the personal management of J. W. Packard with F. E. Cavanaugh as superintendent. This new firm having the only independent lamp manufactory in the Dominion, making a lamp of an established reputation and being very advantageously situated as regards the supply of labor and materials should be able to command an extensive trade. The complete lamps in all their details and adapted to any base, voltage and candle power are manufactured in the King street factory.

BUSINESS.

The Page Belting company of Concord, N. H., announces the sale of several belts to electric light and street railway companies. The company has made a special feature of dynamo belts, and is building up an extensive business in this particular line.

The District Telegraph company of Little Rock, Ark., has moved its office to 307 West Markham street, and is now under the management of W. G. Brown, who is also manager of the Arkansas Electric Supply company. All the lines have been overhauled.

The Enterprise Electric company has already made, so it is reported, a number of very fine sales of N. I. R. wire. The general western agency for this wire was only secured a short time since, but its reputation is such that its introduction in the West, it appears, is to be an easy matter.

The Electrical Supply company, Chicago, reports having sold, during last month, a very large number of Stanley fan motors for alternating work, also a large number of Crocker-Wheeler motors. They are actively pushing the sale of the Wirt station indicator, which has now become well established and has been adopted by some of the large parent companies.

Albert Blanchard, for a number of years Chicago manager for the Pond Engineering company, has severed his connection with that company, and is now at room 427 Rookery, Chicago. He is prepared to furnish estimates and plans on complete steam power plants. All of the work for the Pond Engineering company done in Chicago and vicinity has been under his personal supervision, and the success of the installations is the best evidence of his ability in this line of work.

The Havemeyer building now being erected in New York city, will have an installation of over 3,000 incandescent lamps. The wiring will be done in interior conduit throughout, and the generating plant will be of the most modern type, the dynamos being directly coupled upon the shaft of the engine. The contract for the entire electrical equipment has been awarded to H. Ward Leonard & Co., New York. This concern has also secured the contract for the Betz office building of Philadelphia, in which will be between 3,000 and 4,000 lamps. The plant is to have slow speed dynamos, directly coupled on the shaft of the engine.

The Central Electric company, Chicago, has received a large stock of weather-proof wire, in double and triple braid. The company's success with the Lundell fan motor is very encouraging. Orders for interior conduit are still being received and the Central Electric company can be congratulated upon the maintanance of its large business during the hot weather.

Among the busiest manufacturing concerns in the vicinity of New York at present is the Ball & Wood company, with shops at Elizabethport. Night and day the works are driven to their fullest capacity in turning out the new improved Ball high speed Engines, and something over 6,000 horse power is at present on the floor under construction. A contract amounting to about $40,000 was closed by this company for a large steam plant recently in Western Pennsylvania. Among other large engines now building is one for Hartford, one for Waterbury, two for Binghamton, two for Bethlehem, one for Kingston, one for Geneva and three for Jersey City.

E. J. Wessels, of the New York office of the Short Electric Railway company, has recently closed an order for 30 horse power single reduction motors and a 100 horse power generator for the Syracuse, Eastwood Heights & DeWitt Railroad company, of Syracuse, N. Y. Short motors are to be used by the Hartford & Wethersfield Horse Railway company. The Collins Park & Belt Railroad company of Atlanta, Ga., is now in successful operation with two 150 horse power generators and 10 Brill cars, equipped with 20 horse power single reduction Short motors. The company is operating the two ends of its system, not having, as yet, been able to complete the line through a part of the city.

The Electric Manufacturing company of Oconto, Wis., will hereafter be represented in Illinois, Indiana, Iowa and Nebraska by Wm. Hood & Co., 239 La Salle street, Chicago. The incandescent lamp manufactured by this company is known as the "Brilliant," and a stock of ten thousand will be carried in Chicago. Mr. Hood has the exclusive agency in the four states named and the right to take such business as may be offered him in any other western states. T. A. Pamperin, general manager of the Oconto company, was in Chicago for several days during last week and closed the deal with Mr. Hood that will undoubtedly be highly satisfactory and profitable to both parties. Mr. Hood has a wide acquaintance and will undoubtedly make a success in introducing this lamp to the trade.

ELECTRICAL PATENTS.

Issued Aug. 9, 1892.

480,266. Secondary Battery Plate. Edward R. Knowles, Brooklyn, N. Y.

The plate is composed of an alloy of about 82 parts lead, 16 parts tin, 1.9 parts antimony, and 0.1 part arsenic.

480,272. Ignitor for Gas Engines. Emory I. Nichols, San Francisco, Cal.

480,284. Incandescent Electric Lamp. Paul Scharf, Vienna, Austria-Hungary.

Two tubular metallized bearings are provided upon the neck of the lamp, to which the conducting wires are soldered.

480,285. Arc Lamp. Charles Schmid, Chicago, Ill.

The carbon is given a positive feed by a mechanically suspended retaining clamp, adapted to be released by a mechanically acting trip-feed.

480,319. Electric Bell. George W. Conover, Chicago, Ill.

480,340. Burglar Alarm. Fred H. Neal and John R. Donnelly, Fairfield, Me.

An elliptical spring is placed with its convex surface in the line of motion of the door or window and adapted to close a circuit.

480,362. Motor Truck. John A. Brill, Philadelphia, Pa.

480,369. Time Cut-out for Electric Service Systems. Samuel R. Linville, Philadelphia, Pa.

The cut-out consists of a trigger, clockwork tripping the trigger, a switch for cutting out the service circuit, and a bell-crank lever connected with the switch and controlled by the trigger.

480,372. System of Electric Lighting. George F. Myers, Pittsburg, Pa.

The object of the invention is to provide means for lighting the cars of a cable railway by placing conductors in the conduit and providing trolley wheels upon the car.

480,375. Electric Lighting System. Charles Selden, Baltimore, Md.

A Wheatstone bridge is interposed in the main line wire and is arranged to supply a definite current to the translating devices connected in the bridge wire.

480,384. Galvanic Battery. Herbert H. Dow, Midland, Mich.

The battery is composed of a zinc element, a bibulous sheet moistened with the electrolyte and a layer of finely pulverized carbon.

480,392. Method of Electric Soldering. Elihu Thomson, Lynn, Mass.

The method of soldering or brazing which consists in passing a current through the bodies to heat them to the proper temperature. The first claim reads as follows:

"The herein described improvement in soldering or brazing, which consists in generating heat in the body of the piece or pieces of metal to be united, through the resistance of the material to the passage of an electric current through it, such current being of volume sufficient to develop the determinate or required soldering or brazing temperature."

480,393. Method of Electrical Regulation. Henry E. Vineing, Roseville, N. J.

A supplementary electro-magnetic regulator is provided with adjustable means in the nature of sectional coils for varying the current supply which actuates the primary regulator.

480,409. Closed Conduit for Electric Railways. Alexander L. Lineff, London, England.

The invention embodies improvements in a system in which a magnet carried upon the car induces magnetism in a pair of magnetic conductors to cause them to attract a flexible conductor carrying a current, the flexible conductor lying in a closed conduit, the current passing to the car through one of the magnetic conductors where the flexible conductor has been attracted to make contact with it.

480,411. Block Signal Apparatus. Thomas H. Patenall, Rahway, N. J.

480,470. Supporting Device for Electric Arc Lamps. John Maier, St. Louis, Mo.

480,475. Telegraph Key. Alfred E. McClaren, Joplin, Mo.

A telegraph key is adapted to be connected with any one of the wires to which the operator attends without his moving from his seat.

480,491. Electrolytic Cell. Elisha B. Cutten, New York, N. Y.

An anode consisting of carbon pencils projecting from a carbon bar is enclosed in an outer tank and the bar is enclosed in a projecting trough.

480,492. Method of Electrolytically Producing Potassium Chlorate. Elisha B. Cutten, New York, N. Y.

The method consists in electrolyzing magnesium chloride in the presence of potassium chloride and slaked lime.

480,493. Method of Electrolytically Producing Potassium Chlorate. Elisha B. Cutten, New York, N. Y.

The method consists in electrolyzing magnesium chloride in the presence of potassium chloride and magnesium oxide.

480,507. Circuit Closing and Breaking Device for Railway Tracks. Thomas H. Patenall, Rahway, N. J.

A reciprocating plunger is operated by the passing train to force a circuit maker out of engagement with one pair of contacts and into engagement with another pair.

480,525. Electric Arc Lamp. Elmer A. Sperry, Chicago, Ill.

480,539. Support for Electric Arc Lamps. Augustus Wright, Providence, R. I.

The support is adapted to bring the lamp into a convenient position for cleaning and to break the circuit through the lamp and close the circuit through the main circuit.

480,543. Electric Railway. Francis B. Badt, Chicago, Ill.

The underground transformers are connected in multiple to the primary wires, and the secondary wires are connected with plates upon the surface with which contact surfaces, carried upon the car, engage to successively close the multiple circuits through the motor upon the car.

480,546. Electric Door Opener. Louis Bates, Jersey City, N. J.

480,567. Duplex Telegraph. Thomas A. Edison, Newwark, N. J., assignor, by mesne assignments, to the Western Union Telegraph Company. Patented in England Feb. 5, 1875, No. 384; in France April 28, 1875, No. 107,859; in Italy April 30, 1875, No. 2,940 and 7,803; in Austria-Hungary June 28, 1875, No. 2,936 and No. 14,584, and in Russia May 24, 1878, 3,163.

The invention embodies the method of transmitting two distinct messages over one wire in the same direction at the same time, one by reversal of current and the other by increasing or decreasing the current strength.

480,573. Conduit for Electric Wires. Samuel H. Flagg, Providence, R. I.

A glass pipe is enclosed within a metal pipe and somewhat longer, so that the coupling forms a portion of the outer pipe.

480,575. Electric Accumulator. Giovanni Gandini, Lodi, Italy.

The electrodes are formed of a mixture of lead oxide and small pieces of carbon having a thin top layer of lead oxide and a porous partition separating the electrodes.

480,576. Method of and Apparatus for Testing Circuits for Electric Time Systems. William F. Gardner, Washington, D. C. Filed Jan. 7, 1891. Renewed July 8, 1892. Serial No. 439,416. (No model.) Patented in France Dec. 10, 1889, No. 201,080.

508,577. Clock Synchronizing Device and System. William F. Gardner, Washington, D. C.

480,644. Telegraph Transmitter. Charles Willoughby, San Francisco, Cal.

The transmitter comprises a bank of keys like a typewriter, by means of which the Morse or other telegraph alphabet can be transmitted over the line at a high rate of speed.

480,651. Electric Fuse Box. Geo. W. Baumhoff.

480,656. Telephone. James A. Christy, San Francisco, Cal.

480,673. Electric Low Water Alarm. Erneste Rothlisberger, Lima, Ohio.

480,678. Dental Engine. Charles W. Thomas, Jersey City, N. J.

The direction of rotation of the drill is adapted to be altered by two independent friction gears and independent connections between the gears and a common driving sheave.

480,681. Electrical Spool. Schuyler S. Wheeler, New York, N. Y.

480,683. Electric Push. John F. Wollensak, Chicago, Ill.

480,689. Automatic Circuit Closer for Telegraph Keys. Charles W. Bradford, Clinton, Me.

480,694. Electric Switch. Jacob S. Gibbs, Hartford, Conn.

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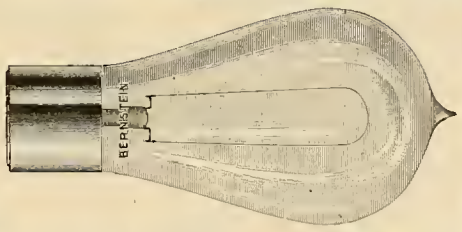

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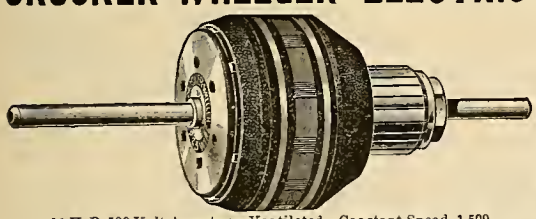

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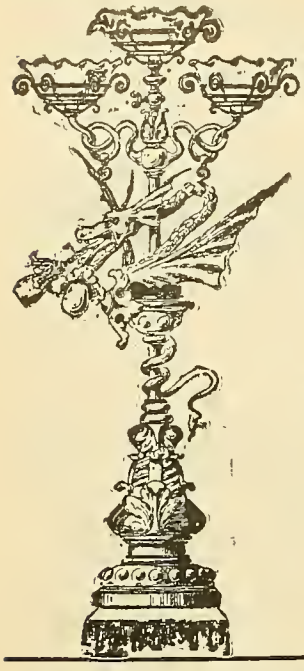

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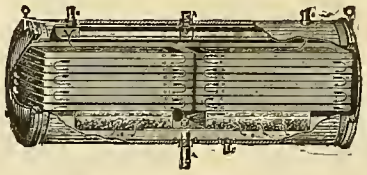

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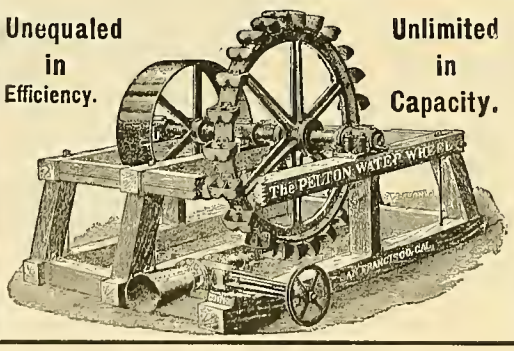

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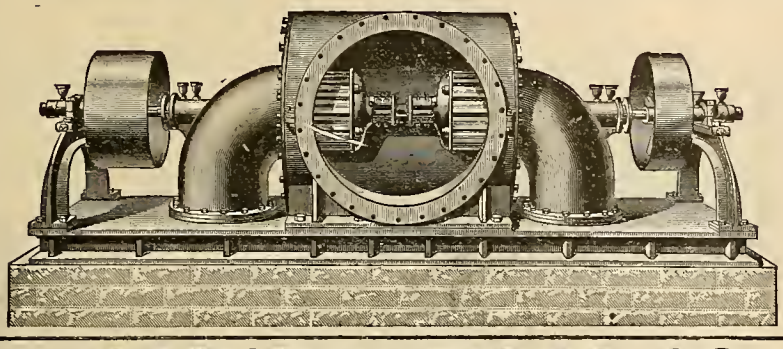

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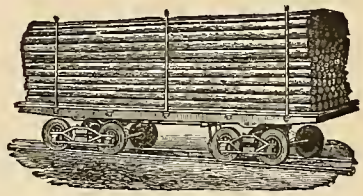

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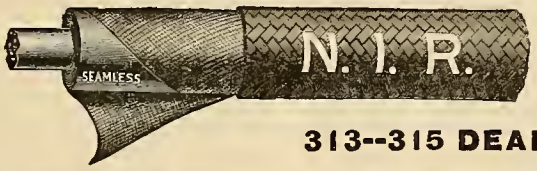

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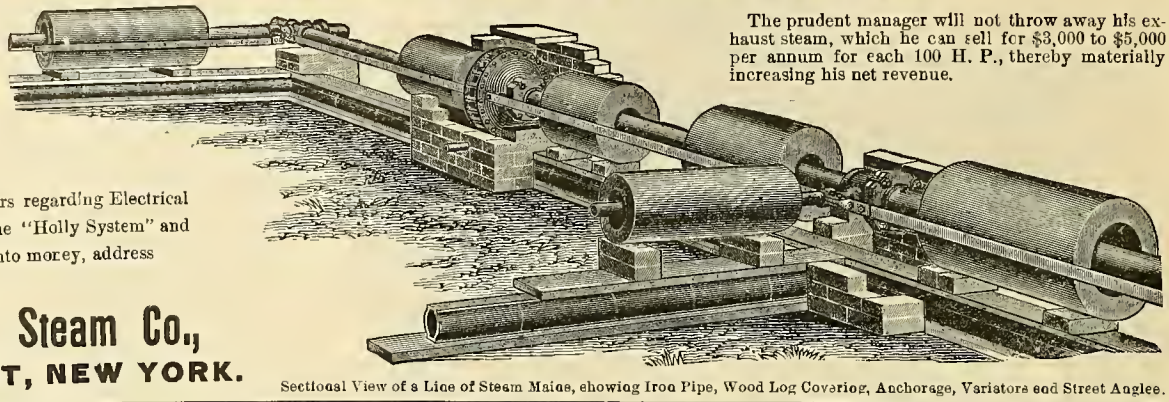

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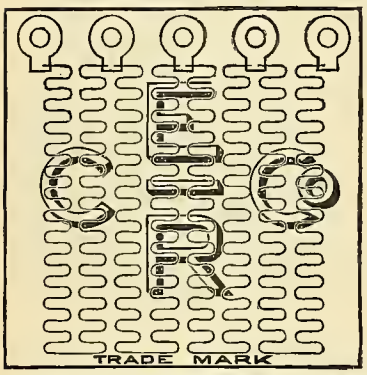

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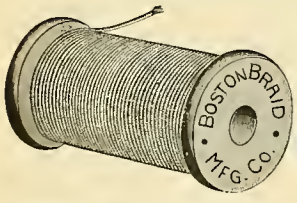

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27 Beach Street, Boston, Mass.

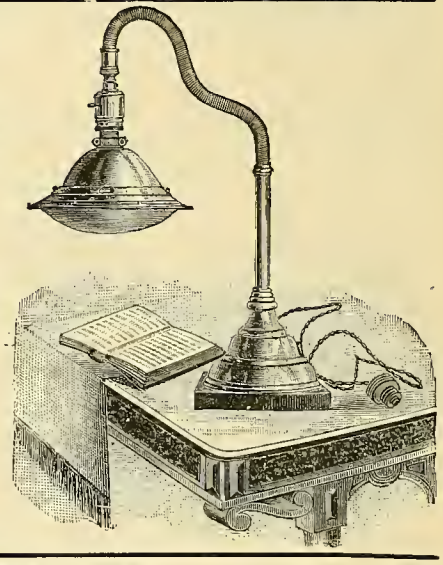
C-S SPECIALTIES.

C-S Reflector Shade.

Made of Aluminum with ground glass diffusion plate. A strong white light exactly where needed, and nowhere else. A soft white light throughout the room. Quadruples the effective light of any lamp

C-S Portable Lamp Stand.

Has flexible arm which holds lamp indefinitely in any position at will. Arm indestructible and may be curved or coiled into an endless variety of graceful shapes.



The Cutter Electrical & Mfg Company,
27 SOUTH 11th STREET,
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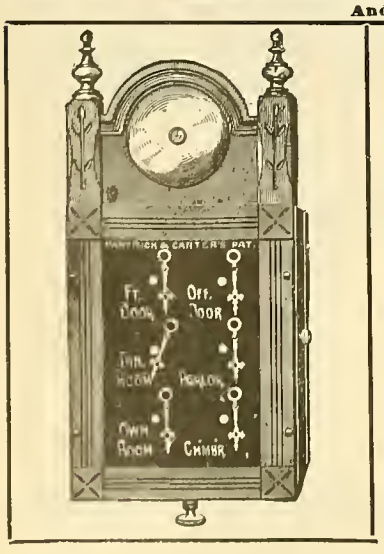
Insulating Compounds, Tape and Armature Varnish.

MANUFACTURED BY

THE STANDARD PAINT CO.,
2 Liberty St., NEW YORK.
Chicago Office: 542 "The Rookery."

SOLD BY
THE ELECTRICAL SUPPLY CO., Chicago.
NOVELTY ELECTRIC CO., Philadelphia,
PETTINGELL-ANDREWS CO., Boston
And Supply Houses Everywhere.



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FRANKLIN S. CARTER CHARLES M. WILKINS. E. WARD WILKINS.

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PARTRICK & CARTER CO.,

125 South Second Street, PHILADELPHIA, PA.

SOLE PROPRIETORS OF THE PATENT NEEDLE ANNUNCIATORS.

Manufacturers of and Dealers in all Kinds of

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Bells, Disque Leclanche Batteries, Gas Lighting Apparatus, Bronze goods and a full line of supplies for hotel and house work.

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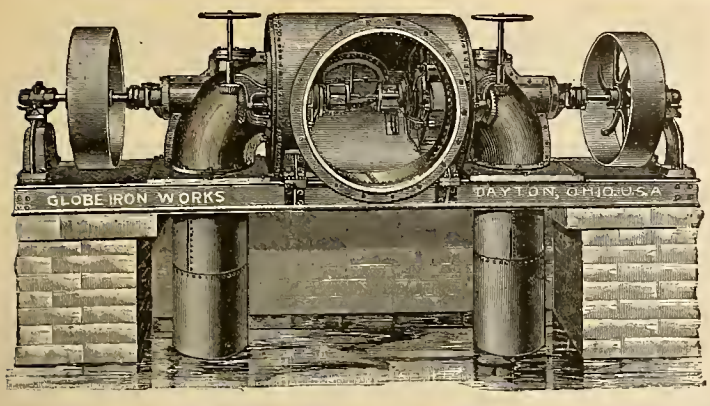

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TURBINE WATER WHEEL.

PARTICULARLY ADAPTED TO DRIVING

Electric Light and Power Stations

On account of its high efficiency at all stages of gate, steadiness of motion and easy working gate, the construction of which makes it the most sensitive to the action of a governor of any wheel on the market.

SEND FOR CATALOGUE Illustrating various styles of setting on both vertical and horizontal shaft.

THE DAYTON GLOBE IRON WORKS CO.,

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JAMES LEFFEL WATER WHEELS

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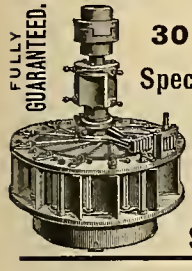

110 Styles and Sizes. Upright and Horizontal.

30 YEARS' CONTINUOUS BUSINESS
affords every facility for making them.

Specially Adapted to all Purposes and Situations, Electric, Mining, Irrigating and Manufacturing.

Plants of all kinds driven by them. Easy working gates. We guarantee highest power, with smallest quantity of water, at full and part gates; insuring easy regulation and steady motion. Successfully operating under heads of 2 to 400 feet. Write us for fine pamphlet and state your wants.

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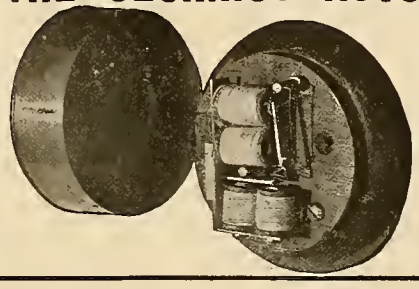

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ALBERT SECHRIST,

Manufacturer and Patentee,

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GONDA BATTERIES.

TRADE MARK

THE STANDARD OPEN CIRCUIT BATTERIES OF THE WORLD,
And the best made anywhere.
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For Iron 3 Joint Poles, Write To

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Bulk Electric Contractors
FOR
COMPLETE PLANTS

of every kind, including buildings, steam plants, water powers, electric generating plants, pole lines, underground work, road beds, bridges, motors, inside wiring, etc.

Having no agencies and no connection with any manufacturing concern, we install any apparatus and any system desired.

NINE YEARS' EXPERIENCE.

ORDERS FOR WESTINGHOUSE ENGINES

DURING JULY, 1892.

COMPOUND ENGINES.

			H. P.
Wilmington City R'y Co.,	6th order,	Wilmington, Del.,	330
Brooklyn City & Newton R. R. Co.	1st "	Brooklyn, N. Y.,	330
" " " "	2d "	" "	330
" " " "	3d "	" "	330
" " " "	4th "	" "	330
Allegheny County Light Co.,	49th "	Pittsburg, Pa.,	330
" " "	50th "	"	330
Bamford Bros. Silk Mfg. Co.,	4th "	Paterson, N. J.,	200
St. Louis Smelt'g & Refining Co,	6th "	St. Louis, Mo.,	130
Newport News Ship Building and Dry Dock Co.,	9th "	Newport News, Va.,	130
East End Electric Light Co.,	22d order.	Pittsburgh, Pa.	130
Brookline Artificial Ice Co.,		Brookline, Mass.,	85
Drexel Institute,	4th "	Philadelphia, Pa.,	85
Alliance Mill & Elevator Co.,		Milnor, N. Dak.,	85
Solvay Process Co.,	1st "	Syracuse, N. Y.	65
" " "	2d "	" "	65
Arlington Hotel,	1st "	Hot Springs, Ark.,	65
" "	2d "	" "	65
J. P. Curtiss,		New Britain, Ct.,	65

Total, 19 Engines, aggregating 3,480

STANDARD ENGINES.

			H. P.
Thomas D. Whitaker,	31 order,	Bonneville, N. J.,	2 0
Detroit Motor Co.,	2d "	Detroit, Mich.,	201
Dunnell Mfg. Co.,	41st "	Pantucket, R. I.,	150
American Sugar Refining Co.,	10th "	S. Boston, Mass.,	150
Morris Machine Works.	6th "	Baldwinsville, N. Y.,	100
St. Louis Smelting and Refining Co.,	7th "	St. Louis Mo.,	75
W. E. Peck & Co.,	1st "	New York,	75
" "	2d "	" "	75
Chicago & N. W. R'y Co.,	1st "	Chicago, Ill.,	75
" " "	2d "	" "	75
John Bromley & Son,	8th "	Philadelphia, Pa.,	75
Ramsdell Paper Mills,	9th "	Salisbury Mills, N. Y.,	75
*Linden Paper Co.,	1st "	Holyoke, Mass.,	60
" "	2d "	" "	45
Jarvie Paper Co.,		Claremont, N. H.,	45
O. G. Cowles,	2d "	Oswego, N. Y.,	45
Rio Grande Smelting Works,	4th order,	Socorro, N. Mex.,	45
S. D. Warren & Co.,	25th "	Cumberland Mills,	35
Westinghouse Machine Co.,	18th "	Pittsburgh, Pa.,	35
Dunnell Mfg. Co.,	42d "	Pawtucket, R. I.,	35
St. Nicholas Building,	1st "	Pittsburgh, Pa.,	25
Chicago & N. W. R'y Co.,	3d "	Chicago, Ill.,	25
Westinghouse Air Brake Co.,	29th "	Wilmerding, Pa.,	25
C. G. Bonlt,		Ahnapee, Wis.,	25
East End Electric Light Co.,	23d "	Pittsburgh, Pa.,	15
James Stewart & Co.,		St. Louis, Mo.,	15
St. Nicholas Building,	2d "	Pittsburgh, Pa.,	10
Rich Electric Heating Co.,		Mt. Vernon, N. Y.,	10
Crane & Co.,	3d "	Dalton, Mass.,	10
Morris Machine Works,	7th "	Baldwinsville, N. Y.,	10
West End Street Railway Co.,		Boston, Mass.,	5

* Subject to countermand.

Total, 31 Engines, aggregating, 1,845

JUNIOR ENGINES.

			H. P.
Pencoyd Iron Works,	12th order.	Pencoyd, Pa.,	50
B. F. Stoner,		Bellwood, Pa.,	50
Macatawa Park Association,		Holland, Mich.,	35
R. F. Livengood,		Delavan, Minn.,	35
Engler & Handke,		Bristol, S. D.,	35
Franklin Glazier & Son,		So. Gladstonbury, Ct.,	35
M. B. Potter & Co.,		Hitchcock, S. D.,	35
John L. Ominger,		Amsterdam, N. Y.,	25
Agent,		Sydney, Australia,	25
David Bradley Mfg. Co.,		Chicago, Ill.,	25
Whitall, Tatum & Co.	5th order,	Millville, N. J.,	25
Pencoyd Iron Works,	13th "	Pencoyd, Pa.,	25
Agent,		Sydney, Australia,	15
Jackson Pulp Co.,	2d order.	Jackson, Mich.,	10
Texas Elevator and Compress Co.,		Dallas, Texas,	10
Agent,		Sydney, Australia,	10
Albert Hermann,		Paris France,	10
Jules Senn,		Lyons, France,	10
Agent,		Paris, France,	10
Fontaine Crossing Co.,	5th "	Detroit, Mich.,	5
Crystal Ice Co.,		Youngstown, O.,	5

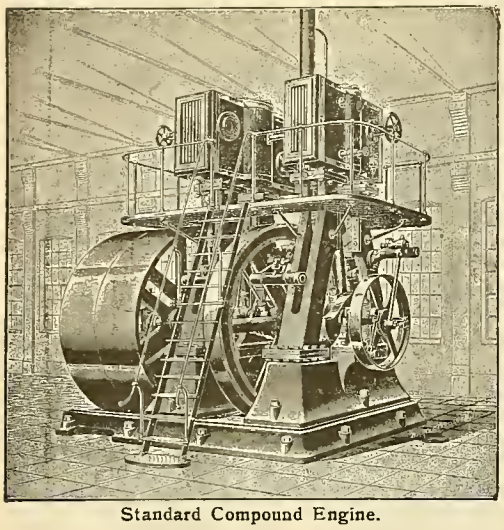
Total, 21 Engines, aggregating 485

Grand Total for July,..... .....71 Engines, aggregating 5,810 H. P.

RONEY MECHANICAL STOKER—Recent Orders.

			Stokers.
Carnegie Steel Co.,	19th order,	Pittsburg, Pa.,	16
Baltimore City Pass. R'y Co.,		Baltimore, Md.,	14
Joliet Enterprise Co.,	3d "	Joliet, Ill.,	12
Westinghouse Air Brake Co.,		Pittsburg, Pa.,	12
Cheney Bros.,		So. Manchester, Ct.,	8
Pittsburg Plate Glass Co.,	5th "	Pittsburg, Pa.,	8
Allegheny County Light Co.,	34 "	" "	8
Kerr Thread Co.,		Fall River, Mass.,	7
Paige Tube Works,		Cleveland, Ohio,	6
Niagara Falls Paper Co.,		Niagra Falls, N. Y.,	5
Linden Paper Co.,		Bolyoke, Mass.,	4
National Rice Milling Co.,		New Orleans, La.,	4
Chicago Cold Storage Exchange,		Chicago, Ill.,	4
Rumford Falls Paper Co.,		Rumford Falls, Me.,	3
Otis Falls Pulp Co.,		Otis Falls, Me.,	3
Decatur Gas Light Co.,	3d order,	Decatur, Ill.,	2
Pittsburg Water Works,		Pittsburg, Pa.,	2

WESTINGHOUSE, CHURCH, KERR & CO., Engineers.



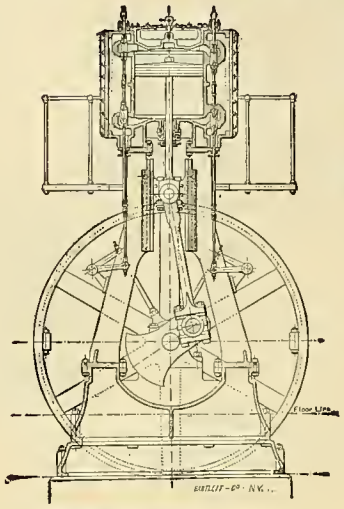
Standard Compound Engine.

THE LAKE ERIE ENGINEERING WORKS,

—BUILDERS OF—

SIMPLE, COMPOUND, TRIPLE AND QUADRUPLE

EXPANSION ENGINES,



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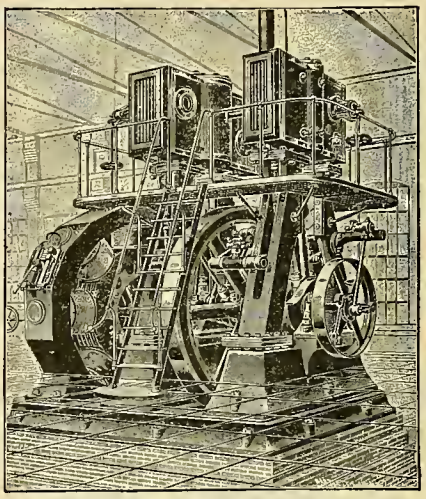
Both Condensing and Non-Condensing, from 250 to 8,000 H. P. Especially designed for direct connection to Multipolar Generators.

BEST ECONOMY AND REGULATION GUARANTEED.

BUFFALO, N. Y.



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Address all inquiries to

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WESTERN REPRESENTATIVES OF

The Lake Erie Engineering Works.

They are prepared to contract at a reasonable price for the complete installation of Power Plants, of any Capacity, for any Service, and at any Place.

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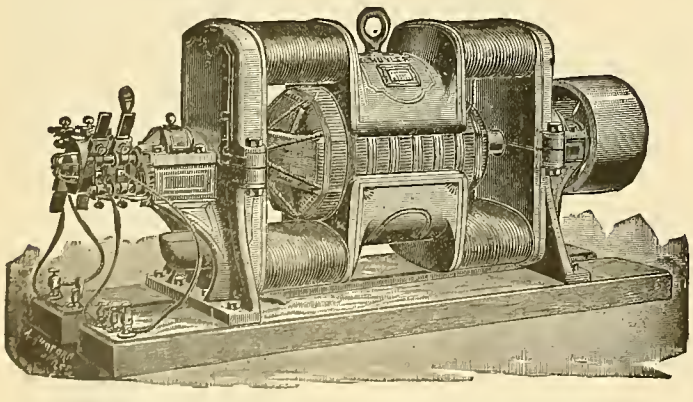
—SYSTEM OF—

ARC LIGHTING

CONTAINS THE FOLLOWING IMPORTANT FEATURES:



Instantaneous and Automatic Regulation.

Self-Lubricating Boxes.

Ventilated Armature, proof against a burn-out

A Pure White Steady Light.

THE SCHUYLER ELECTRIC CO.,

MIDDLETOWN, CONN.

SPECIAL NOTICE.

Our patrons and the electrical public are cautioned against being annoyed with intimidating letters from our competitors.

We are prepared to fully protect our customers in the use of:

Series Lamps for Arc Circuits.

Combination Automatic Cut-Out and Lamp Socket.

Fan Motors for Alternating and Direct Current Circuits.

Long Distance Series Incandescent Lighting Apparatus.

Transformer and Direct Current Apparatus.

New Catalogue and Price List in course of preparation.

HEISLER ELECTRIC CO.,

MANUFACTURING AND CONSTRUCTING ELECTRICAL ENGINEERS.

OFFICE:	Storage Battery	WORKS:
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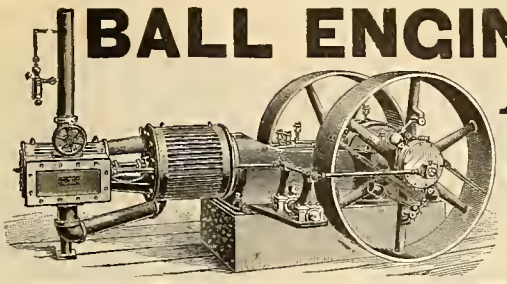
Crook, Horner & Co., Baltimore, Md.
Smith-Courtney Co., 1419 Main St., Richmond, Va.
L. M. Rumsey Mfg. Co., St. Louis, Mo.
Cooley & Vater, 224 Washington Ave. So., Minneapolis, Minn.
F. R. Dravo & Co., Lewis Block, Pittsburgh, Pa.
Risdon Iron Works, San Francisco, Cal.
Northwestern Supply Co., Tacoma, Wash.
E. G. Gilbert, Atchison, Kan.
J. H. Houghton, 201 Congress St., Boston, Mass

BALL ENGINE CO., ERIE, PA.



Automatic Cut-off ENGINE.

With New Improvements, Unequaled Regulation, Highest Economy, Durability, Smooth and Quiet Running.

The Best Engine for Electric Lighting and Electric Railways.

SIMPLE. TRIPLE EXPANSION.
CROSS COMPOUND. TANDEM COMPOUND.

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Engines and Complete Steem Plants for Lighting and Power Installations. Bent Pipe and Coils in Iron, Brass and Copper, for all kinds of service.

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When you are in need of First-Class Porcelain for Electrical Purposes, write the

TRADE MARK.

Werranted Hard Porcelain.

WANNOPEE POTTERY CO.,

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Estimates Cheerfully Given.

Write Us at Once, We Can Save You Money.

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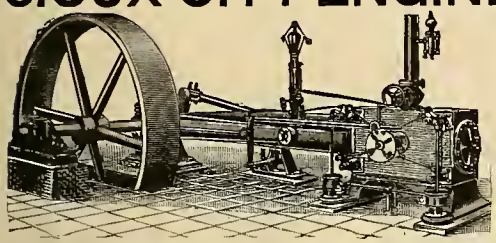

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Corliss Engines,

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Simple, Compound, Condensing,

Complete Plants Furnished.

Works: SIOUX CITY, IA.

BRANCH OFFICE:
48 S. Canal Street, CHICAGO.

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FOR ELECTRICAL USES.

Graphite Rods of Various Lengths, from 1-5 Ohm to 100 Ohms Resistance to the inch. Graphite Boxes and Crucibles, Resisting Heats of 4,000 Degrees. Inquiries Gladly Answered.

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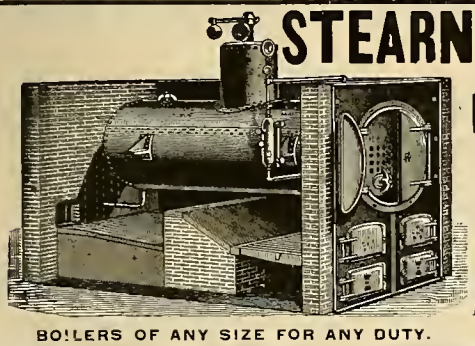

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COMPLETE POWER PLANTS FOR

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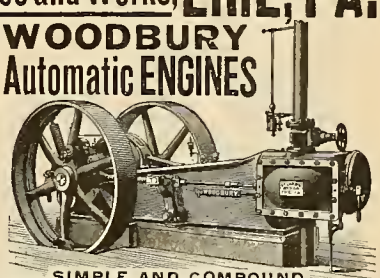

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RAWHIDE DYNAMO BELTING.

CARRIES NO STATIC ELECTRICITY.

Greatest Adhesive Qualities. Causes Less Friction than any other Belt

RAWHIDE HYDRAULIC PACKING.

RAWHIDE PINIONS FOR ELECTRIC MOTORS A SPECIALTY.

—THE—

Chicago Rawhide Mfg. Co.,

The only Manufacturers in the Country.

Lace Leather Rope and other Rawhide Goods of all kinds by Krueger's Patents.

This Belting and Lace Leather is not affected by steam or dampness; never becomes hard; is stronger, more durable and the most economical Belting made. The Rawhide Rope for Round Belting Transmission is superior to all others.

75 OHIO STREET, - CHICAGO, ILL.

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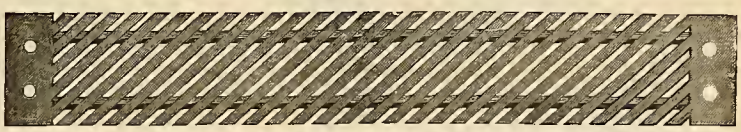

That doesn't require a **BLOWER** to secure a draught.

IT IS THE

KELLY GRATE,

And for DURABILITY, PERFECT FUEL COMBUSTION and SUPERIOR STEAMING QUALITIES, IT HAS NO EQUAL. It will burn ANY KIND of HARD or SOFT COAL equally well. They are especially adapted for hard, continuous service required by ELECTRIC LIGHTING PLANTS. We warrant them NOT to WARP, and to OUTWEAR TWO COMMON GRATES. When your plant requires grates again DON'T be content with one that is "good enough," but see the same number of DOLLARS and secure the BEST—that is, THE KELLY GRATE. Invest a stamp in writing us for descriptive circular. We will return it, and tell you about our SHAKER GRATE, the only one of its kind made in the United States or any other place.

GIVE US A CHANCE TO BE OF USE TO YOU.

KELLY BROS., - GOSHEN, IND.
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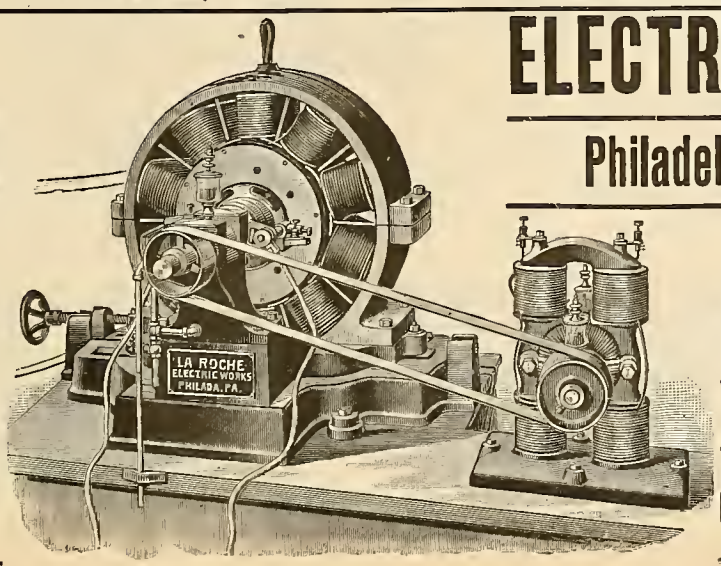
DYNAMOS,

100 TO 1200 LIGHT.

Installed complete for City or Town Lighting.



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DYNAMOS,

Direct System.

1 TO 1000 LIGHT.

Motors For Arc or Incandescent.

Currents from 1-8 to 50 H. P.

Chicago Office, Garden City Electric Co.,
267 and 269 Dearborn Street.

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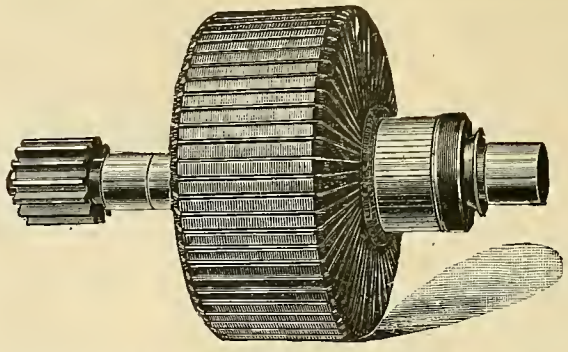
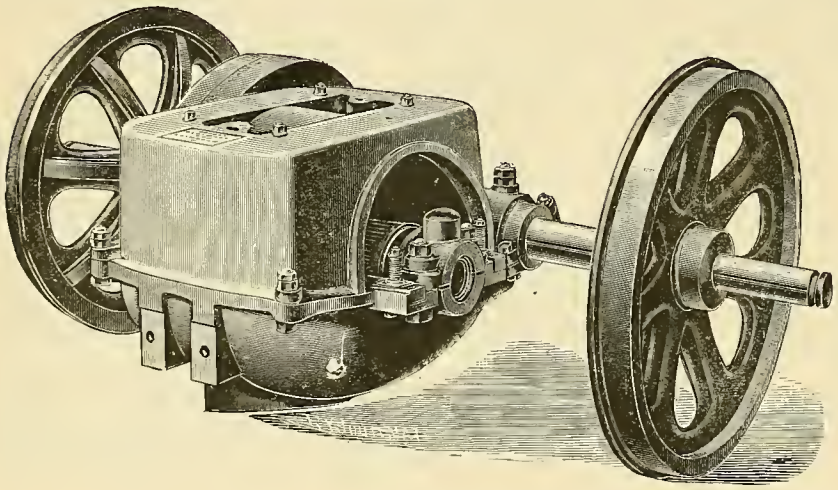


THE THOMSON-HOUSTON ELECTRIC CO.

HAVE PLACED UPON THE MARKET A

NEW STREET RAILWAY MOTOR.



It Excels all Preceding Motors.

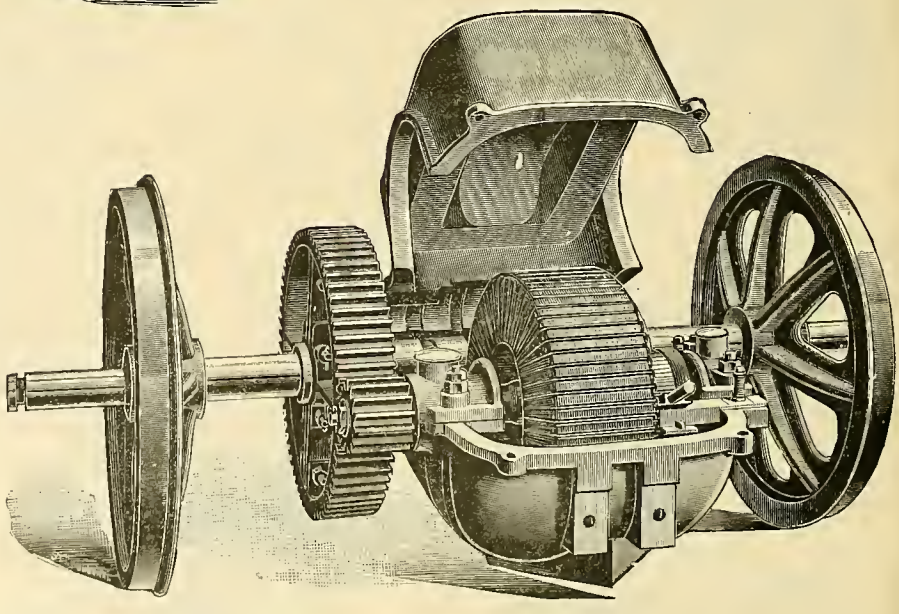
Cost of Maintenance Reduced to a Minimum.

$10 per Year for Renewal of Pinion and Gear.

3382 Already Sold to Railway Companies.

Strong Indorsements from those using it.

Send to us for Prices and Information.



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Boston Office: 620 Atlantic Ave. Chicago Office: 173 Adams Street.

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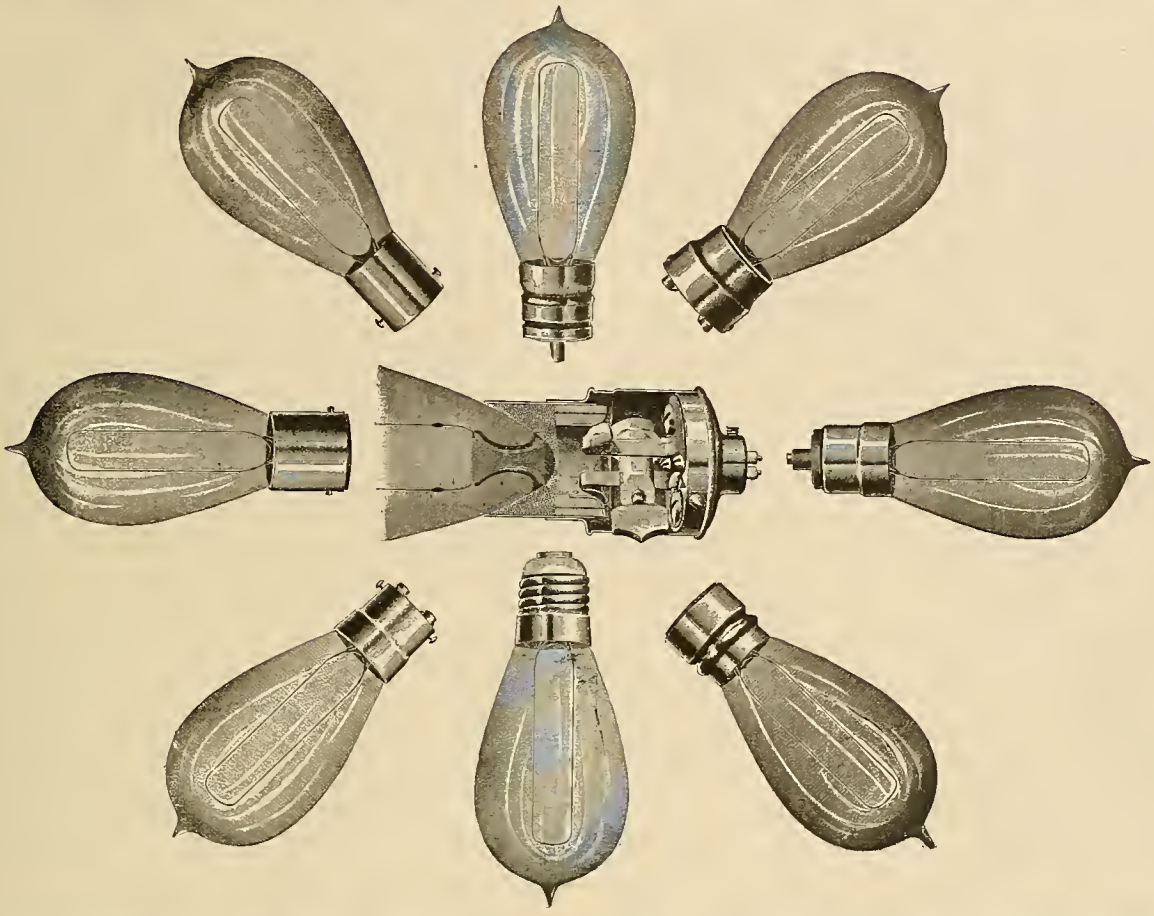
LONG LIFE.



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We are General Western Agents for

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And will make you factory prices on all kinds of RUBBER WIRES and CABLES, LEAD ENCASED CABLES, INCANDESCENT LAMP CORD.

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OUR WEATHER-PROOF WIRE CANNOT BE EXCELLED.

THE KNAPP ELECTRICAL WORKS,

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WHICH IS THE BEST RUBBER WIRE?

THE ANSWER.

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The funeral editor came in with a light, cautious step and sat down by his desk to think over the general mutability of human affairs and wonder why the manager didn't buy each of them a fan motor.

The exchange editor wiped a bit of mucilage off his shears and without looking up said:—

"Here is one for you, boys."

Dead silence, except the busy scratching of a pen.

"What is the difference between a 'plain drunk', who has been arrested, and a broken suspender?"

The funeral editor glared at him with a wicked scowl.

"Don't get personal Snipsey."

"Scissors" slid a quart bottle of gum nearer the edge of his desk. The new reporter turned around.

"Any blamed chump could answer that—let's see—'why is'—'why is'—er—what did you say?"

"What is the difference between a 'plain drunk', who has been arrested, and a broken suspender?" repeated the exchange editor.

"Oh! yes, 'what is'—w'y one is a—is a 'jag of joy' and the other is—is—oh—confound it! a jackass couldn't see through one of your jokes!"

"So I discover."

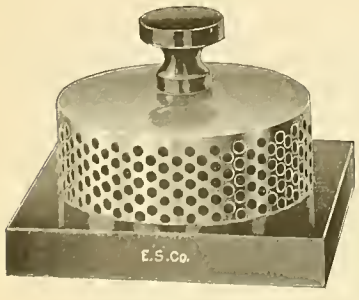
The sporting editor took a fresh chew—

"Oh, come off. you aint in it, I'll knock that conundrum out the first round—lemme see—'why is'—yes, well, one is a—is a busted suspender, and the other is a—hold on, I've got it—and the other is a suspended bust! that's easy—see?"

"Time!" called the funeral editor who had been listening.

"Nopee!" exclaimed Snipsey, "that's pretty fair but it isn't my version"—he laid one hand on the glue bottle and firmly gripped the shears in the other, keeping one eye on the funeral editor—"one is the ragged end of a jag, and the other is—is the jagged end of a rag."

The funeral editor slipped out soft and easy with the new reporter close in his wake. The sporting editor grinned a sickly grin and the office towel flapped lazily in the breeze.—*Electric Spark.*



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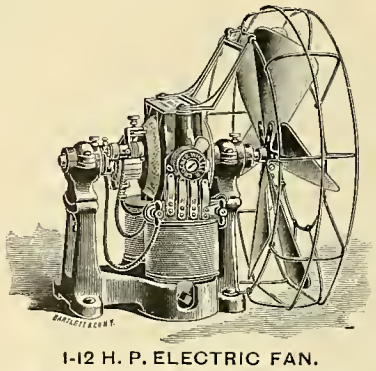

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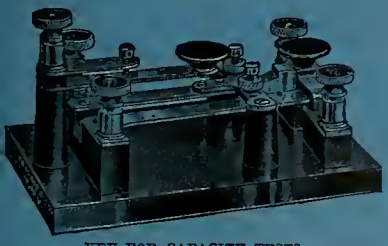

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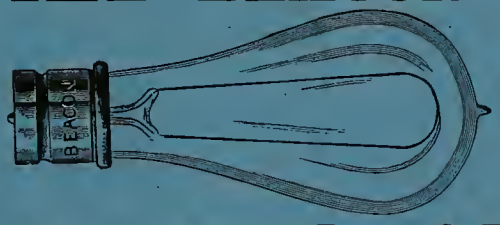

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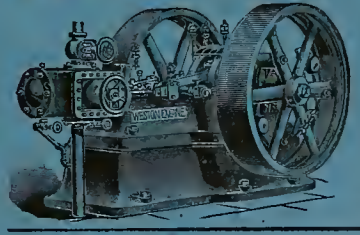

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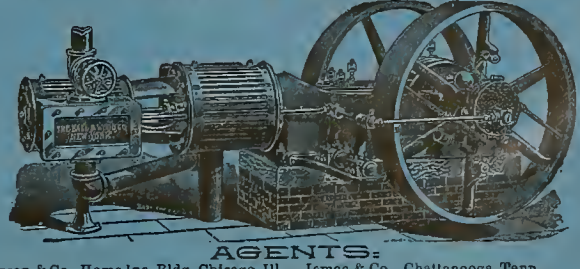

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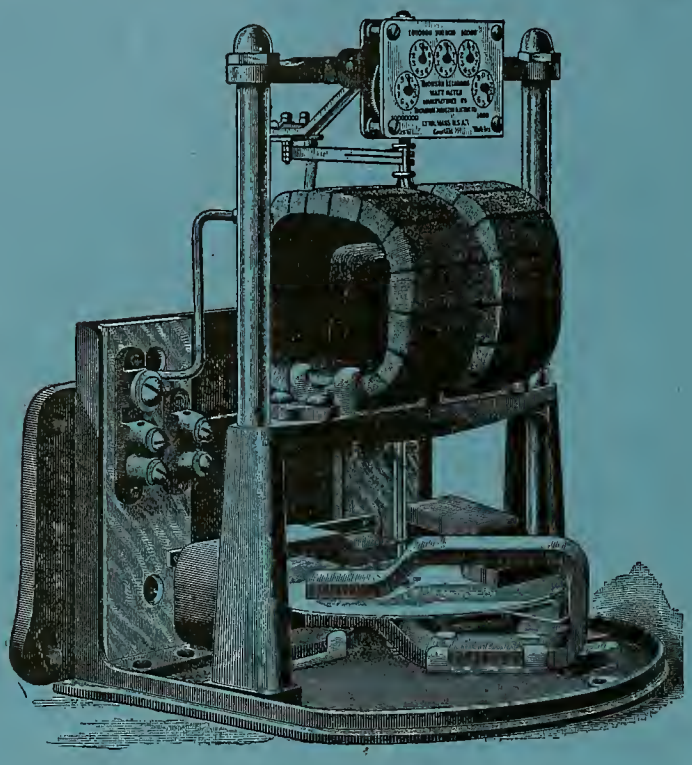

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INDEX AND CLASSIFICATION OF ADVERTISEMENTS.

ALPHABETICAL LIST.

American Battery Co..... ix
American Desk & Seating Co.. xiv
American District Steam Co.... xvi
American Electrical Mfg. Co.. iv
American Engine Co..... xii
Andrae, Julius.....—
Andrews & Co., A. H..... ...—
Babcock & Wilcox Co., The.... i
Baggot, E xiv
Ball Electric Light Co..... iv
Ball Engine Co.....xix
Ball & Wood Co., The l
Beacon Vacuum Pump & Elec. Co.i
Becker Mfg. Co., John..... xiii
Beggs, J. E., Mch. & Supply Co. x
Bernstein Electric Co..... xii
Boston Braid Mfg. Co..... xvi
Bowers Bros..... xvi
Bridgeport Mach. Tool Wks.. —
Bristols' Mfg. Co..... ..—
Brookfield, Wm..... xii
Brush Electric Co viii
Bryan, W. H..... xiv
Bryant Electric Co..... xii
Buckeye Electric Co., The..... ix
Butler Hard Rubber Co.....—
Carpenter Enamel Rheostat Co. xvi
Central Electric Co..... ... v
Chicago Rawhide Mfg. Co.....—
Crescent Ins. Wire & Cable Co. xiii
Crocker-Wheeler Electric Co.. xiii
Cushing, F. W..... vii
Cutter. Geo..... i
Cutter Electrical & Mfg. Co...—
Dayton Globe Iron Works Co..xvii
Densmore Typewriter Co..... xii
Detroit Electrical Works..... xxiv
Diamond Electric Mfg. Co.... xii
Dixon Crucible Co., Jos..... xvi
Dudley & Co., W. W..... xvi
Duplex Electric Co., Ltd.....—
Eastern Electric Cable Co..... xiii
Easton Electric Co.....—
Eastman Kodak Co..... xiv
Edison General Electric Co.....viii
Electric Cons. & Supply Co... vi
Electric Engr'g & Supply Co.. ix
Electric Mfg. Co., The..... vi
Electric Secret Service Co..... xix
Electrician Pub. Co.. xv, xvi, xviii
Electrical Construction Co. The. xii
"Electrical Progress"..... xii
Electrical Supply Co., The ... xxii
Elektron Mfg. Co..... x
Empire China Works x
Enterprise Electric Co..... xv
Falls Rivet & Machine Co..... ix
Ferracute Machine Co..... xvi
For Sale Advertisements. x, xii, xiii
Fort Wayne Electric Co..... xxiv
General Electric Co..... iv
Gravity Purifier Co..... ....—
Greeley & Co., The E. S.....l
Gregory. Chas. E..... xii
Hart & Hegeman Mfg. Co..... x
Heisler Electric Co.....—
Hill Clutch Works..... xix
Hine Eliminator Co.....—
Holmes, Booth & Haydens.... xiv
Hood & Co., Wm..... vi
Hughes Bros. Mfg. Co..... . xii
Illinois Electric Lamp Co..... xv
India Rubber & G. P. Ins. Co. xxiii
Institute of Technology..... xiv
Interior Conduit & Insulation Co. x
International Okonite Co..... i
Jewell Belting Co..... i
Johns Mfg. Co., H. W..... x
Kartavert Mfg. Co..... xvi
Kelly Brothers ..... —
Klipstein, A..... xii
Knapp Electrical Works..... xxi
Lake, J. H. & D., Co ..... —
Lake Erie Engineering Works.xviii
Lane & Bodley Co.....xviii
La Roche Electric Works..... xix
Leclanche Battery Co., The .. xvii
Lefmann, Julius xvii
Leffel, & Co., Jas xvii
Leonard & Co., H. W.....xvii
Link Belt Machinery Co..... xv
Loud, H. M. & Sons Lumber Co. xiv
Lovell Mfg. Co., Ltd..... xiii
Mather Electric Co..... iv
Moore, Alfred F..... i
Morse & Co., A. M..... xv
Munsell & Co., Eugene..... xii
National Carbon Co..... xiv
National Electric Mfg. Co.... —
National India Rubber Co....—
New York Insulated Wire Co. xv
N. Y. Safety Steam Power Co. x
New York & Ohio Co..... l
Ostrander & Co., W. R..... xix
Page Belting Co..... —
Partrick & Carter Co..... —
Pearson & Co., W. B.....xviii
Pelton Water Wheel Co .. . xiv
Perkins Elec. Switch Mfg. Co. ix
Phoenix Glass Co..... xix
Pioneer Armature Co.....xiii
Porter-Leavitt Elec. Motor Co. xiii
Queen & Co..... xiii
Racine Hardware Mfg. Co.....—
Railway Equipment Co..... ix
Redding Electric Co.....iv
Ries Electric Specialty Co..... x
Roebling's Sons Co., J. A iv
Rose Elec. Light Supply Co... xii
Royal Electric Co.....—
Samson Cordage Works..... xii
Sawyer-Man Electric Co..... xi
Schuyler Electric Co.....xviii
Sechrist, Albert..... xvii
Shultz Belting Co.....xviii
Siebert, G..... xiii
Siemens & Halske Electric Co. xiii
Sioux City Elec. Supply Co., —
Sioux City Engine Works.... xix
Smith, A. T..... .....—
Smith, Thos. G. Jr.....—
Somoff, J. L..... —
Sperry Elec. Mining Mach. Co. xvi
Standard Electric Co..... vi
Standard Paint Co x
Stanley Electric Mfg. Co..... v
Star Electrix Co... xv
Stearns Mfg. Co..... xix
Sterling, W. C..... xv
Stilwell & Bierce Mfg. Co. xiv, xv
Sunbeam Incand. Lamp Co...xxiii
Taylor Engine Co.....—
Thomson-Houston Elec. Co.. ii, xx
Union Hardware Co.....xii
Utica Elec. Mfg. & Supply Co. x
Van Nuis C. S..... i
Vulcanized Fibre Co..... xv
Waddell-Entz Company..... xii
Wannopee Pottery Co..... xix
Want Advertisements..... xiii
Western Electric Co.....xiv
Westinghouse, Church, Kerr & Co..... xvii
Westinghouse Elec. and Mfg Co xi
Weston Engine Co..... i
Woodhouse & Rawson, Ltd.....—
Worthington, Henry R..... xii

CLASSIFIED LIST.

Annunciators.
Central Electric Co.
Detroit Electrical Works.
Electrical Supply Co., The.
Knapp Electrical Works.
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Partrick & Carter Co.
Western Electric Co.

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Kelly Bros.

Fuse Wire.
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Knapp Electrical Works.
Sperry Elec. Mining Machine Co.

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Partrick & Carter Co.

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Bryant Electric Co.
Central Electric Co.
Cutter, Geo.
Cutter Electrical & Mfg. Co.
Detroit Electrical Works.
Edison General Electric Co.
Electric Cons. & Supply Co.
Electric Engineering & Supply Co.
Electric Manufacturing Co., The.
Electrical Supply Co., The.
Enterprise Electric Co.
General Electric Co.
Greeley & Co., The E. S.
Hart & Hegeman Mfg. Co.
Hood & Co., Wm.
Klipstein, A.
Knapp Electrical Works.
Queen & Co.
Redding Electric Co.
Sioux City Elec. Supply Co.
Utica Elec. Mfg. & Supply Co.
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Enterprise Electric Co.
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International Okonite Co., The.
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Vulcanized Fibre Co.
Wannopee Pottery Co.
Western Electric Co.

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Central Electric Co.
Crescent Ins. Wire & Cable Co.
Cushing, F. W.
Cutter, Geo.
Detroit Electrical Works.
Eastern Electric Cable Co.
Edison General Electric Co.
Electrical Supply Co., The.
Enterprise Electric Co.
Holmes, Booth & Haydens.
International Okonite Co., The.
India Rubber & Gutta Percha Insulating Co.
Knapp Electrical Works.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Roebling's Sons Co., J. A.
Sperry Elec. Mining Machine Co.
Waddell-Entz Company.
Western Electric Co.

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Bernstein Electric Co.
Buckeye Electric Co.
Central Electric Co.
Cutter Electrical & Mfg. Co.
Edison General Electric Co.
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Electrical Supply Co., The.
Hood & Co., Wm.
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Sawyer-Man Electric Co.
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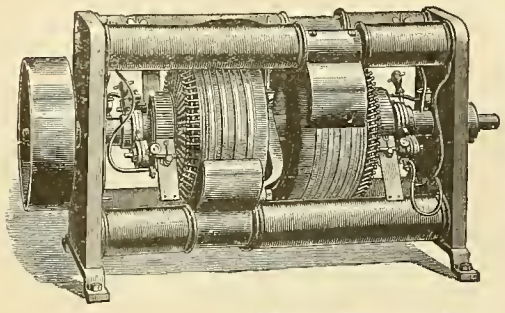
"IS NOT IN IT."



In what? In the preposterous **"Combine"** which has lately been formed to make legitimate business the cat's-paw of a stock-jobbing operation. The BALL ELECTRIC LIGHT COMPANY is opposed to any and every combination that seeks to do business upon other than a fair and straightforward basis. An enormous capitalization signifies excessive expenses and decreased dividends; and, invariably, the balance sheet must be against the public.

The BALL ELECTRIC LIGHT COMPANY is proud of its past record. It has conducted its enterprise upon strict business principles, and has gained a reputation which, though often attacked by the make-up of the present "Combine," has never yet been injured. The Company's stockholders are happy; so are its patrons. It is now prepared to go "a step better," and herewith announces the completion of the new

BALL AUTOMATIC DYNAMO.

Beginning with the season now opening, we are placing on the market an AUTOMATIC DYNAMO. Do not think from this that we are offering in place of our celebrated dynamo any new and untried departure, or that we are offering our old dynamo with some external complicated mechanism called "an automatic regulator" of little merit save in name only.

We are placing the justly praised BALL **Dynamo**, as simple as of old, but containing **within itself** the power of self-action and adjustment to the varying conditions of the load that may be brought upon it.

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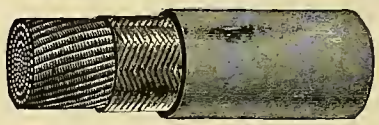

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Masonic Temple, Denver, Colo.
401-407 Sibley Street, St. Paul, Minn.
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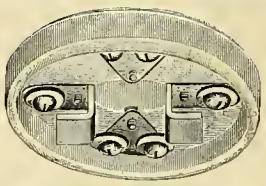

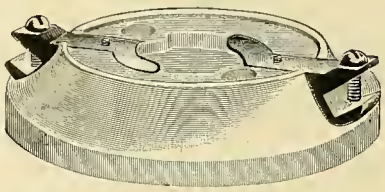

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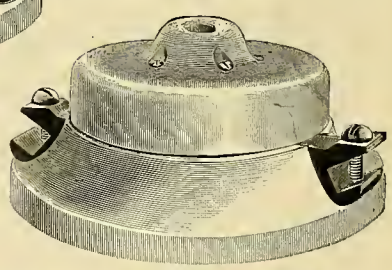

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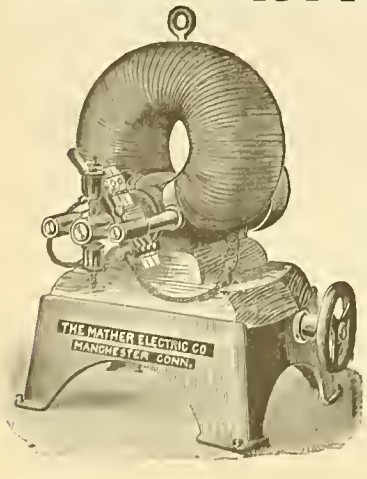

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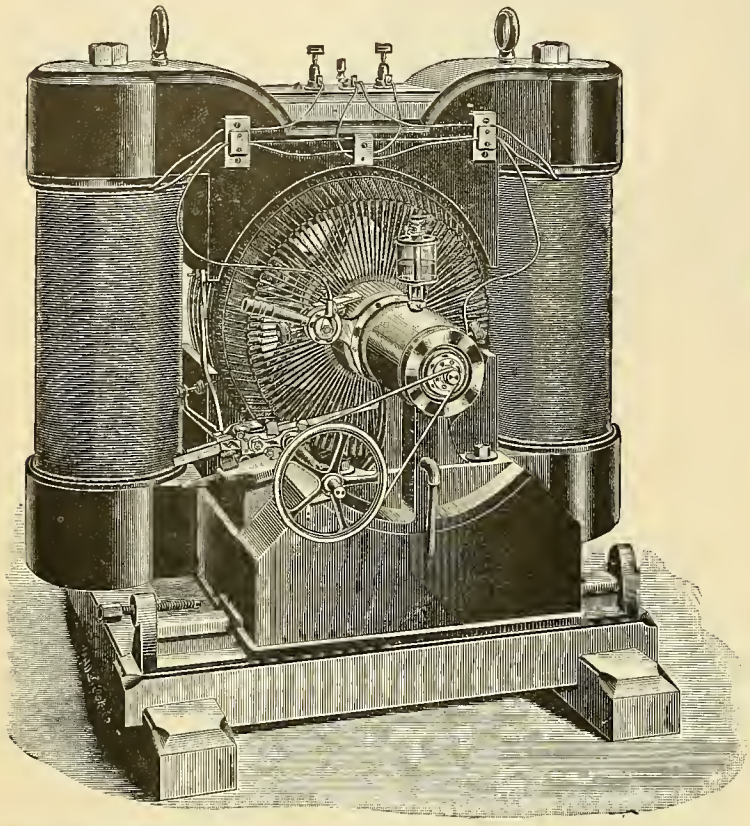

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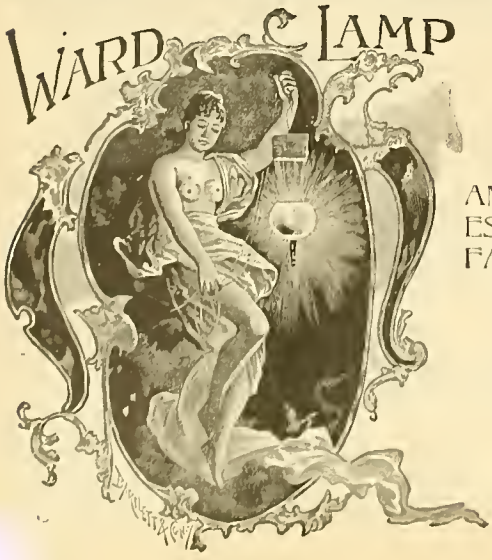

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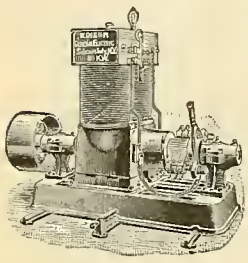

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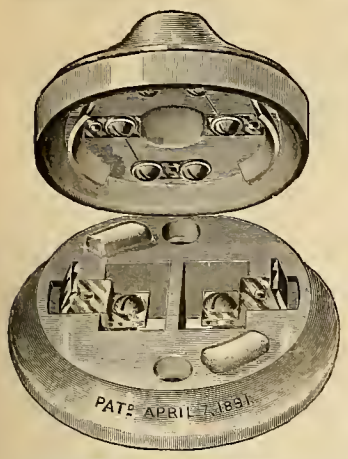

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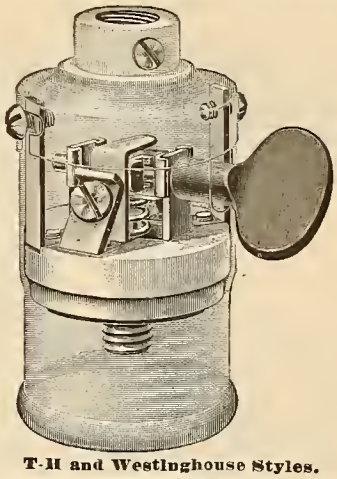
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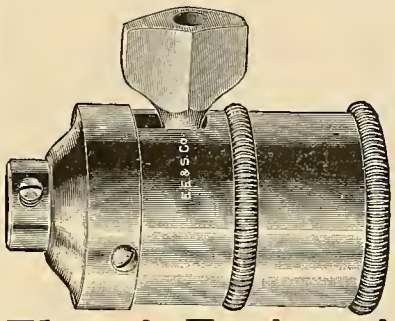

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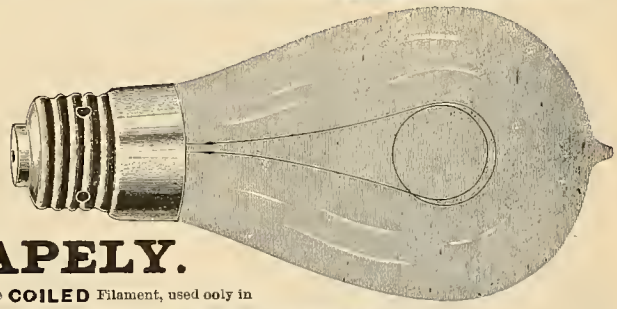

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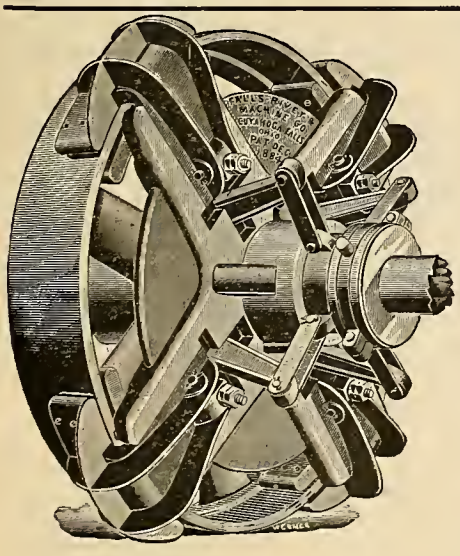

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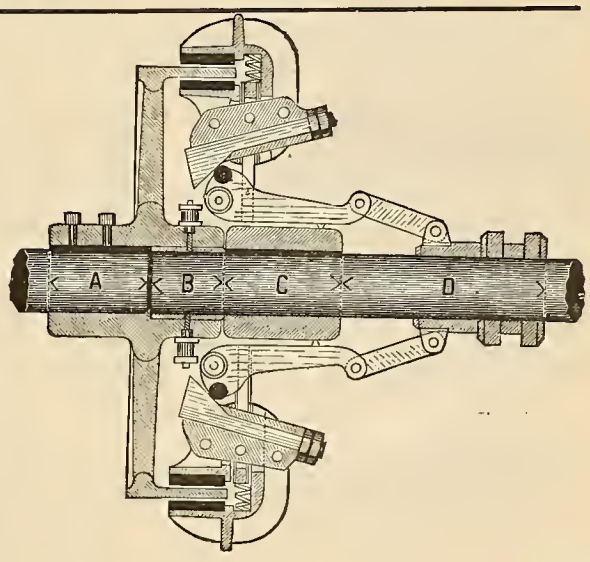

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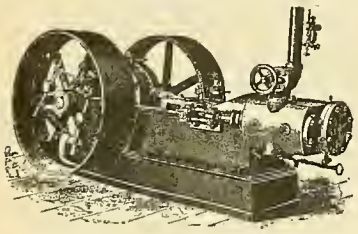

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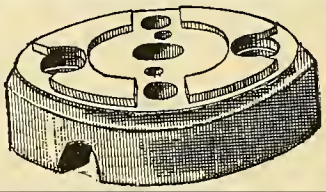

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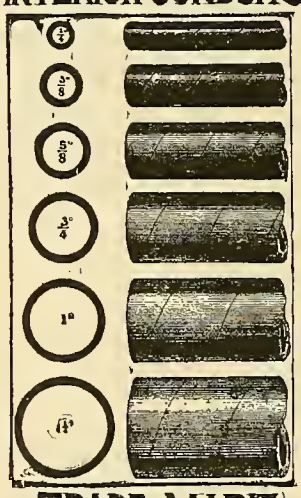

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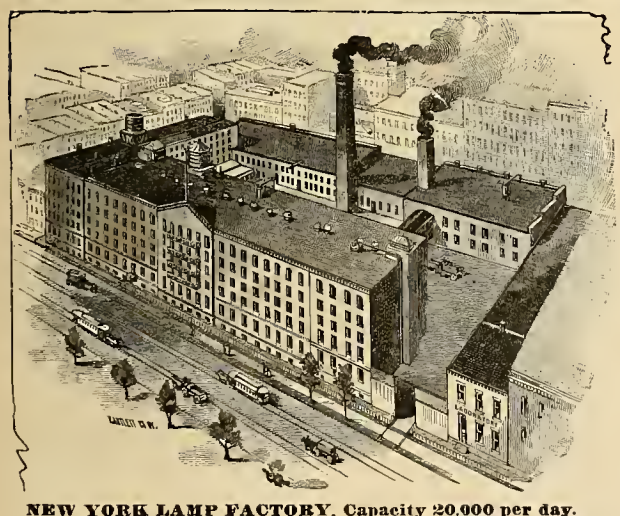

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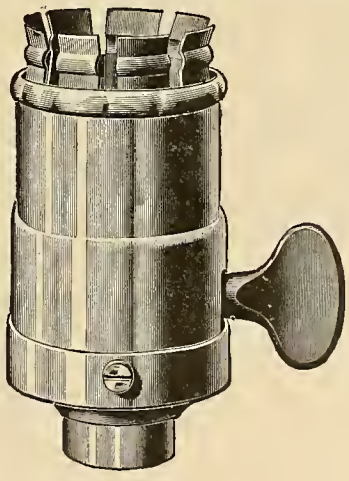

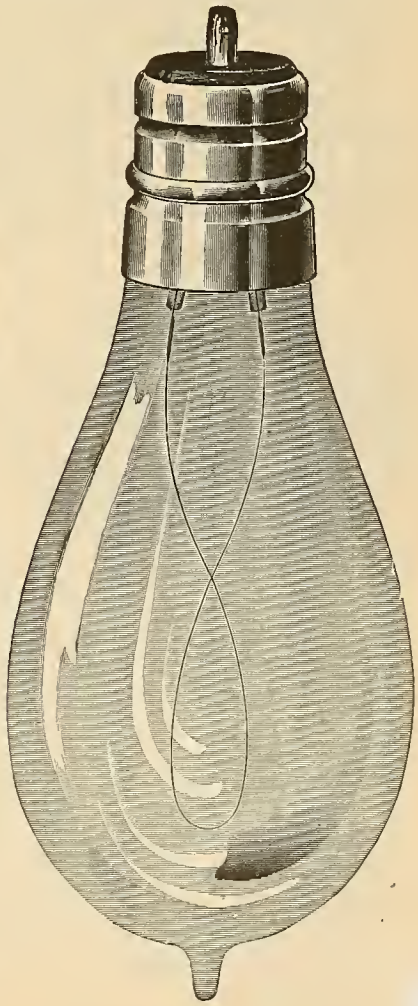

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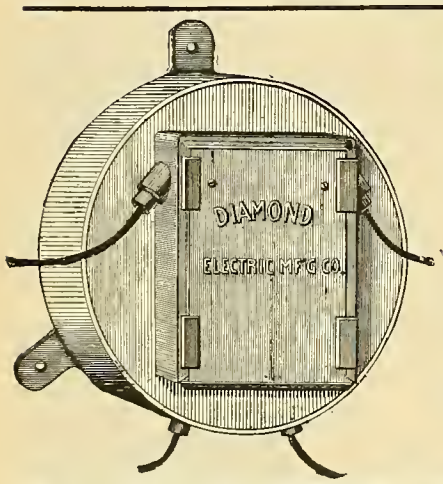

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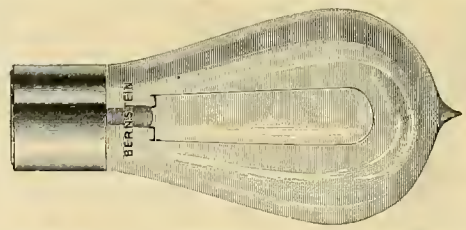

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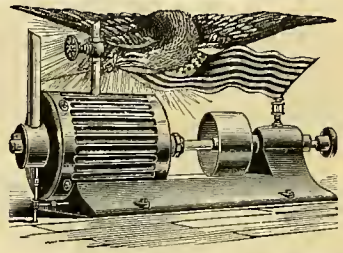

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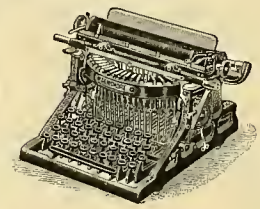

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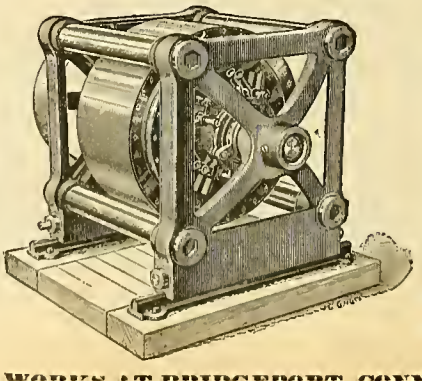

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Fahrig's Electrostatic Process for the Manufacture of Ozone.

Ozone was first discovered by Van Marum a century or more ago, but it was first investigated and brought prominently to the notice of medical and scientific men by Schönbein of Germany, in 1845. From that date to the present it has been a subject of active study by scientists, sanitarians and medical men generally. Ozone seems to exist in a minute quantity in the atmosphere, and how it is formed there and the conditions of its existence have long been matters of dispute. Schönbein, Andrews in England, and Houzean in France were the earlier and important exponents of the view that ozone is a normal constituent of the atmosphere. In a valuable monograph published in Germany in 1879 Prof. Engler comes to the same conclusion. On the other hand, however, the Russian chemist, Schoene, after a long series of observations and laboratory experiments, concludes that the effects ascribed to ozone in the air are due, not to that substance, but to another strong oxidizing agent, hydrogen peroxide. This view is shared by others of the present time, while several careful experimenters seem to deny the presence of either substance.

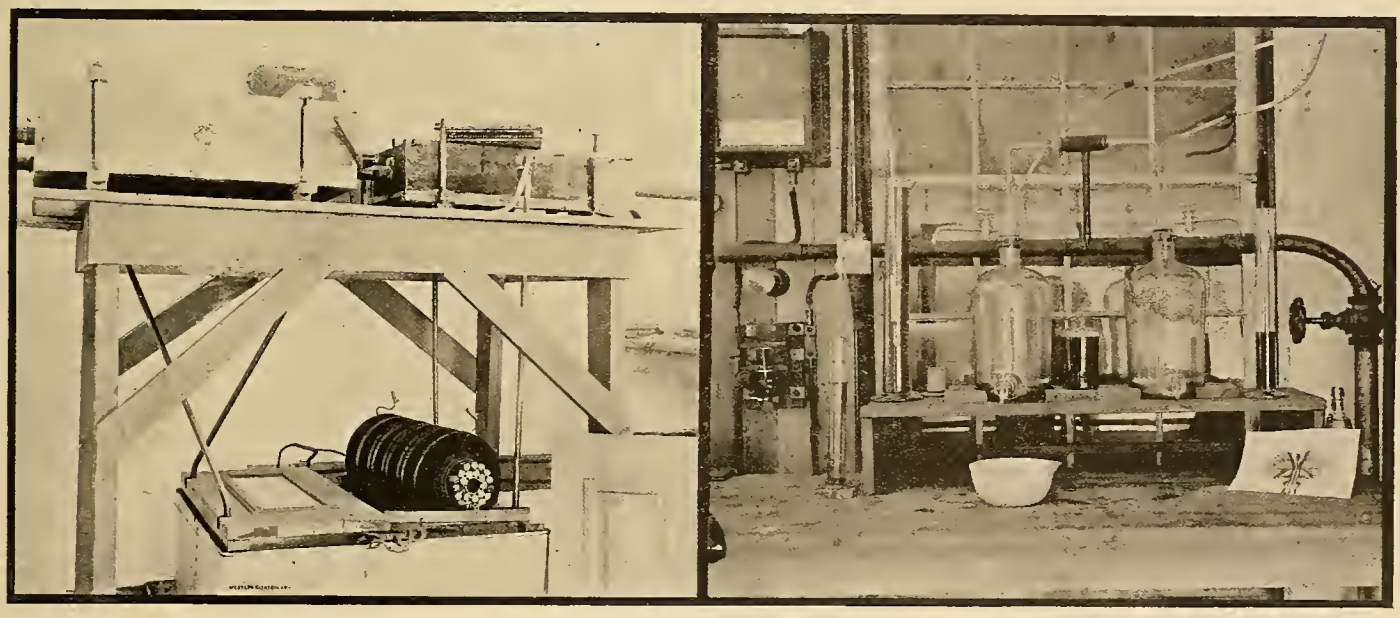

FIG. 1. FAHRIG'S ELECTROSTATIC PROCESS FOR THE MANUFACTURE OF OZONE.

Ozone is best made by the passage of electricity through oxygen, and many scientists have been working upon apparatus devised for the practical preparation of it in quantity. By the slow combustion of phosphorus in moist air ozone is also formed, but only in limited amount. Various appliances in which this principle is employed have long been in use in laboratories and elsewhere for purposes of illustration.

Although fifty years ago it was clearly shown by Schönbein that ozone could be readily produced from the ordinary oxygen of the air by the passage through it of the electric spark, it is fair to presume that few, if any, of the readers of the WESTERN ELECTRICIAN have had an opportunity to inspect what could be very properly called an ozone factory. Such a plant exists, though, at Marseilles, Ill., and from the accompanying illustrations a very clear idea may be had as to the extent to which the project has been developed commercially in this country.

The Marseilles plant is operated in conjunction with the American Ozone Water company and the gas is utilized to ozonize table waters and high grade carbonated mineral waters. The two establishments, located side by side, are, however, separate, mechanically speaking, except that the ozone is delivered to the Water company's plant by pipe.

The process employed in the Marseilles plant is that of Prof. Ernst Fahrig, who recently came to the United States from England for the purpose of establishing the manufacture of ozone on a large scale. The Fahrig process, in so far as the generation of the ozone from oxygen is concerned, is strictly an electrostatic one. The idea of producing ozone on a large scale was first conceived by Prof. Fahrig in 1878 while he was engaged in experimenting to produce calcium chloride directly from sodium chloride by electrolysis. Through these experiments it occurred to him that an easier way could be found to produce on a large scale a more effective bleaching agent than chloride of calcium. Ozone was well known to him, of course, through Schönbein's investigations, as the strongest oxidizing agent, and the knowledge of the influence of the electric spark upon oxygen led him to experiment with an alternating current of very high tension. In 1884 his first ozone plant was built in Manchester, England, and in 1887 a large plant, the St. Helens Ozone Works, was built in London, England. This led to the organization of an ozone syndicate, which now controls Prof. Fahrig's European patents pertaining to ozone. In 1888 Prof. Fahrig exhibited the products of the St. Helens Ozone Works, London, at the Manchester technical exhibition, where they may still be seen. In 1891 Prof. Fahrig came to this country with the view of exploiting his United States patents. The Marseilles plant was the outcome of his first negotiations in America, and it is claimed, furthermore, that it is the first plant in this country established to produce ozone for commercial purposes.

As has been already stated, in the Fahrig process the ozone is generated through the aid of electricity, the chemical portion of the process consisting chiefly in the production of the oxygen through the agency of a heated compound of peroxide of manganese and hydrate of soda and lime.

The manner in which the Fahrig process, which is extremely simple, is carried out will be better understood by reference to the diagram, Fig. 2. This cut shows the relative arrangement of all the apparatus constituting a Fahrig ozone generating equipment. In this diagram A is a furnace consisting of eight 5 inch by 6 feet pipes, a a, connected in series and placed in four rows of two over a fireplace built of fire brick in the usual way. To the first of the pipes, a, there is connected an air pipe b with valve b^1 leading from a blower B, which is operated at a speed of 4,000 revolutions per minute and gives an air pressure of 10 inches on the U-tube b^2. Joining the air pipe is a steam pipe c with valve c^1 and test pipe c^2 tapped off the main steam pipe of the boiler plant. From the outlet tube of the furnace a pipe d extends and carries the pressure gauge d^1. This pipe branches into the test pipe e and the gas pipe f, both pipes being furnished with stop valves. A hand-regulating steam valve g is provided for regulating the draft and combustion in the furnace. The gas pipe f leads to the two washer barrels C and D. The construction of the washers is very plain. Each is an air-tight barrel half filled with water, the supply of water being kept clean and cool by the water being forced in through pipes h h, and out through the siphon pipes i i, to the waste pipe k. Washers C and D are joined by a pipe l. From D a pipe m extends to the gas reservoir E, in which the pressure is maintained by water power through the inlet pipe n and outlet pipe o. A water glass is at p with a scale to show the height of the water in the reservoir, and q is a gauge to indicate the gas pressure. From the reservoir E a pipe r extends to the ozone generating apparatus. This consists of three ozonizing generators, F F, of which No. 1 and 2 are connected in multiple, with No. 3 in series. Just beneath the ozone generators in boxes G and G^1 are two specially wound and insulated converters that deliver current to the generating boxes above at a calculated electromotive force of 40,000 volts. H is an alternating dynamo of a capacity of 112 amperes at 50 volts pressure; I is the exciter dynamo. Switches, meters and regulators are placed conveniently in the ozonizing room, so that the operator can vary at will the current in the primaries of the converters, and thus change the electrical pressure in the generators. The electromotive force obtained in the secondary coils is, as was before stated, calculated to be 40,000 volts. The secondary wires are enclosed in glass, and again in hard rubber tubing, and extend up through the tables and enter the generators through glass tubes set into the sides of the boxes. K is an apparatus for ozonizing alcoholic liquors. L L are experimental jars for the purpose of treating various liquors.

The operation of the plant is as follows: The pipes of the furnace are filled with a compound of peroxide of manganese and hydrate of soda and lime. A fire is built in the furnace and the air blower is started. When the temperature reaches 250° the chemicals which are to act as an oxygen absorbent are ready for action. The air passing over the chemicals is decomposed, its oxygen being retained by the absorbing chemicals, while the nitrogen passes out through the waste pipe e, the valve being left open. After an oxidization of 10 to 15 minutes the valves b' and e' are closed, shutting off the air blast and closing the nitrogen pipe c^2. The draft in the furnace is now increased, raising the temperature to

about 400°. After a minute's increased heating, which causes the chemicals to give up the absorbed oxygen and leave it in a free state in the pipes, the steam valve c' and gas valve f' are opened far enough to obtain a steam pressure of about 15 pounds per square inch. The steam, rushing through the pipes, carries the oxygen with it and carries it through pipe f to washer G. Here the steam is condensed, leaving the free oxygen to pass to the second washer D for an additional cooling. From the washer the gas is carried to the reservoir E. The valve o is opened, so that the water escapes in the same proportion at which the gas is accumulated. The oxygen is now ready for the ozone room. When from 10 to 15 cubic feet of pure oxygen have been obtained, the steam valve c' and gas valve f' are closed, the draft in the furnace reduced and the air valve b' and nitrogen valve e' opened. Now the chemicals, which have been deprived of all their oxygen, absorb fresh oxygen from the atmosphere passing over them, and after 10 to 15 minutes have elapsed the operation is repeated as before described. When a sufficient quantity of oxygen has been obtained, the gas inlet valve m' is closed and the outlet valve r' opened. To create a pressure in the reservoir, the water outlet valve o' is closed and the inlet valve n' opened; the water now flows in the reservoir forcing the oxygen out through r to the ozonizing generators $F F$. In passing through the generators each molecule of oxygen is brought under the direct influence of the electric discharge, and is thus converted from its original state O_2 into O_3, or what is known as ozone.

As the ozone generators and the converters are, from an electrical standpoint, the most important portions of the Fahrig apparatus, a detailed explanation the construction of these two parts will be of interest. Figs. 1, 3, 5 and 6 are several views showing the generators and converters. Fig. 1 is a reproduction of two photographs taken in the ozone room at Marseilles. These general views show the relative positions of the ozone generators or boxes, the converters underneath, and the operator's test table, switches, etc. One converter, it will be noticed, has been raised from its oil box so that its construction might be more easily seen. This transformer is simplicity itself. It is 27 inches long and has a 5 inch iron core consisting of a number of bundles of annealed iron wires. A single layer of heavy copper wire constitutes the primary coil, while the secondary is made up in five sections wound on five separate spools. Twenty pounds of No. 37 B. & S. wire were required for the secondary.

In Fig. 3 one of the ozone boxes is also shown apart. Reference to Figs. 5 and 6 will enable the reader to obtain an idea of the details of a generator's internal arrangement.

The case or box of a generator is built of wood, and measures on the outside 24 by 18 by 8 inches. The box proper is lined inside with plate glass and is made air-tight with insulating cement. The generator proper is made up of plates of ¼-inch glass and glass tubes ¼-inch in diameter. The plates and the layers of tubes are arranged alternately as indicated in Fig. 6. Each tube is drawn solid at one end and contains an aluminum wire. Fig. 5 shows two of the tubes with the wire cores. In the generators at Marseilles two of the glass plates are pasted each on one side with a sheet of aluminum foil as shown in Fig. 6. This diagram shows also the electrical connections of a generator. It should be explained that the distances between wires and wires wires and foil, foil and foil, foil and wires, and wires and wires, are equal.

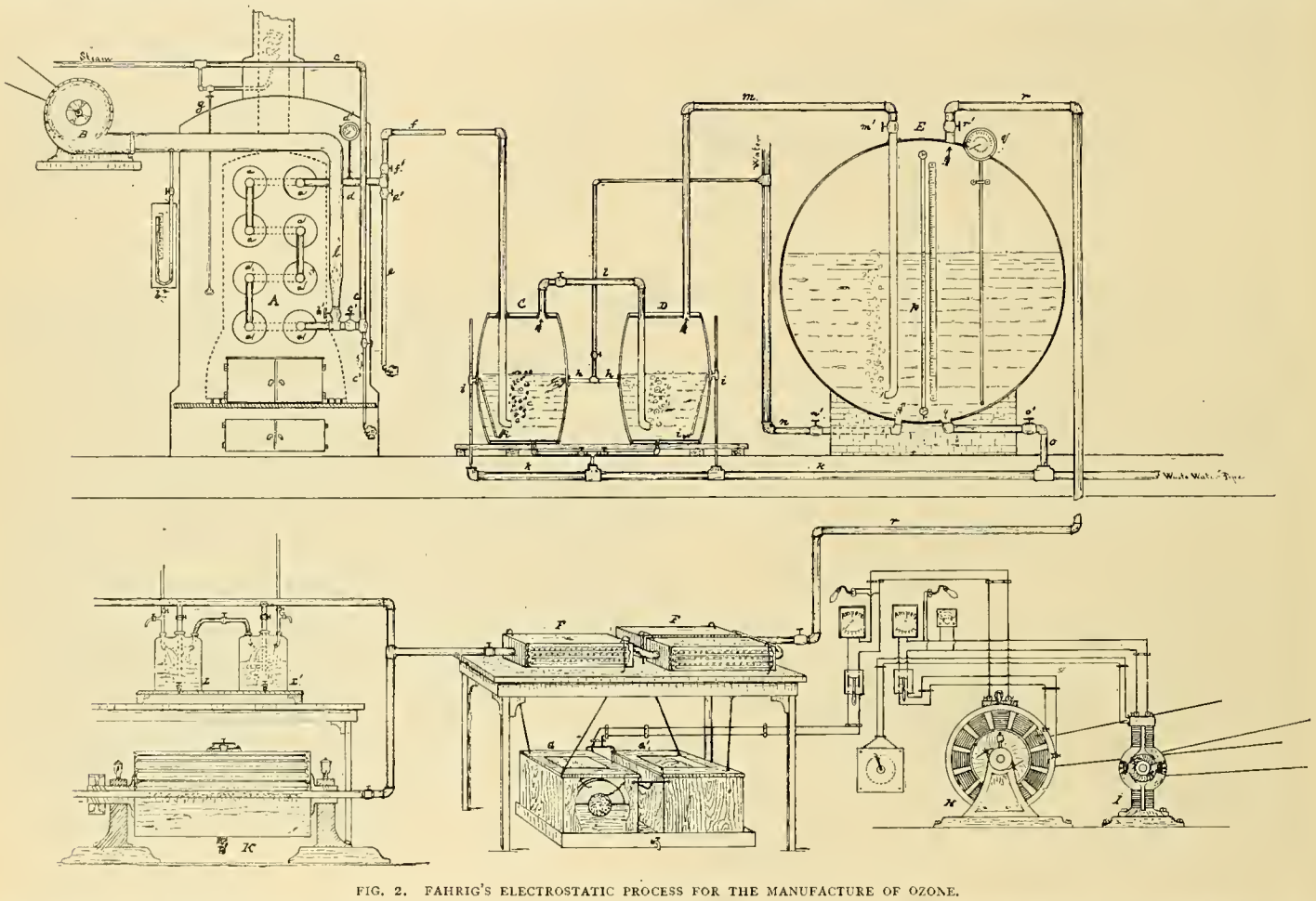

FIG. 2. FAHRIG'S ELECTROSTATIC PROCESS FOR THE MANUFACTURE OF OZONE.

Prof. Fahrig states that the generators, although simple in construction, require the greatest care in building. In his work he had to be guided entirely by practical tests. Having proved that for the commercial production of ozone a 40,000 volt transformer gives the best result with the most economical working, the surface of the condensers, the thickness and distances between plates and wires must be found by experiment. But irrespective of the number, it may be said that the surface of the entire discharging medium being 10 by 20 inches, a 5 millimeters thickness and a 5 millimeters distance between will give the best result. The glass must be of the best quality and of as even thickness as possible. The rods must be straight and even in diameter. The aluminum foil or tinfoil and the aluminum wire must be pure, or nearly so. In building a generator, after the rods and plates have been thoroughly washed with nitric acid, rinsed in cold water and then in hot water and last in methyl spirit they are at once coated all over with a varnish made of 20 ounces of button lac to 1 gallon of spirit-fini dissolved at 120 degrees temperature; after a straining of from 12 to 15 hours it may be used with a flat 2-inch wide camel's hair brush. The rods are dipped in the varnish and receive also three coats. The sheets are cut to the size, 10 by 20 inches, leaving a 1 inch margin of glass around the sheet. Each sheet has of course a strip of foil projecting, to which the secondary wires from the generator may be attached. Before cementing the sheets to the plate glass, they are pressed against a sheet of steel netting with meshes 3 millimeters square. This fills the sheet with a great number of raised points, so to speak, that serve to direct the discharge more evenly from plate to plate. The aluminum sheet is now varnished on the under side, placed upon the glass and pressed evenly with a felted pressure board and left to dry for twenty-four hours. Then the sheet is varnished over, and when dry the plate and its conducting surface is ready to go into the generator. The thinner the foil the better the result. The quality, too, of the varnish and the manner of varnishing form a most important part in the successful working of the generators.

After a study of the construction and the electrical connections of a Fahrig generator, a most natural question is, "Does the electrical discharge, which acts upon the oxygen flowing through the generator boxes, pass through the thick glass plates and solid glass rods?" Mr. Fahrig answers this question in the affirmative. He states that an inspection of the interior of the box during action reveals a bluish brush discharge between plates and tubes, and as the gas fed to the boxes is oxygen and that leaving the boxes is ozone, and as the electrical discharge through oxygen produces ozone, it is most reasonable to conclude that the brush discharge must be through the glass. Neither plates nor tubes, though, show any change in structure even under the microscope. It is seldom that a generator plate gives way. It is a peculiar fact, though, that if a plate does break the crack is usually zig-zag and in one direction; that is, the line of the break is, as indicated in Fig. 7, from terminal corner to terminal corner. The plates, though, show no sign of puncture. The rods, if they break, invariably do so at about one inch from the end. The transformers are wound for 40,000 volts, and the current passing through the primaries is constant, but the electromotive force now and then seems nearly to double itself. This effect is detected by the pitch of the sounds in the generators. This seems a peculiar phenomenon. It does not last long, and it ends usually in a snapping and jumping over of sparks; then all is normal again.

With reference to the commercial utilization of ozone, Prof. Fahrig says: "Ozone is the strongest oxidizing agent known, and should be most useful particularly in bleaching processes. At present chloride of lime is used extensively as a bleacher. Chlorine, however, in a pure

and dry state has no bleaching properties. But from its great affinity for hydrogen, forming oxygen and hydrochloric acid, chlorine becomes the strongest bleaching agent. It is the oxygen set free in the chlorine in combination with the water which performs the bleaching. Now ozone is nothing but oxygen in a condensed state. Oxygen converted into a 1, 2 or 3 per cent. ozone is a powerful bleacher. It is a mistaken idea that ozone can be produced at any per cent. of strength. Six and 7 per cent. of ozone is about the strongest one would care to handle, and a 1 per cent. of ozone is strong enough for most any commercial oxidation. Ozone seems designed as nature's own oxidizing agent. By employing ozone instead of chlorine we substitute a harmless substance for a deadly poison. It would be a step forward did our spice merchants adopt ozone for bleaching ginger, pepper and all other food stuffs. It could be used also for treating drinking waters. Ozone alone can kill the bacteria in water. For instance there is a splendid artesian well giving water with valuable medicinal properties, but on account of the water's passage at 1800 feet depth through coal and iron ores, it is highly impregnated with sulphureted hydrogen. There is no process so simple and inexpensive as treating such waters with ozone. Twenty grains of ozone per 1,000 gallons of water gives a good result. Here we have at once a large field for the use of ozone. Ozone could be used for bleaching paper, especially the better grades; also for treating sewage; for separating sugar in sugar refining; for preserving meat, fish, milk, etc.; for aging alcohol in general, and whisky in particular. By carefully handling whisky direct from the still we produced in 24 hours, with a six to one volume ozone pressed through at 7 inches U-tube pressure with a loss of 1.5 per cent., a liquor equal to that aged 10 years. The butyrine, amyline and toxy acids yield to ozone, whereas the most destructive distillation does not effect them. Whisky aged by ozone has been pronounced of first-class quality.

"Ozone is also used for making iodoform of very superior quality; for making aldehyde; for oxidizing heavy oils; for linoleum and and oilcloth manufacture; for sterilizing water; for brewing purposes and for general medicinal preparations and sanitary uses; for oxidizing aniline in

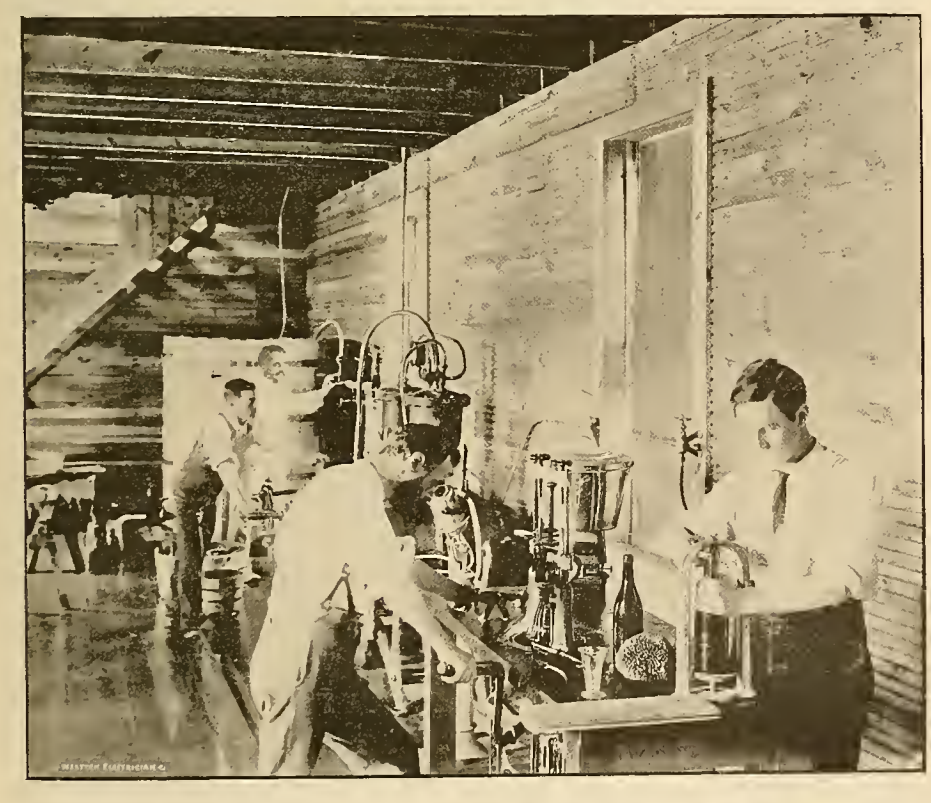

FIG. 4. FAHRIG'S ELECTROSTATIC PROCESS FOR THE MANUFACTURE OF OZONE.

course of manufacture; for solidifying $H_2 S O_4$; for treating the sour mash in distilleries; for oxidizing animal products; bleaching wool, silk, ivory, bone, wax, tallow; bleaching sponges; treating eucaliptus and cod liver oil, citron and olive oils. A very brilliant experiment is the charging of certain liquids with ozone, which produces a phosphorescent light. This phenomenon has been observed by others beside myself, and Drs. Ring and Jeserich of Berlin attributed the light to the process of killing bacteria in the liquid. I cannot, however, entertain this theory. That ozone kills the bacilli is a fact, but the appearance of the phosphorescent light does not always prove that bacilli are present."

Figs. 8, 9 and 10 show the main portions of the apparatus at the Marseilles plant, while Fig 4 is a view of the bottling room of the American Ozone Water company. Fig. 8 is the blower which forces the air down from an elevated point in the building to the furnace, Fig. 9. Fig. 10 is a

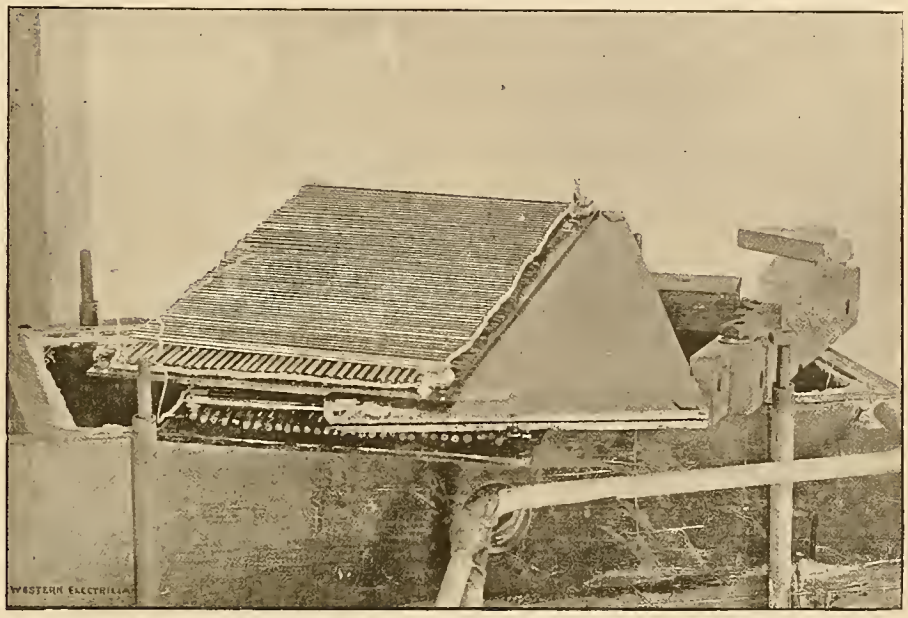

FIG. 3. FAHRIG'S ELECTROSTATIC PROCESS FOR THE MANUFACTURE OF OZONE.

view of the alternator and its exciter, which furnishes the 50 volt current to the converters at the generators in the ozone room. It was not possible to obtain a picture of the reservoir.

For the information and photographs relative to this interesting installation the WESTERN ELECTRICIAN is indebted to Prof. Fahrig and also to General Manager Gustave Mourath, Chicago. Mr. Mourath, it should be stated, acted as Prof. Fahrig's consulting electrical engineer in the construction of the Marseilles plant.

The South Covington Cincinnati Street Railway company has filed a petition in the County Court against Edward R. Stearns for the condemnation of a lot on the west side of Lowell street, between Eleventh and Liberty streets, Newport, Ky., 122 feet front by 425 feet to low water mark on the Licking River, to be used as a location for a power house.

Electricity at the World's Fair.

Preparations for the work of equipping the electric intermural railway at the World's Fair are progressing rapidly. The awarding of the contract for the erection of the elevated structure and the location of the power house in the southeastern corner of the park, near the forestry building, have already been noticed in the WESTERN ELECTRICIAN. Work has been begun on the foundations for the elevated tracks and the heavy timbers will soon be on the ground. The electrical and mechanical engineering of the plant is in charge of B. J. Arnold, who is now at work on the plans for the power house. The station will be equipped with Babcock & Wilcox boilers of 4,000 horse power capacity, and oil will be used as fuel. The largest engine will be one of 2,000 horse power capacity of the Reynolds-Corliss cross compound type and manufactured by Allis & Co. of Milwaukee. This will be directly coupled to a huge Thomson-Houston multipolar railway generator of 1,200 kilowatts capacity, the whole making an imposing combination. In addition there will be a tandem compound Reynolds-Corliss 750 horse power engine directly coupled to a 500 kilowatt generator; a Greene 750 horse power engine, made by the Providence, R. I., Steam Engine company, belted directly to a 500 kilowatt generator; a Williams 750 horse power vertical engine, made by the Lake Erie Engine Works of Buffalo, coupled directly to a 500 kilowatt generator, and a McIntosh & Seymour engine of 750 horse power directly coupled to a 500 kilowatt generator. All of the electrical machinery will be of the Thomson-Houston type, and the dynamos will be multipolar and of great size. The total capacity of the machines is 3,000 kilowatts. The condensing machinery will be placed in a pit in the engine room. Here, also, will be located the well from which the boilers will be supplied with water. This will be connected with the lake by a tile pipe, and will be partially filled with water, which will, of course, stand at the level of the lake. A feature of the plant will be the provisions made for visitors. The partition separating the boiler and engine rooms will, in the upper portion, be constituted of a series of arches, and a gallery will extend on either side of this the whole length of the building. Spectators will thus have an uninterrupted view of the boilers on one hand and the engines and dynamos on the other. Another "show" feature in contemplation is the placing of a mass of incandescent lights at the bottom of the well, which will illuminate the water and show it surging in response to the action of the pumps. This will doubtless constitute a popular attraction.

Nearly all the outside work for the incandescent wiring at the World's Fair has been accomplished. Mr. Keller, the superintendent of the installation, returned from Pittsburg last week, and Mr. Broadnax, the engineer of construction, came back from New York last Monday. The plans for the wiring of the administration building have been prepared. A feature will be the lighting of the great dome, which will be partly accomplished by arc lamps concealed by a false ceiling, which will cover a portion of the space over the center of the building. Fifty-light clusters of incandescent lamps and others of smaller size will encircle

the interior space on the several floors and add to the general effect.

Mr. Gardner, the designer of the Electra, the Electric Launch & Navigation company's successful boat, is in the city conferring with the World's Fair officials to determine whether any changes shall be made in the model before the orders are placed for the boats needed. The length favored by the Electric Launch & Navigation company is not to extend 34 feet.

The Electra continues to make occasional trips about the grounds. On Friday of last week Mrs. Whitelaw Reid

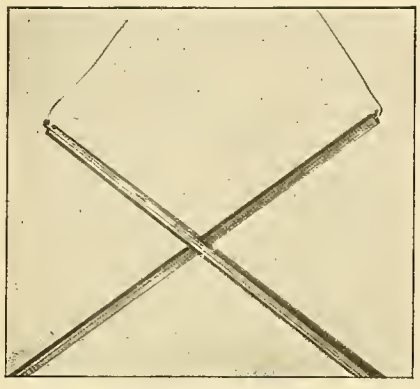

FIG. 5. FAHRIG'S ELECTROSTATIC PROCESS FOR THE MANUFACTURE OF OZONE.

and Secretary Rusk enjoyed the pleasures of a ride on the lagoons in a boat propelled by electricity.

The French minister of commerce and industry recently appointed thirty-nine committees to take charge of the exhibition of French products at the World's Fair. Among the number was one appointed to take charge of groups 122 to 135, which comprise the department of electricity. The appointees are men who are well known in the electrical world. They are MM. Baron, of the postal and telegraph department; Dr. Berthelot of the faculty of sciences; Carpentier, electrical engineer; Fontaine, president of the Gramme society; Fribourg, inspector general of telegraphs; Mascart, director of the Central meteorological office; Menier, cable manufacturer; Mounier, professor of the Central schools of arts and manufactures, and others.

At a recent meeting of this committee it was stated that the government had been asked to make an appropriation of $20,000 for an exhibition of the French telegraph service. With this as a nucleus, a creditable exhibit of electrical apparatus could be made; otherwise the cooperation of manufacturers could not be secured, as an appeal to their patriotic pride would not alone induce them to stand the necessary expense. The government, it was stated, had refused the desired aid, as the administration felt it had sustained the national honor sufficiently by its participation in other classes.

This statement of the unwillingness of the government to share in the electrical exhibit had such a discouraging effect that the members of the committee decided at once to send in their resignations. One of the number, however, announced that he had not despaired of inducing the government to reconsider, and at his request the members of the committee determined to postpone, for a short time, sending in their resignations.

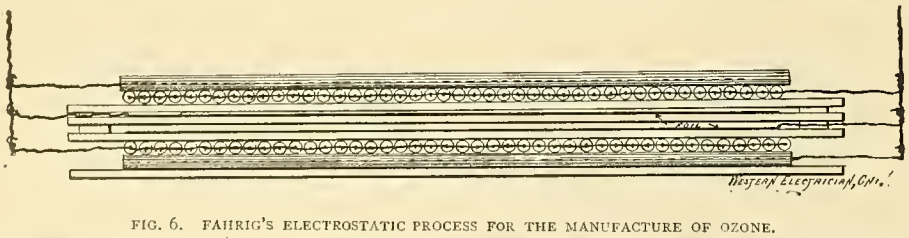

FIG. 6. FAHRIG'S ELECTROSTATIC PROCESS FOR THE MANUFACTURE OF OZONE.

Marketing Vegetables by Electricity.

In writing of the "truck farming" region of Southeastern Virginia, a correspondent of the *Manufacturers' Record* of Baltimore says:

In one of our trips the other day we visited the old town of Hampton, which is connected with Old Point Comfort (Fortress Monroe) by a line of electric railway. While examining the "old Episcopal church," said to be the third oldest church in America built by English people, we saw two electric flat cars pass rapidly down the line en route for Old Point loaded to their full capacity with potatoes, cabbages, cucumbers and tomatoes. We believe this to be the first point in the world where "taters are toted to market" by electricity. The sight was a novel one. On one hand was the old church, with its ivy covered walls and its old tombstones dating back to 1700, and here within twenty feet was an electric line carrying farm products to market. Extremes meet in Hampton.

Electric Railroading in Ohio.

Neighborhood rivalry is doubtless responsible for the following amusing description of the electric railway in Lima, O., which is taken from the *Courier* of Findlay, O.:

Prominent, if not chief, among the eccentricities of Lima is her street car line. It looks like the "last existing copy of the original edition" of the electric motor. It is a sort of an overhead, double-trolley system. The trolleys run on top of the wires, being held in place by suspended weights and are connected with the motor by means of flexible, insulated wires, the whole arrangement trailing out behind the car like a dilapidated kite tail. The motive power is applied by means of chain belt and cogs, which apparatus when in motion, makes as much noise as a good sized rock crusher. It can hardly be said with truth that the cars run. They just proceed over the sagging rails with a combination of movements. They transport the people from place to place very much as the Santa Clara street underground system did in San Jose. You enter the car, drop your nickel in the slot and ride half a block. Then the ancient vehicle hobbles off the track, bumps sidewise over the cobbles for a while and you walk to town.

THE BOOK TABLE.

STREET RAILWAYS; THEIR CONSTRUCTION, MAINTENANCE AND OPERATION. By C. B. Fairchild. Published by the Street Railway Publishing company, New York.

This book is by far the most complete work on street railways that has thus far been published in this country. It is designed to help builders and operators of street railways, but it also contains much information that will be interesting to capitalists who have invested in street railway securities or contemplate such investment. The several systems of street railway propulsion are described, the apparatus employed is explained and the best modern practice in track and line construction, etc., is clearly presented. The first chapter of the book is devoted to elec-

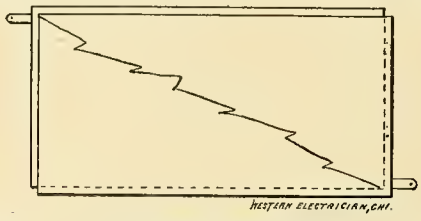

FIG. 7. FAHRIG'S ELECTROSTATIC PROCESS FOR THE MANUFACTURE OF OZONE.

tric traction. After a brief explanation of fundamental principles, the special application of electricity to the operation of street railways is described. The best known types of generators, motors and other devices are illustrated and their construction and operation explained. Special chapters are devoted to cable traction, horse traction, steam, air and gas motors, and elevated roads.

The work will be of particular value to those who desire reliable information on car building and track construction. A chapter is devoted to each of these subjects. There are many other interesting and valuable features in this work which will commend it to street railway managers. Under the head of "Discipline and Rules" directions are given for the conduct of a model road. These are especially commended to superintendents as forming the ground work for rules for the guidance of their employes. Many excellent suggestions are also contained in the chapter on book-keeping and classifications of accounts that will be readily appreciated by accountants.

Throughout the entire work the author has shown a familiarity with the most minute details that will at once inspire confidence. His suggestions are practicable and they disclose an intimate knowledge of the requirements of modern practice. This is particularly noticeable in the chapters on track construction and car building, already alluded to, which are probably the most valuable portions of the book. Altogether the work is a most timely and valuable contribution to street railway literature.

THE SCIENTIFIC AMERICAN CYCLOPEDIA OF RECEIPTS, NOTES AND QUERIES. Published by Munn & Co., New York.

This work contains 12,500 receipts and replies compiled from the notes and queries of correspondents as published in the *Scientific American* during the last fifty years, together with many valuable and important additions. The information is presented in concise form convenient for reference. Instructions are given for working different processes in the arts. Many of the principal substances and raw materials used in manufacturing are defined and described. The work shows evidence that much attention has been given the compilation in order to make the information trustworthy.

Phenomena of Atmospheric Electricity.

The recent remarkable auroral disturbance produced curious phenomena on the telegraph circuits and instruments of submarine cables and aerial land lines that may afford data for scientific men in determining the actual nature and laws of the mysterious auroral phenomenon itself, says the New York *Sun*. In a broad sense telegraph circuits are affected by auroral displays in the same manner as by violent thunder-storms, but the precise effects from the two causes are very different. Interrup-

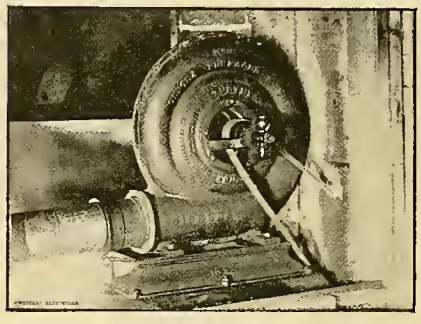

FIG. 8. FAHRIG'S ELECTROSTATIC PROCESS FOR THE MANUFACTURE OF OZONE.

tions to telegraphic communication on lines in far northern latitudes are of frequent occurrence. The lines in Canada, for instance, which run north of Lake Superior, from Montreal to Winnipeg, are at certain seasons of the year interrupted almost nightly by slight auroral disturbances. But the disturbance on July 16th was the most remarkable in its effects on telegraph circuits of any noted for a great many years, if not the greatest of all such displays. A prominent electrician in this city took careful notes and tests of the effects of this disturbance, and he calculated that the force of the electrical current from the auroral disturbance was equal to 500 volts.

It is interesting to note, too, that the telegraph instruments showed the auroral disturbance to be very much greater during the day, from about 11 in the morning to 4 in the afternoon, our time, when there was no spectacular display of celestial scenic effects, than it was at night when the wonderful phenomena was so apparent. The electrical disturbances were noted at precisely the same

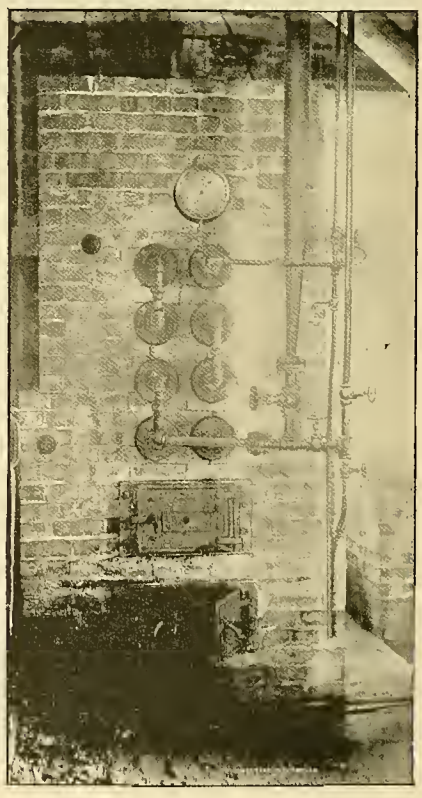

FIG 9. FAHRIG'S ELECTROSTATIC PROCESS FOR THE MANUFACTURE OF OZONE.

time in this city, in Chicago, and in Nova Scotia and Newfoundland. In Chicago it was noted that, while the sky was cloudless and the sun was shining brightly, tremendous currents of electricity charged the air, completely interrupting all telegraphic communication. The currents came in waves at irregular intervals.

But the most interesting effects were noted on the delicate instruments of the Atlantic cables, and with these, on account of their peculiar construction, various phenomena

of the auroral disturbance could be noted that were not possible on land line instruments. With the latter the effect was simply to put a current or a ground on the circuit, which broke things up generally and prevented all communication. On the cable instruments the length, intensity, and direction of the waves of electricity were recorded accurately. The effects were noted on the instruments of the cables that run into this city from Nova Scotia, and on the long cables at Nova Scotia and Newfoundland, which run under the Atlantic to Ireland. It was on the long cables that the auroral effects were displayed most strongly, and as the cable drops direct from the office into the ocean, and lies at the bottom, in some places three miles down, the presumption that the auroral force was exerted through that watery space as well as on the instruments directly is of interest.

The siphon recorder, the instrument used for submarine cable telegraphing, is the most sensitive kind of a galvanometer in practical use. The auroral disturbance interrupted communication entirely. During the disturbance, especially between the hours of 11 and 3 midday, the siphon or needle was deflected intermittently very strongly from the zero, or middle, position, and it swayed first to the right, and then to the left. The movement of the needle was very slow. It would suddenly move away to the left, pulled by, say, a northerly current, and would be pulled very far, indeed, beyond the limit of any cable current, indicating that the current was very powerful. It would remain at the extreme point of deflection from 5 to 10 or 15 seconds, and then return slowly to zero. Sometimes immediately, sometimes a few seconds or minutes later, the needle would be pulled slowly in the other direction by a southerly current, would deflect to a remarkable distance, remain there a few seconds, and then return slowly to zero. That seemed to indicate that the electrical

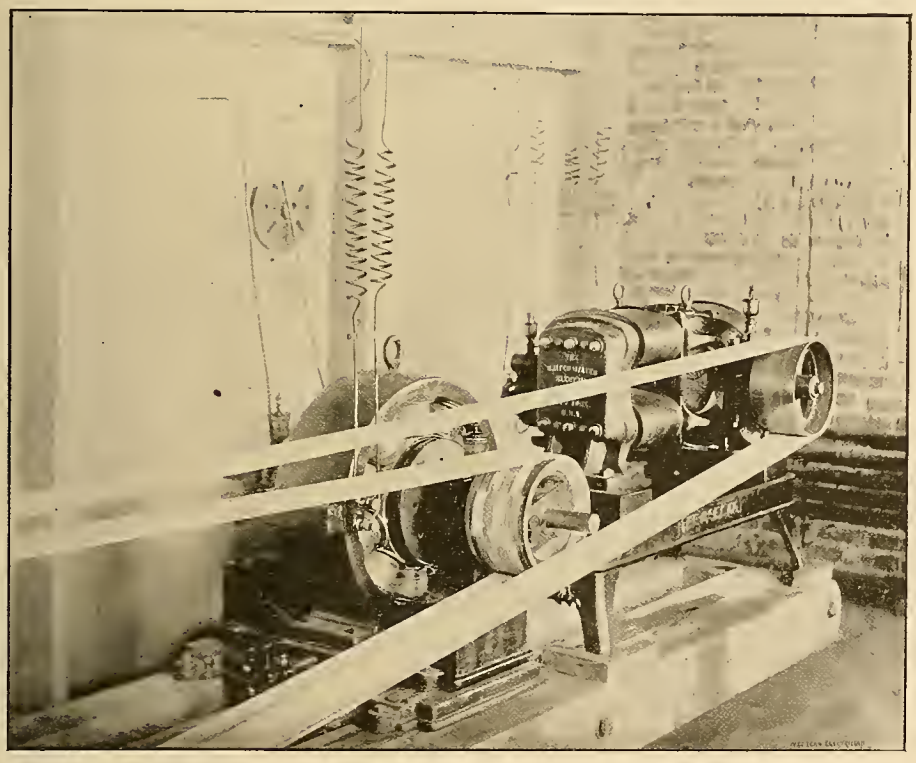

FIG. 10. FAHRIG'S ELECTROSTATIC PROCESS FOR THE MANUFACTURE OF OZONE.

currents set up by the aurora were very powerful, were steady and of long duration, and alternated in direction of force in their polarity; they were like great waves of the ocean ebbing and flowing. The effect of a severe thunderstorm on a cable instrument, felt often when the storm is far at sea, is a quick, instantaneous jerk of the siphon, the effect lasting only an instant. The cables were effected in the evening of the auroral display when the heavens were aglow with the magnificent streamers and banners of light, but the interruption was very slight as compared with that experienced during the day.

Physicians and Electricians.

In commenting on the convention of the American Electro Therapeutic association, which is to be held in New York this fall, the *St. Louis Globe-Democrat* says: "Such a communion is calculated to do an immense amount of good in directing attention to the admirable results that have been attained in many departments of surgery and medicine by means of electrical applications. Another outcome of such a meeting can be looked for with satisfaction. The field of electro-therapeutics is covered by three pretty clearly defined classes of practitioners—the really earnest and scientific worker; the ordinary practitioner, who, recognizing that electricity is 'the thing nowadays,' uses it in a blind and perfunctory manner, knowing, perhaps, that certain causes give certain general results, but not knowing or, perhaps, not caring to know why; and the electrical medical humbug. It is no small advantage that such an opportunity can be afforded of differentiating between sound and questionable practice, and it is not unlikely that the stimulus afforded by the proposed convention will be the means of urging on many practitioners who may now come under the second class to such work a will place them in the first rank."

Badt's Alternating Current Electric Railway System.

The apparatus for conveying power to electric motor cars by underground conductors which is illustrated by the accompanying cuts is the invention of Lieut. F. B. Badt of Chicago, who proposes to use alternating or multiphase currents for this purpose. It is proposed to transform the current in step-down converters located at short distances apart, using two surface conducting rails, connected with the secondary coils of the transformers, to conduct the current to the car motors by rolling contacts. It is, however, possible to make one transformer answer for a considerable extent of tract by using suitable switching arrangements. The conductors are to be laid in sections insulated from one another, and an automatic switch is provided by which the rails next in advance of the car will be thrown into circuit in time to furnish the working current as soon as the car has moved over them in the proper position and cutting it off after the car has passed. By this device, it is claimed, the conducting rails will only be in circuit at the time of the passage of a car.

Fig. 1 gives a diagrammatic view of the parts of the apparatus in their relative vertical positions, while Fig. 2 shows an enlarged detail of a transformer and its associated parts. Referring to these cuts, *A* is an underground cable containing two conductors. The cable proper is composed of successive sections, each of which is securely let into the side of the box *E* by means of the stuffing-box *D*. Within this box the main conductors are bared and from them lead the terminals of the primary coil *F*, and in opposition to the secondary coil *H*, whose terminals lead through stuffing-boxes into the switch-box *K*. The two cover boxes may be tightly filled by means of the funnels *L L* with oil to assist insulation. In the box *K* is located the switch consisting of an electro-magnet *M*, which is included in the local circuit composed of the conductors M^1 M^2, leading, respectively, from the sectional rails M^3 M^4, Fig. 2. Opposed to this electro-magnet is the pivoted armature *N*, normally disengaged from the contact-block N^1, which forms one extremity of the conductor which leads from the secondary converter-coil. The other conductor *O*, Fig. 1, from the secondary leads to the sectional rail M^4. The armature *N* may be held away from the contact point N^1 by spring, gravity or otherwise, as may be convenient. The rails M^3 M^4 are made in successive fairly well insulated sections laid upon the surface. These sections are, preferably, slightly less in length than the distance between the trolley wheels *R R* and *S S*.

In the underground cable it is proposed to use currents of 2,000 volts potential, or higher if desired, to be transformed down to fifty volts. If for any reason the local circuit is closed, no particular loss of current will ensue, for insulation sufficient to confine a current of such low voltage in the sections of conducting rail can easily be obtained. Moreover, if by any possibility a local short circuit should be completed, small damage, if any, would be done on account of the low voltage of the local current. Suitable fuse-plugs would be placed in any or all of the circuits or connections, as desired, for the purpose of insuring safety, and the car is preferably provided with two motors, though more or less could be used, and with two sets of trolley-wheels. One set will be placed forward on the car and the other toward the rear. The conductor

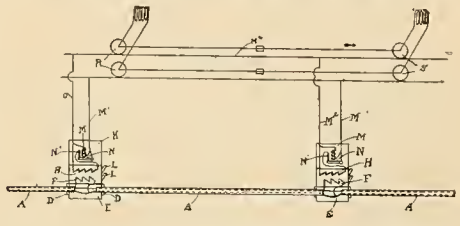

FIG. 1. BADT'S ALTERNATING CURRENT ELECTRIC RAILWAY SYSTEM.

rails or strips are preferably arranged between the tracks or rails on which the car is supported, and consist each of successive sections insulated in the ordinary manner and so far as may be convenient from each other.

Various means may be devised for closing the switch in the first instance to start the car—as, for example, a storage-battery cell or two may be associated with the car. Assuming that current taken up by the forward trolleys is being passed through the motors on the car and through the magnet of the switch to hold its armature up and the circuit closed, the car will, of course, tend to move forward under the action of its motors. Its forward motion speedily carries the forward trolleys toward the next succeeding set of conductor rails or strips. The rear trolleys will, however, at such time necessarily be on the set of rails or strips in the rear of those against which the forward trolleys act. This current is being supplied to operate the car and to keep the rear rail-sections in circuit through the rear trolley. At the same time the forward trolleys, being connected, as shown, with the rear trolleys, a circuit is closed through the switch associated with the next converter, and a sufficient current is diverted through such circuit to close the switch or lift up the armature and complete the circuit through the secondary coil of the forward converter. This brings the forward trolleys into circuit and they lead a current through the motor or motors of the car. When the rear trolleys pass off of the set of conductor-rails on which they are acting, they will of course cause the release of the switch and the local circuit connected with these rails will be broken; but before this action takes place, since the conductor rails are somewhat less in length than the distance between the trolleys, the forward trolleys will have passed on to the second successive or forward conductor rails and will have brought them into circuit and the current will be supplied through them, as last above described.

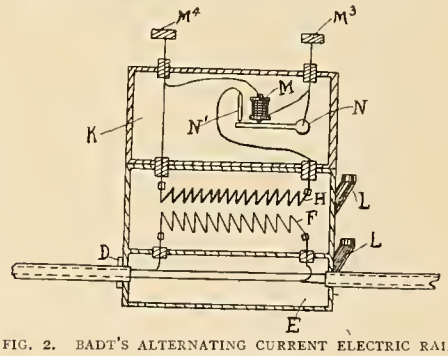

FIG. 2. BADT'S ALTERNATING CURRENT ELECTRIC RAILWAY SYSTEM.

The system with some modifications is applicable to conduits already laid. Lieut. Badt has also devised a mechanical switch for this system by which the current is turned on and off by means of projecting pins from the trolleys. The advantages of the invention are the absence of overhead wires, the presence of the current in the surface conductors only when the car is over them, and the low voltage employed in these rails. The principal defect of the system is the lack, at the present time, of a satisfactory alternating current motor adapted to street car work, but when this want shall have been supplied Lieut. Badt's invention will no doubt be thoroughly investigated by practical tests.

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CORRESPONDENCE relating to electricity, or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

	PAGE.
Fahrig's Electrostatic Process for the Manufacture of Ozone. Illustrated	109, 110, 111, 112, 113
Electricity at the World's Fair	111, 112
Marketing Vegetables by Electricity	112
The Book Table	112
Electric Railroading in Ohio	112
Phenomena of Atmospheric Electricity	113 112
Physicians and Electricians	113
Badt's Alternating Current Electric Railway System. Illustrated	113
Editorial	114
George A. Redman. Portrait	115
Brussels-Antwerp Electric Express	115
Street Railway Convention	115
Electrical Quackery in England	115
A Baltimore Electrical Project	115
A Beautiful Southern Aurora	115
Electric Drill for Mines. Illustrated	116
Safety Side Cutting Plier. Illustrated	116
Dynamo and Engine Combined. Illustrated	116
Northwestern Electric Light Association	116
Pattee's New Lamp-hour-recorder. Illustrated	116
Iona Ceiling Cut-out. Illustrated	116

DEPARTMENTS.

Correspondence	117, 118
New Incorporations	118
Electric Lighting	118, 119
Electric Railways	119
Telegraph	119
Telephone	119
Miscellaneous	119
Trade News	119
Business	119, 120
Electrical Patents	120

ELECTRICAL interests in Northern Michigan and Wisconsin will hereafter be especially guarded by an organization formed last week by representatives of the electrical companies in that region. It will be known as the Northwestern Electric Light association, and among the names of the members are many who are well known as successful station managers. It is quite probable that the new organization will do good work in promoting the interests of those engaged in electric lighting and opposing oppressive legislation. It has started out well and is deserving of success.

IT appears likely that the French electrical exhibits at the World's Fair will be meager, as the government has declined to make an appropriation for a telegraphic display, which would have served as the nucleus for an electrical exhibit of considerable size. This action is to be sincerely regretted. One of the greatest attractions of the Paris exhibition of 1889 was the display of American electrical inventions, but it does not appear that the Frenchmen are disposed to reciprocate in kind, even in a lesser degree. England and Germany will each make fairly large exhibits of electrical products. France, with hardly anything to show in this department, will make a sorry showing beside them. It will be a great pity.

EVIDENCE of the eagerness with which the public generally grasps at information on electrical topics is presented in the statement of the officers of the Chicago University, who have in charge the arrangements for the university extension course of lectures. The subjects which lead all others in point of popularity are electricity and American history. Interest in both of these topics, especially the latter, has been greatly stimulated by the World's Fair. Everybody interested in educational work realizes what a fascination there is for the student in everything pertaining to electricity. It is not to be wondered at, therefore, that a popular series of lectures by men of wide reputation would prove a great attraction at this time.

IT was hoped that the labor troubles at Buffalo would be settled without involving the telegraph operators in the strike, but, according to the daily papers, there is reason to believe that some of the operators will join the strikers. The operators on the Lackawanna road want more money and fewer hours. Almost precisely the same conditions exist on the Erie road. The Vanderbilt roads pay about the average wages, but the hours of labor are the same as on the other two roads. The adjustment of these differences is likely to result in a strike. This statement, which, it is claimed, was authorized by a member of the Order of Railway Telegraphers, conflicts with the avowed policy of that organization. It is to be hoped that a strike may be averted, as conflicts between labor and capital are generally attended by hardship to the men.

PROJECTS for high speed electric railways to connect adjacent cities are not confined to the United States. An engineer, presumably a Belgian, rejoicing in the name of Prosper van den Kerchove de Gand, has proposed to the government an electric railway to connect Brussels and Antwerp, trains to be run at the rate of 83 miles an hour. As the distance between the two cities is slightly less than thirty miles and as the country is almost perfectly flat it is thought that the plan is a feasible one. It is proposed to run single cars of large size and to make the trip in 20 minutes. The cost of the railroad is put down at $2,300,000, and, what is somewhat surprising, it is stated that the promoter of the scheme is prepared to furnish the money if the right to operate can be obtained from the government. It is to be hoped that he will be allowed to put his plan in operation. The results would be awaited with interest.

IT IS gratifying to learn that steady progress is being made on the long-distance telephone line that is to connect New York and Chicago during and after the World's Fair. The latest reports state that a point between Goshen and Elkhart, Ind., has been attained in the westward progress of the work of construction, and before long South Bend will be reached. Work is also under way from the Chicago end. The company which is back of the enterprise has generally been accorded fair treatment by the authorities of the cities on the route, as it is generally recognized, even by aldermen, that the project is one deserving hearty support. There is little doubt that conversation between Chicago and New York—a distance of almost a thousand miles—can be successfully held, and the accomplishment of this feat will be one of the greatest of the striking electrical achievements of the nineteenth century. The project is in line with enlightenment and progress, and it is entitled to public approval.

WITHIN ten miles of the city of Baltimore there is an excellent water power capable of furnishing 10,000 horse power throughout the year. This power has never been utilized, but now it is proposed to build an electrical generating plant at this point and transmit the current to the city. Advocates of municipal plants have already prepared statements showing that the city can light the streets with electric lights and sell enough power to street railway companies and manufacturers to realize a handsome profit on the investment. They are just now bending all their efforts toward securing the passage of an ordinance authorizing a $1,000,000 loan which will enable them to put their pet theories into practice.

It is hardly possible that this scheme will go through. It is much more probable that private capital will eventually be called upon to develop the water power of the Gunpowder river. If the estimates presented by engineers are reliable, there may be a great future for Baltimore as a manufacturing city of the first class.

ANY plan for using alternating currents in street railway work is sure to excite interest, and no doubt Lieut. Badt's invention, which is described on another page, will attract much attention. The idea has advantages that are apparent. Economy of transmission is secured by underground circuits carrying alternating currents of high potential, which are, however, transformed in converters, placed at frequent intervals under the track, down to a pressure of fifty volts. Connection is made with the car motors through surface conductors and trolley wheels. These conductors are laid in insulated sections slightly shorter than the car body. An automatic switching arrangement allows only that portion of the conductors under the car to be in circuit, as the car passes along, but even should an accidental contact be made by a man or an animal the voltage is so low that no harm would be done. The principal drawback to the scheme, as it is outlined on paper, appears to be the lack of an alternating current motor adapted for street railway work. With this difficulty obviated, Lieut. Badt appears to have one of the most promising of the many schemes for electric railways operated by means of underground conductors.

IT now appears that the original programme of the American Street Railway association will be followed, and the convention held at Cleveland, O., October 19th, 20th, and 21st, despite the fact that the dedicatory exercises at the World's Columbian Exposition will be held at the same time. This conflict of dates will undoubtedly have a bad effect upon the attendance at the Cleveland convention. As was pointed out last week, the street railway men of Chicago, and in fact of the entire West, will be much more interested in the exercises at Jackson Park than in the proceedings at Cleveland. It cannot be expected that the heads of the great street railway lines of Chicago will have any time to devote to the Cleveland meeting. Every man connected with these lines will find plenty to occupy his time in handling the great throngs that will be attracted by the exercises at Jackson Park. It is generally believed in Chicago that there will be more street railway men in the World's Fair city than at Cleveland during the convention. It is therefore to be expected that the manufacturers of street railway apparatus and the supply dealers will find it necessary to give quite as much attention to Chicago as Cleveland, and it is probable that Chicago concerns will give much more. It would seem that the conflict in dates would jeopard the success of the convention, yet the announcement is made that the original plan will be followed. Secretary Richardson says the matter has been passed upon by the executive committee, and that that body did not feel warranted in making the change. This is certainly to be regretted, as it will cause considerable disappointment among the friends of the association in Chicago and elsewhere.

THE process of manufacturing ozone for commercial purposes by passing oxygen through a box or compartment in which there is a constant brush discharge due to the action of an alternating current of 40,000 volts pressure is one that will possess a peculiar attraction for all who are interested in the phenomena of electricity. That such a plant is in actual operation in the state of Illinois, not far from Chicago, will no doubt be news to nearly all the readers of the WESTERN ELECTRICIAN, as heretofore the work done in this direction has been almost entirely confined to Europe. The fact is as stated, however, as a reference to the complete description of Prof. Fahrig's process which is published in this issue will testify.

Of particular interest are the details of the generating boxes in which the oxygen is transformed into ozone by the electric spark. The description is too long to be reproduced here, but the essential feature is the alternate arrangement of thick glass plates and glass tubes containing aluminum wires. It would hardly seem possible that the current, even at 40,000 volts, could pass through such approved insulation as this, but Prof. Fahrig says that there is no doubt about it. He states, further, that an inspection of the interior of the box during action reveals a bluish brush discharge between plates and tubes, and as the gas fed to the boxes is oxygen and that leaving the boxes is ozone, and the electrical discharge through oxygen produces ozone, we are irresistibly led to the conclusion that the brush discharge must be through the glass. Neither plates nor tubes, however, show any change in structure even under the microscope.

Several other interesting facts are noted by Prof. Fahrig. The generator plates seldom give way, but when one does break it has been noticed that the crack is usually zig-zag and in one direction; that is, the line of the break is from terminal corner to terminal corner. The plates, however, show no sign of puncture. The rods, if they break, invariably do so at about one inch from the end. The transformers are wound for 40,000 volts, and the current passing through the primaries is constant, but the electromotive force now and then seems to double itself. This effect is detected by the pitch of the sounds in the generators. This is a peculiar phenomenon. The increase does not last long, and it ends usually in a snapping pressure and jumping over of sparks; then all is normal again. The study of the behavior of currents of electricity at high potentials is of absorbing interest, but it is seldom that an opportunity for observations of this character is combined with operations of commercial utility, as is the case in the electrostatic process of manufacturing ozone.

George A. Redman.

In electrical circles George A. Redman, whose portrait is herewith presented, is known principally as superintendent of one of the largest electric lighting stations in the country operated by water power. Mr. Redman has long been an advocate of utilizing water power for generating electricity, and he has fully demonstrated at the Brush station at Rochester, N. Y., the practicability of his views. For eleven years he has been in charge of the Brush plant in that city. This station, which has already been illustrated and described in the WESTERN ELECTRICIAN, has attracted much attention. It possesses many interesting features devised by Mr. Redman and this has naturally brought him into prominence in the electrical fraternity. Mr. Redman has just been appointed general superintendent of the Rochester Gas & Electric company, which controls all of the lighting companies of the Flower City.

Mr. Redman was born at New Orleans, La., in 1847, but removed to Rochester, N. Y., at an early age and has since resided in that city. His first experience was gained with the New York, Albany & Buffalo Telegraph company, whose service he entered at the age of fourteen years. Since that time he has been connected in some capacity with the electrical interests of Rochester. His first days in telegraphy were passed under James D. Reid, who was at that time superintendent. Enos M. Barton, now president of the Western Electric company, was an operator at the Rochester office when Mr. Redman entered the service. Application to his duties secured recognition and promotion and it was not long before Mr. Redman occupied a prominent position in telegraph circles. He displayed excellent judgment and executive ability of a high order. He was manager of the American District Telegphone company, Edison Telegraph exchange and Western Union office at Rochester. Eleven years ago he left the telegraph field to engage in electric lighting, which at that time was just beginning to attract attention in commercial circles. The Brush Electric Light company of Rochester had been formed and Mr. Redman was made superintendent. The company had only seventy arc lamps at that time, but it soon began to enlarge its business, and its station to-day is one of the largest in the country. An idea of the progress that has been made in electric lighting in Rochester can be gathered from the fact that there are now operated from the central stations of the consolidated company over 2,300 arc and 23,000 incandescent lamps and 1,100 motors. There are four central stations, three of which are operated by water power, aggregating 7,000 horse power, and one exclusively by steam. The total driving capacity of the stations, water wheels and steam engines, is 9,900 horse power. Thomson-Houston, Brush, Western Electric, United States and Edison generators are employed.

Mr. Redman is popular with his neighbors and the business men of the community, and they have often shown their confidence in him. Mr. Redman has never aspired to public office, and, aside from serving one term in the city council, has declined to engage in politics, although pressed to do so.

Mr. Redman is a member of the National Electric Light association and takes an active part in its proceedings. His paper on the utilization of water power for operating electric light stations, which he read at the Montreal convention, brought out the most interesting discussion of the meeting, and attracted considerable attention not only in this country but abroad. It was one of the most valuable contributions on the subject.

GEORGE A. REDMAN.

Brussels-Antwerp Electric Express.

One of the most interesting projects recently proposed in Europe is that of the electric railway between Brussels and Antwerp. The projector of the enterprise is by no means a visionary but is a man who has built up a wide reputation as an engine builder. His name, which is formidable, Prosper van den Kerchove de Gand, is said by *L'Electricien* of Paris to be a guaranty that the project is proposed only after careful deliberation.

The traffic between the two cities has become so great that a new line is a necessity. It is Van den Kerchove's proposition to the government that the new line be electrically operated and that trains shall be run every ten minutes. The service, he thinks, would prove popular, as, freed from the soot and smoke of the engines, the ride would be a pleasant one, and the fact that with a ten minute schedule no reference to a time-table would be necessary would be especially appreciated by travelers.

The route is direct, and the electric trains, which would be substituted for the 16 express trains running daily each way, would make the trip in 20 minutes. Each train would be composed of a long car, seating 60 persons, with motors on the axles, which would take current from an overhead wire. The speed has been estimated at 83 miles per hour. The estimated cost of the road is $2,300,000, which Van den Kerchove expresses himself willing to risk, giving to the state a certain proportion of the receipts for the right of operation.

Of the enterprise *L'Electricien* says, "It is a splendid project and one that is perfectly feasible. Brussels-Antwerp will be followed by Brussels-Paris—a distance that will be traversed in an hour and a half."

Street Railway Convention.

The suggestion made in the WESTERN ELECTRICIAN last week that the date of the street railway convention at Cleveland be changed so as not to conflict with the opening exercises of the World's Fair was received with approval, especially by the street railway men of Chicago.

It appears, however, that the association has already secured a hall at Cleveland and that other arrangements have progressed so far that it is feared that a change cannot be made. W. R. Mason, general manager of the Railway Equipment company, Chicago, last week received a letter from Secretary Richardson of the association in which he said:

> The matter of changing the date of our annual meeting has been under advisement by the executive committee, and it has been considered unwise to make any change. The week preceding the Chicago display there will be a similar "turn out" in New York. The week after the Chicago demonstration would be too cool, while the first week in October is too early, so that the meeting will, doubtless, be held as provided for in the constitution.

Electrical Quackery in England.

One of the greatest impostures of the day received a severe blow recently, says London *Industries*. A patient suffering from hernia had applied to the Medical Battery company. He was examined by an expert whose qualification consisted in his being a salesman in the West End. This exceptionally qualified medical man told the patient he was not suffering from hernia, but might do so soon if he did not wear one of Harness' notorious so-called electric belts. This was therefore applied. It gave rise to great pain, and the patient eventually consulted a doctor, who told him he had been suffering from hernia all the time, and that the so-called electric belt was injuring him seriously. The patient had only paid £2 out of the £5 5s. for the belt, and was sued by the so-called Medical Battery company, with the result that he obtained his money back.

Let us consider this exposure of astounding quackery. A man believes he has a very serious complaint. He sees electrical cures advertised in all directions, and seeks medical advice. He is introduced to a shopwalker, who poses as a qualified medical man, and foists upon the patient an absurd belt with bits of zinc and copper sewn in, and charges five guineas for it. It must be remembered that this is not an isolated case. The salesman from the West End stated that he had "treated" some 16,000 cases. That is to say, the health, and perhaps the lives, of 16,000 people have been wantonly risked, and something like £80,000 taken as payment.

Our readers may think it strange that a technical journal should devote space to a case about electropathic quackery. Unfortunately, there is little chance of such cases being known otherwise, as the daily papers have taken their share of the £80,000, and are not, therefore, prone to explode this scandalous fraud. We were glad to see that Mr. Gatehouse gave evidence as to the uselessness of the belt. Mr. Gatehouse has, perhaps, done more than any other person toward exposing this system.

A Baltimore Electrical Project.

The suggestion has been made that a large amount of money could be saved for the city of Baltimore if the overflow of the water at the Loch Raven dam were used for the operation of a plant to light the entire city by electricity. The dam is 170 feet above mean tide and the total flow of the Gunpowder river in 1891 averaged 424,413,698 gallons a day. The depth of the water varies at different times, but the flow never ceases. On July 18, 1891, the greatest depth of the year—three feet—was recorded. The dam is ten miles from the city hall in an air line. It is said that the buildings, machinery and engineering work necessary to utilize the flow of water in obtaining 10,000 horse power and generating and delivering the resulting current of electricity in Baltimore would cost $400,000. This would provide, roughly speaking, for 10,000 arc lamps or 100,000 incandescent lamps.

It is proposed to use a heavy current, reducing the pressure at sub-stations in the city. At present about one-fifth of the city is lighted by electricity. It is estimated that 4,000 arc lamps would be required to light the entire city. The use of this number of lights would leave 6,000 horse power from the generating plant unexpended which it is said could be used to operate electric railways or other electrical enterprises until the growth of the city would require it to be expended in the electric light service.

The cost of 4,000 arc lamps would be about $150,000. A rough estimate of the length of circuit wires required for such a system places the total at 500 miles. At $100 a mile, the cost of the circuit wires would be $50,000. The poles generally used would cost $12 each, which would make an additional $50,000. Their erection at $2.50 each would cost $10,000. These items of construction added to $400,000 for generating and delivering brings the total cost of plant to $660,000, to which must be added the purchase and equipment of sub stations. The sum of $1,000,000, itis said, would be sufficient to cover the entire cost. The payment of 3½ per cent. interest on this amount, which would be $35,000, and the operating expenses would be the annual cost to the city.

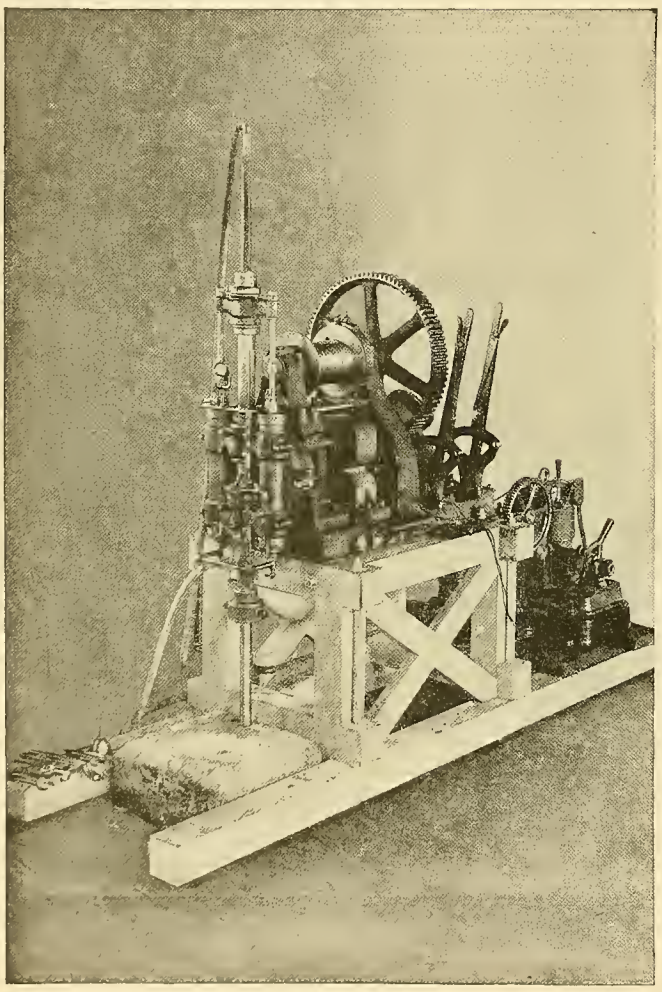
The appropriations by the city council for the lighting deparment in 1892 within the old city limits are $132,000 for gas, including repairs, $8,025 for gasoline, and $127,000 for electric lighting, making a total of $267,025. For the Annex the appropriations were $12,018.80 for gas, $5,420.90 for gasoline and $1,152.90 for electric lights, a total of $18,592.60. In addition to these sums there are 130 lamp lighters, who are paid $8 a week, which amounts to over $54,000 a year. The present lighting service costs the city about $340,000 a year, and it is claimed that a vast annual saving would result from the operation by the city of its own electric light plant, amounting to a sum sufficient to pay off the $1,000,000 loan necessary to start the plant.

A Beautiful Southern Aurora.

A strikingly grand view of the aurora australis was obtained between 11 o'clock and half-past 11 last night at Sydney, and off the coast to the southward, says the Sydney, Australia, *Herald*. The brilliancy of this astronomical phenomenon was so great as to cause many persons to suppose it was the effect of a terrible fire, and had it occurred several hours later and more to the eastward, there are not a few who would hav declared it was the precursor of a glorious sunrise. Altogether it was a grand sight. As seen from the steamer Electra, which arrived in port soon after midnight, Capt. Edward Farrell says that just before making the Heads he and his passengers had a splendid view of the aurora. It was deep rosy pink, with lighter vertical stripes, and spread over the whole of the southern horizon from southwest to southeast. It has seldom been seen in this latitude so striking and beautiful as it was last night.

Electric Drill for Mines.

The drilling apparatus shown in the illustration is mounted upon a heavy timber frame. Behind this is an electric pump supplying water to the drill and having a capacity of about 700 gallons per hour against a pressure of 150 pounds to the square inch. It also supplies water to the hydraulic cylinders of the drill as well as the drill rod. Valves are set in the pipes leading to the pressure cylinder so that any desired pressure may be put upon the drill bit. A valve also controls the supply of water to the drill rod, the pump being able to supply an ample amount to keep the cutting rim of the bit perfectly free and clean. The drill head is arranged with a heavy hinge so that, when uncoupled from the drill rod, it may be swung away from the frame to allow room for hoisting the drill rods from the hole. Here also the machine shows its complete fitness for this work, for at the top of the main standards of the iron frame is arranged a small hoisting drum, which, by the simple movement of a lever, is geared to the armature of the motor, and the machine is ready, with the aid of a block and fall, to hoist out its own drill rods. In the experiments which were made with one of these drills at the factory the drill under a pressure of 120 pounds per square inch on the pistons of the pressure cylinder bored



ELECTRIC DRILLS FOR MINES.

through twelve inches of solid blue granite in three minutes. Under a pressure of 75 pounds the drill cut through 12 inches in six minutes, and at a pressure of 35 pounds it cut through the same amount in about sixteen minutes. These cutting speeds were made with the drill bit and short barrel coupled directly to the drillhead, and will necessarily be slightly diminished when a considerable length of rod has been driven into the rock, but they are sufficient to show conclusively that the even motion of the electric motor makes it the ideal power for this work. The drill is placed on the market by the General Electric company.

Safety Side Cutting Plier.

The accompanying cut represents a new device placed on the market by Vallee Bros. & Co. of Philadelphia. It is a side cutting plier with insulated handles. The handles are covered with a moulded insulating material, which is very durable and of high insulating quality, and, as is readily seen, prevents any contact with electric currents if by accident live wires are handled.

Dynamo and Engine Combined.

The accompanying illustration represents the combination dynamo and engine now being manufactured by the Diamond Match company of New Haven, Conn. This machine comprises a complete and independent plant for factories, offices, stores, steam yachts, and especially for mining, or any underground work where a movable plant is desired.

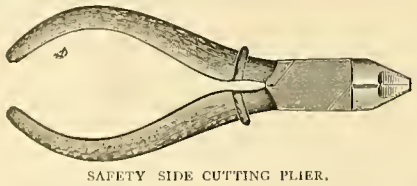
Northwestern Electric Light Association.

The electricians, managers and officers of the electrical works of the Northern Peninsula of Michigan and Northern Wisconsin formed an association at Marinette, Wis., Aug. 19th, under the title of the Northwestern Electric Light association.

The officers elected were H. C. Higgins of the Marinette Gas, Electric Light & Street Railway company, president; T. A. Pamperin, manager of Citizens' Light & Fuel company, and president of the Electric Manufacturing company of Oconto, Wis., secretary, and Louis Lusk, president of the Edison Electric Light company of Antigo, Wis., treasurer. The directors are G. S. Leykom, James R Dee, F. B. Warren, A. A. Foreman and John F. Fitzpatric.

The object of the association will be the regulation and settlement of lines of policy and exchange of ideas on matters of mutual interest in the electrical business.

A number of honorary members were elected, including H. G. Hamilton of Sault Ste. Marie, Canada, W. T. Sullivan of the Chicago Auditorium and J. E. Bowers, president of the Crystal Falls board.



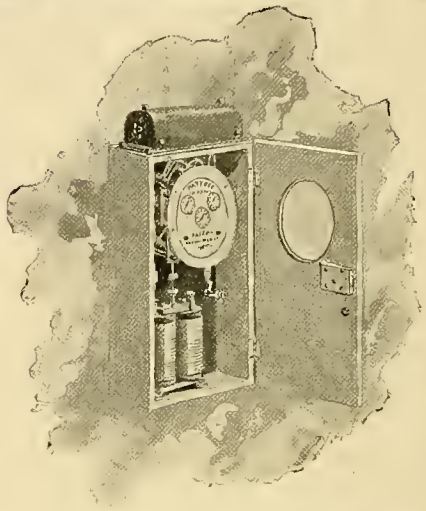
SAFETY SIDE CUTTING PLIER.

After the adjournment of the meeting the visitors, under the guidance and through the courtesy of President Higgins, inspected the well equipped and regulated electric light plant and street railway under the management of that gentleman. The next meeting will be held on October 12th, at Oconto, Wis.

Pattee's New Lamp-Hour Recorder.

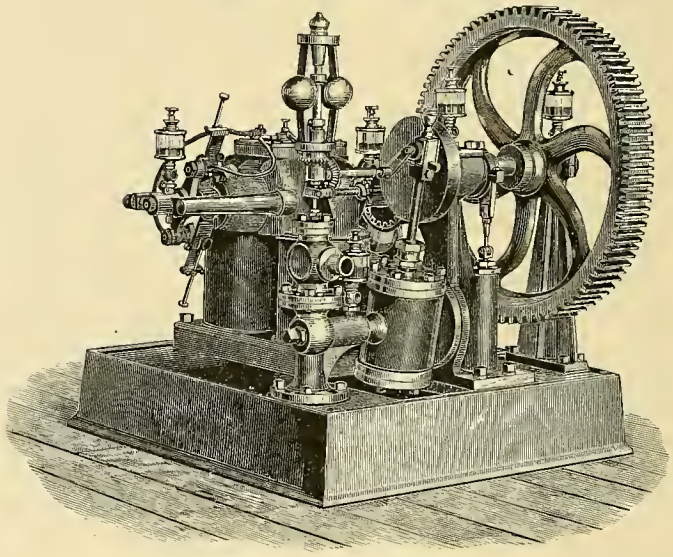
A new form of Pattee's electrical lamp-hour recorder for incandescent circuits is illustrated herewith.

When used for this purpose the recorder is connected in shunt with the group of lamps or the motor and it then



PATTEE'S NEW LAMP-HOUR RECORDER.

tells their actual running time. In the case of lamps on series or multiple series circuits the Pattee recorder is designed to carry the full current, and in either case it is the simplest and most reliable device for the purpose. Quite a number have been used during the past year on both arc

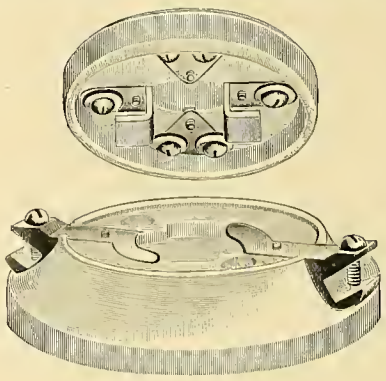


DYNAMO AND ENGINE COMBINED.

and incandescent circuits. The device is manufactured by George Cutter, Chicago.

Iona Ceiling Cut-out.

The accompanying cut illustrates a new design of ceiling cut-out, the Iona. The cap which holds the fuse is fastened to the base by a long clip interlocking with the



IONA CEILING CUT-OUT.

V piece of the cap; and this is further fastened by a phosphor bronze spring, thus obviating the inconvenience of screws. This cut-out is being placed on the market by the Redding Electric company, 41 Federal street, Boston.

CORRESPONDENCE.

New York Notes.

NEW YORK, August 20.—The probability that the overhead system of electric traction will soon have a place on the streets of New York has caused another clamorous outbreak of denunciation in the daily press of this city. Many of these attacks are so conspicuously inaccurate and vehemently unjust as to be simply farcical; and in this competition of silliness the *Evening Post*, which, before the evil days of Godkin, was conducted by William Cullen Bryant, easily maintains the lead. In place of sober argument this journal prejudges the question like this:

Upon the question of the danger of the system to both life and property there is no room whatever for discussion. The record of deaths and accidents, both among human beings and animals, and of fires communicated to adjoining property, fills columns in the newspapers of every city in which the wires have been strung. The *World* has been doing valuable service during the past few weeks in collecting evidence of this kind, and the showing which it has made of the results in Boston and Cleveland especially is appalling enough to restrain even an alderman from voting to extend the system in any direction. In Boston, where the trolley exists in its more aggravated form, the official record of disasters is made up of almost daily entries of lives lost, or persons injured, or property set on fire, or accidents from collisions, or panics caused by the inability of the fire department to approach a burning building because of the network of deadly wires stretched over the street in front of it.

Surely evidence of this character ought to be convincing, and any body of city officials sworn to guard the public interests ought to be incapable of consenting to the introduction of such a constant menace as this into the streets of a great city. It appears to be taken for granted, however, that our aldermen will consent, no matter what arguments or protests are laid before them. Their action will have to go before Mayor Grant for approval, and it would be entirely consistent for him to refuse to give it. He won for himself great credit as a public-spirited executive in his energetic and successful fight against the deadly electric lighting wires. Nothing in his public career has been so popular as his cutting down of the telegraph poles and forcing all the electric wires, deadly and harmless, under the ground. Yet the peril of the electric lighting wires was a mere trifle compared to those which the trolley would introduce. To abolish the first and then consent to the introduction of the second would be an act of inconsistency for which there would be no defense.

After a perusal of this editorial the well-informed reader will hardly know which is the more amusing—the spectacle of the *Evening Post* patting our Tammany mayor on the back or its statement that the peril of electric light wires is a "mere trifle" compared to that of the trolley.

Telephone subscribers in Brooklyn are complaining that the induction from the trolley wires of the electric railways in that city interferes with the efficiency of the service. All-metallic telephone circuits are suggested to remedy the difficulty. In test cases in other states it has been decided that, in case of conflict, the electric railway companies, as common carriers, have a right to use the highways superior to that of the telephone companies.

The Harlem Bridge, Morrisania and Fordham Railroad company has been successful in its fight to prevent interference by the town commissioners of railway of Westchester, Westchester county, with the laying of its tracks. The road is better known as the Huckleberry road. When it started on the work of extending its lines in Westchester there was much excitement among the citizens. Some of the track was laid, and soon as laid torn up. The town commissioners alleged that the company had not the right to lay the tracks. A temporary injunction was obtained restraining them from interfering with the work, and Judge Andrews of the Supreme Court has now handed down a decision making it permanent.

A corporation known as the New York Visual Telegraph company filed articles of incorporation on Tuesday with the county clerk at Elizabeth, N. J. The company's capital is placed at $100,000, and its business will be to transmit news and perform other public services by means of electrical devices. The incorporators and stockholders are James E. Browne of Elizabeth, William W. Rider of New York, and Albert Blackburn of Yonkers.

The new electric railway in Plainfield, N. J., although completed on only one side of the city, carries 2,500 passengers a day. North Plainfield will probably adopt a similar system of rapid transit, as the new road has become very popular. Mayor W. L. Saunders of North Plainfield is now traveling about the largest cities studying the merits of the different methods of street car propulsion, to aid his council in making a decision.

The papers in the suits brought by the Edison Electric Illuminating company and the Edison Electric Light company against the Equitable Life Assurance society have not been served upon the officers of that society yet. It is claimed that the electric plant in the Equitable building contains several infringements of Edison's patents, and the complainants ask for an injunction restraining their use and for the profits obtained from their use. The Equitable uses the United States Electric company's system, and the suits are brought in anticipation of the decision of the judges of the Circuit Court of Appeals in the suits between the Edison and United States people over the incandescent lamp patents. If the decision is in favor of the former the injunction will hold good.

W. F. O.

St. Louis, Mo.

ST. LOUIS, Aug. 20.—The Autumnal Festivities association has contracted for a large amount of electric incandescent lighting for the public streets this fall. The lamps will be employed principally on Twelfth, Broadway, Fourth, Market and Olive streets, where ornamental arches are now being erected. The lights will all be of 16 candle power. The Missouri Electric Light & Power company will furnish current for 5,000 of these lights; the Laclede Gas Light company 2,000, and the St. Louis Electric Light & Power company 2,000, making a total of 9,500. The association furnishes the lamps and sockets, while the companies named furnish lines, converters, current, and make connection. An important feature of the illumination will be an immense revolving ball, which will be painted to represent the globe. It will be suspended over the corner of Broadway and Olive streets—probably the busiest corner in St. Louis. It will be 78 feet in diameter, and will be illuminated by 3,000 varicolored incandescent lights. At each revolution the colors change, thus presenting a most attractive and unique spectacle. The illumination will be made on ten gala nights, to be selected later, between August 29th and October 10th. This is the most extensive use of the incandescent light wholly for public festivals that has been made in the West, if not in the country.

The Clayton & Forest Park Railway company, which has recently received authority to build an electric road between Union avenue and the city limits on the west, is now before the County Court of St. Louis county asking for a franchise to build and operate the road through St. Louis county to the town of Clayton, the county seat. For a large portion of its length the road runs over private property, owned principally by the capitalists who will build the road. It is expected that the road will be in operation by October 1st.

It is reported that John Scullin, the St. Louis & East St. Louis street railway magnate, will at once build an electric railway from the bridge approach, East St. Louis, to Deuverside and Alta Sita.

J. D. Gerlach of Chester, Ill., who was recently granted franchises for water and electric light systems at that point, together with contracts for public water service and electric street lighting by arc lights, is now having preliminary plans and estimates prepared for a combined plant of proper capacity. He has engaged Wm. H. Bryan of St. Louis as his engineer.

E. Ruebel, president of the St. Louis Electrical Supply company, has just returned from an important business trip to Arkansas.

No decision has yet been reached by the Cass Avenue railway officials regarding the electrical system or the size and arrangement of units which will be used. The total cost of the change will approximate $2,000,000, and it will give employment to over 600 men for four months or more. There will be required about 40,000 tons of 78 and 85-pound rails, and probably 300 tons of fastenings. The cross ties will be of sawed white oak, 5 by 7, spaced two feet between centers, with three ties under each joint. The contract for copper wire has been placed with John A. Roebling Sons' company of Trenton, N. J. It is expected that 100 motor cars and the same number of trailers, all of extra length and the highest finish, will shortly be ordered.

The city of Edwardsville, Ill., will receive proposals until September 6th, for an exclusive electric lighting franchise and city lighting contract, both to run for ten years. The city will require at least twenty arc lights of 2,000 nominal candle power. The bidder is also required to name a schedule of maximum rates for arc and incandescent lights furnished to private consumers. The arc lights for the streets are to be located not less than 35 feet above the ground, and are to burn all night and every night. Wm. H. Hall is city clerk.

The reports of the street railways of St. Louis, recently made for the second quarter of the year 1892, are quite interesting. All of the roads show a large increase in the number of passengers carried. The increase is particularly large for those roads which have recently adopted improved motive power. The reports may be summarized as follows:

Road.	Power.	Trips.	Pas'ng'rs
Baden & St. Louis	Horse *	5,155	43,720
Bellefontaine	Electricity	36,306	801,090
Cass Avenue and Fair Grounds	Horse †	54,650	845,650
Citizens	Cable	101,346	2,487,289
Fourth street and Arsenal	Horse †	3,528	5,760
Jefferson avenue	Horse ‡	45,794	503,790
Lindell	Electricity	169,958	3,833,839
Missouri	C'ble & El'ty	278,430	3,842,071
Mound City	Electricity	82,432	1,120,494
Northern Central	Horse †	41,084	550,674
Peoples	Cable	58,058	1,260,725
St. Louis	Cable	204,240	3,127,456
St. Louis & Suburban	Electricity	29,806	1,766,119
Southern	Electricity	70,186	1,232,385
Union	Horse †	50,870	415,202
Union Depot	Electricity	142,056	2,107,404
Totals		1,373,799	23,450,168

The Webb City, Mo., Electric Light & Power company, recently organized with a capital stock of $150,000, will make large additions and improvements. George M. Myers of Kansas City is manager.

Probably the most important and extensive street railway measure now pending before the Municipal Assembly is the bill authorizing the City Central Railway company to construct and operate an electric railway. The route proposed covers the entire central portion of the city, and considerable distances are covered on the tracks of existing roads. Beginning at Sixth and Locust streets, it runs west to Thirteenth over the tracks of the St. Louis & Suburban electric, thence south to Pine, west to Nineteenth, north to Cass avenue, west to North Nineteenth on the tracks of the Cass avenue electric, north to North Market, west to Twenty-fifth, north to Hebert, west to Spring avenue, thence over the tracks of the Northern Central electric north to National Bridge road, and west to Fair avenue, north to Ruth avenue, thence to Florissant avenue, thence northwest on Florissant avenue to the city limits. A branch begins at Nineteenth and runs west on Madison to Jefferson, Webster, south to Cass avenue, west to Prairie avenue, north to Garfield avenue, west to Whittier, north to North Market, west to Marcus avenue, thence north and west to the city limits. Another branch runs south from Pine street on Eighteenth, past the new Union depot and across the Eighteenth street bridge to Papin, west to Twenty-first, south to Choteau avenue, west to Armstrong avenue, south to Park avenue, west to Lawrence, south to Magnolia, thence west to its terminus. Another branch starts west from Twenty-first on Papin to Twenty-second, south on Twenty-second and Armstrong avenue to Park avenue, west to Nebraska, south to Osceola, west to Virginia, south to Compton avenue, to Wilmington road, to Michigan avenue, to Ivory avenue, to Seventh street, to city limits. There is to be a spur running west on Rappahannock, from Nebraska to Grand avenues, thence to Magnolia avenue, thence to Kings Highway. Also a branch from Park avenue, on Osceola to Virginia, south to Bates, west to Virginia, south to Kansas, west to Sixth, south to Ivory avenue, southwest to Seventh, south to city limits. There are several other applicants for right of way over the same streets. The backers of the enterprise are keeping very quiet, the only representative on the ground being a Mr. Sweeney, lately of Texas.

The Doe Run & Farmington Electric railway, which was intended to connect Farmington, Mo., with the main line of the St. Louis, Iron Mountain & Southern Railway for the transportation of both freight and passengers, is reported to have been given up for the present.

Messrs. Drake & Orton, contractors, of Chicago, have offered to build the "Manchester Road Electric Railway" between St. Louis and Kirkwood, taking in the large towns en route, a distance of nearly fifteen miles. The cost of the road is now given at $600,000, and a bonus of $150,000 is asked. A meeting was held at Kirkwood on July 25th, at which $4,000 was subscribed. Another meeting was held on the 26th, at Old Orchard, at which subscriptions amounting to nearly $10,000 were made. A committee of three has been appointed to solicit subscriptions. There is quite a widespread belief that the bonus will be raised and the road built. It is even asserted that work will begin within two months, and that the road will be completed by May 1, 1893.

Sixty-two of the motors burned out at the recent fire of car sheds of the St. Louis & Suburban railway have been purchased by T. C. White & Co., of St. Louis, who will at once repair them, so as to be available for active service again at an early day.

So much dissatisfaction has existed at Belleville, Ill., regarding the action of the Citizens' Street Railway company in taking action which appeared to put them in the light of obstructionists to rapid transit that the citizens have be-

* Making plans to change to electricity.
† Now changing to electricity.
‡ Has secured privilege of changing to electricity.

come enraged. On a dark night recently a car was overturned, and a lot of the rails were torn up and thrown in the creek. The road is in the hands of a receiver, who has now decided to discontinue the operation of the road, and all the cars have been taken off. W. H. B.

Northwestern News.

MINNEAPOLIS, Aug. 20.—The stories about the consolidation of the Minneapolis electric companies have been revived by the securing of a permit by the Northwestern General Electric company for wiring the Exposition building with 200 arc lights and 2,000 incandescent lamps to cost $30,000. This is said to be the name of the new consolidated company, but Manager Robertson of the Brush company denies the state ment. He insists that that is simply a reorganization of the Northwest Thomson-Houston company, and adds that the local combination is still under consideration.

The days of the overhead telephone wires in the business center of St. Paul are numbered. It is expected that the work of putting them under ground will be completed this season. On many streets they have been removed already and placed in conduits and tunnels. On the principal streets tunnels are being constructed forty feet below the surface. Some of these tunnels run through solid rock. Wabasha street, from the river to Tenth street, is to be tunnelled this year. Over 61,000 feet of wire will be used in one tunnel. The wires leading to Minneapolis will be laid in the Wabasha tunnel and strung out University avenue. This is a new route. Improvements are promised in the long-distance service to Stillwater, St. Cloud, Mankato, and other points. The St. Paul service will be greatly improved. The St. Paul system now has 2,200 telephone wires. The company intends to put in seven additional cables of 130 wires each, which will make the total 3,120.

In Minneapolis, good headway is being made in getting the wires under ground. Many of the streets are already cleared of the poles. The telephone service is excellent, and very few complaints are made.

The St. Paul aldermen and President Lowry are still at loggerheads over street railway matters. The aldermen accidentally discovered that the company had not paid over to the city the full amount demanded by the ordinance as licenses on cars. It is claimed that since 1885 the company has paid licenses on 442 fewer cars than were turned in for assessment. The city treasurer has, under instructions from the council, sent the company a reminder in the shape of a bill for $4,420. A law passed in 1884 provided for a license of $10 per car. The Como Park line matter and other bones of contention are still in *statu quo*. A compromise is expected.

The Minneapolis exposition, will have an electrical display of considerable magnitude. It will be under the direction of the Northwest Thomson-Houston company. The display will not be so elaborate as that of two years ago.

There have been rumors about the Great Northern Railway company's operating its wires for commercial business to the exclusion of the Western Union. The reports are denied by the officials of the road. John King, superintendent of telegraphs, says that the company has been operating its own wires for two years along the Montana Central division, and will continue to do so. The business out there is limited. He says that the Western Union will continue to handle the commercial telegraph business on the main line of the road, and as far west as Spokane. The contract to that effect has been renewed.

The Minneapolis Street Railway company has several fresh damage suits on its hands. Two were brought by men injured in getting off a car while in motion. A Lake Harriet car was short circuited and burned by the breaking of the trolley wires. A lady claimed she was injured in escaping from the car, and she wants $5,600 damages.

The recent heavy storms have been rough on the telephone and telegraph companies and the street railway systems. The electric system in the two cities has never been so badly knocked out as it was by a tremendous downpour in which eight inches of rainfall in a couple of hours, it was recorded. It was no fault of the motive power, the trouble being due to the washing down of sand upon the tracks in immense quantities. The fall of the roof of the Hill street power house in St. Paul added to the discomforture there.

During the first six months of 1892 the Minneapolis building inspector issued 103 electric wire permits of an estimated value of $91,751. The inspector made 609 inspections, and found it necessary to condemn or make alterations in 113 cases.

The sharp lightning in recent storms burned out a great many telephones.

The Minneapolis council has instructed the city attorney to find out why the Edison Light & Power company has not paid the 3 per cent. earning tax in accordance with the requirement of the ordinance.

The citizens of Grand Forks claim that the telegraph tolls between that point and the Twin Cities are too high. They are agitating for a reduction.

Experts have decided that an iron bridge should be substituted for the wooden one at St. Cloud, over which the new electric interurban is to run.

The South Dakota State Board of Equalization has fixed the assessments on telephone companies the same as last year, except in the case of Yankton, where an advance of $500 is made.

The directors of the Ashland Lighting & Street Railway company have closed a contract with the Thomson-Houston company of St. Paul for changing the horse car line into an electric system.

Helena, Mont., people now have their pick of three telegraph lines—the Western Union, Rocky Mountain and Great Northern.

Receiver Hewitt reports that the receipts of the Stillwater electric lines during June were $2,167.04, and the expenses $2,028.43.

Prof. Shephardson, who has charge of the department of electrical engineering in the University of Minnesota, is preparing for a busy campaign next year. He reports interest and attendance in his department rapidly increasing.

Judge Mitchell of the Minnesota Supreme Court has made a ruling on the speed of street railways that is of interest. He says: "The degree of care required at the crossing of a highway and an ordinary steam railroad is not the test of care required in crossing the track of a street railroad or a public street. Hence the rule in the former case that one approaching the crossing must look up and down the track before attempting to cross is not necessarily applicable to the latter. The failure to do so is not, as a matter of law, negligence."

The new St. Paul & White Bear Electric Railway company has filed a certificate stating that the actual number of shares issued by the company is 2,000, at $100 each.

The Redwood Falls Telephone company has filed articles of incorporation. The capital stock is $4,000.

The Crookston Gas, Light & Heating company has been incorporated with $100,000 capital.

Work is well under way on the interurban ele tric line to connect St. Cloud and Sauk Rapids. The Thomson-Houston company has the job.

The men operating the new electric line at St. Cloud is elated over the cash receipts. They say the total exceeds that reported by a city of twice the size for the same time. C.

PERSONAL.

Jos. E. Lockwood of the Detroit Electrical Works was in Chicago on Saturday last.

Lemuel Bannister, general manager of the Westinghouse company, was in Chicago for several days last week.

J. A. Machado, secretary of the Waddell-Entz company, of New York, is spending his vacation at Lake George, N. Y.

Dr. John McKinlock of the Central Electric company, Chicago, has been spending a few weeks with his family at Mackinac Island.

W. B DeMuno, formerly in charge of the Chicago office of the Electrical Engineering & Supply company of St. Paul, has accepted a position with the Knapp Electrical Works as special agent.

H. C. Miner, president of the Enterprise Electric & Construction company, New Orleans, was in New York last week, during which time he made several calls upon prominent electrical concerns.

W. H. McKinlock, president of the Central Electric company, Chicago, has been taking a cruise on the Southern Massachusetts coast. He reports delightful weather and excellent fishing. He visited the principal watering places and has been having a thoroughly enjoyable time.

A. A. Forman, manager of the Iron Mountain Electric Light & Power company, Iron Mountain, Mich., and F. A. Pamperin, president of the Electrical Manufacturing company of Oconto, Wis., have been in the city several days purchasing an isolated plant for the Marinette Lumber company, Marinette, Wis.

The "Gossiper" of the *Boston Traveller* has this to say of John F. Zebley, well known to the electrical fraternity in New England: "He has been a very large builder of steam, horse and electric railways. He built the street road in Halifax, and built both the Eastern Electric company's works and the horse roads at St. John, N. B., which have recently been consolidated, and besides introducing electric power into the street car system, will control the electric lighting of the city. Mr. Zebley has a delightful summer farm at The Weirs, which is recognized as one of the most beautiful places in New Hampshire."

NEW INCORPORATIONS.

C. F. Hunger company, Cleveland, O.; capital stock, $25,000; manufacturing electrical and other mechanical devices; Edward S. Granal, Cleveland, O.

Beacon Light company, Seattle, Wash.; capital stock, $100,000; general manufacturing, mercantile and electric light business; G. E. M. Pratt, Seattle, Wash.

Consolidated Street Railway & Light company, Salina, Kas.; capital stock, $100,000; to construct, maintain and operate by electricity a line of railway in Salina, Kas.

Harrington Transit company, Spokane, Wash.; capita stock, $50,000; to construct and operate water works, gas and electric light plants, etc.; R. R. Glasscock, Spokane, Wash.

Canadian Whitney-Hoyt Electrical Instrument company, Manchester, N. H.; capital stock, $30,000; to manufacture electrical instruments; D. A. Taggart, Manchester, N. H.

Paterson & Little Falls Electric Railway company, Paterson, N. J.; capital stock, $50,000; to construct, maintain and operate a street railway; John R. Ream, Paterson, N. J.

Northwest General Electric company, Boise City, Idaho; capital stock, $1,750,000; to construct, sell, purchase or lease electric plants or appliances; J. W. Cunningham, Boise City, Idaho.

Mansfield Electric company, Mansfield, O.; capital stock, $50,000; manufacturing and selling electrical supplies for street railway and light; Mansfield Electric company, Mansfield, O.

Leavenworth Electric Transit company, Leavenworth, Kas.; capital stock, $500,000; to buy or lease lines of railway in Leavenworth, Kas., and to operate the same; Wm. C. Hook, Leavenworth, Kas.

Steelton Light, Heat & Power company, Steelton, Pa.; capital stock, $40,000; supplying light, heat and power by electricity to the public in the borough of Steelton, Pa.; James C. Durbin, Harrisburg, Pa.

New York Visual Telegraph company, Elizabeth, N. J.; capital stock, $100,000; to transmit news and to perform public services by means of electrical devices; Percy L. Klock, 49 Liberty street, New York. N. Y.

Spanish American Light & Power company, Jersey City, N. J.; capital stock, $4,000,000; to manufacture and sell light, heat and power, including gas and electricity, etc. DeForest & Weeks, 62 William st., New York.

Puritan Mining & Milling company, Philipsburg, Mont.; capital stock, $1,500,000; operating electric power plants and supplying electricity for cities and towns; to build, maintain and operate telegraph and telephone lines

Northwestern Electric Light & Power company, Chicago, Ill.; capital stock, $25,000; to operate light and power plants, supply and furnish power and light, etc.; Percy L. Shumac, 901 Owings building, Chicago, Ill.

Sonora Electric Light company, San Francisco, Cal.; capital stock, $10,000; to manufacture, construct, maintain and operate system of conductors for the distribution of electricity for light and power; Holland Smith, San Francisco, Cal.

Fort Wayne Electric Railway company, Fort Wayne, Ind.; capital stock, $1,000,000; to own, construct, maintain and operate a street railroad in the city of Fort Wayne and the town of South Wayne and in the territory contiguous to said city and town; Morris, Bell, Barrett & Morris, Fort Wayne, Ind.

ELECTRIC LIGHTING.

It is reported that the Fort Wayne company has purchased the Edison plant at New Orleans for $300,000.

Frank B. Rae has prepared a plan for lighting Belle Isle, near Detroit, by 130 arc and 600 incandescent lamps.

The Boulder, Colo., Electric Light company has amended its articles of incorporation, making the capital stock $50,000.

An effort is being made to organize an electric light and water company at Iron River, Wis., with a capital stock of $50,000.

Fayette, Mo., has voted $12,000 to establish an electric light plant. The proposition carried by more than a two-thirds majority.

By a vote of 179 to 45 the town of Wakefield, Mass., voted for the second time to accept the municipal lighting act and will purchase the plant of the Citizens' company.

The Kansas City Electric Light company will soon begin to equip all the the electric street lights used by the city with twelve foot mast arms projecting from the top of the poles.

The present contract of the town of Marshall, Mo., with the gas company at that place will expire on January 1st, and the town board has just decided to light the streets with arc lamps after that date.

At the recent annual meeting of the Malden, Mass., Electric Light company the stockholders voted to increase the capital stock of the company $100,000, making the entire capital stock $250,000, in order to provide for the additional construction going on.

The Syracuse, N. Y., Electric Light & Power company is the defendant in two suits, one brought by the General Electric company of New York to recover $5,459.91 for goods bought between June 1st and July 1st of this year, and the other by the Thomson-Houston company to re-

cover $5,790.99 for goods bought between February 20th and May 24th, this year. The suits are brought by Robert E. Drake, attorney for the Thomson-Houston company.

The contract between the East Albany Gaslight company and the village of Greenbush, N. Y., for furnishing 220 25 candle power incandescent electric lights, for the sum of $4,500 per annum for the term of five years, has been approved by the trustees of the village.

Negotiations are said to be pending at Portland, Ore., for a big deal between the Willamette Falls Electric company and the General Electric company, looking to the development of the extensive property of the Willamette Falls Electric company in Portland and Oregon City.

C. F. Sugg, president of the Huntsville, Ala., Electric Light & Power company, has closed a contract with the Westinghouse Electric & Manufacturing company, through J. R. Gordon of the Charlotte, N. C., office, for one 1,000 light alternating current incandescent dynamo and fixtures.

The Fort Wayne Electric company has offered to furnish the city of Kansas City, Kan., a plant for city lighting for $196,700. This includes the station and everything complete, with a capacity of 300 arc and 1,200 incandescent lamps. The tower system is to be partially used.

The contract for building the foundation for the new station of the Toledo Electric Light company at the foot of Locust street has been awarded to John L. Burns. The new building will have 1,800 piles driven for a solid foundation, and will require 2,000,000 bricks and 186 tons of iron.

The Board of Managers of the State Industrial School at Rochester, N. Y., has awarded the contract for installing an electric plant for lighting the institution to the Western Electric company, the lowest bidder, for $13,653 82. J. George Kaelber secured the contract for the Chicago company.

At the recent town meeting of East Greenwich, R. I., it was decided to light the streets by electricity, and it was voted to accept the proposition of the Phenix Electric Light & Coal company. This company offered to furnish 35 arc lights to be burnt every night "from early candle light" to 12.30 A. M. for $2,500 per year.

A fire, supposed to have been incendiary, broke out on August 7th in the upper shops of the National Tramway & Electric Light company at Victoria, B. C., which quickly spread to the power house adjoining, and in two hours the whole plant, valued at $200,000, was completely destroyed. The insurance does not exceed $50,000.

The Denver Consolidated Electric Light company made a novel and beautiful display upon the streets of Denver recently. It was a large wagon bearing an electric light plant, dynamo, and all in full blast, which was illuminating all parts of the vehicle and the harness, and making a little glory around the head of the driver.

The council of Seattle, Wash., has advised the board of public works to advertise for bids to ascertain how much it will cost to establish an arc electric light plant in that city. The city electrician has figured that a plant of 300 lights capacity will cost about $80,000 complete. The Fort Wayne Electric company has already asked permission to bid.

The Methodist Episcopal church of Sycamore, Ill., was lighted by electricity for the first time recently, and the pastor took advantage of the occasion to preach a sermon on "Christianity and Electricity." The sermon is said to have been "an excellent one, abounding in forcible illustrations and comparisons that interested, instructed and impressed the hearers."

The Detroit papers report trouble over the electric lighting contract for the coming exposition in that city. The Commercial Electric company has the contract, and it is asserted that the Detroit Electric Light & Power company is endeavoring to induce the authorities to cancel it, on the ground the former company, which uses the Standard arc and National incandescent systems, infringes patents which the Detroit company alone has the right to use in Detroit.

ELECTRIC RAILWAYS.

Batavia and Oak Orchard, N. Y., are to be connected by an electric railway.

A movement is on foot to build an electric railway to connect Columbus and Worthington, O.

The Peachtree Electric Railway company of Atlanta, Ga., has been granted a franchise to extend its line on Spring street.

Property owners on South Pearl street, Denver, will endeavor to have the Tramway company build an electric line on that thoroughfare.

The Mobile, Ala., Electric Railway company has asked for a franchise to build an extensive system of electric street railways on streets not now occupied.

It is said that the electric railway to connect Washington, D. C, and Arlington will be in operation next month. It is reported that an underground conduit system will be used.

It is reported that the Main, Court and Chenango Street Railroad company and the Binghamton Street Railroad company, of Binghamton, N. Y., have consolidated, and that the lines will be operated by electricity.

An important electric railway project by which it is intended to connect Fonda, Johnstown and Gloversville, N. Y., is now under way. It is the Cayadutta electric railway and it will parallel a steam road. Electric locomotives will for the first time be in direct competition with steam locomotives. The contract for the construction has been awarded to H. Ward Leonard & Co., New York.

Chester R. McFarland of Vicksburg, Miss., and E. F. Fuller of New York have applied for a franchise to operate an electric street railway in Vicksburg, and the city council has appointed a committee to confer with the promoters.

A large frame building at Woodhaven, L. I., containing the plant of the Jamaicia Electric Railroad company, was struck by lightning recently and totally destroyed, with the valuable machinery. The loss is about $25,000, partially covered by insurance.

The Aurora Ill., city council has granted a franchise to the Aurora and Chicago railway to run from the business center of that city to Chicago by the way of Riverside. The right of way is now nearly all secured, and the work of construction will soon be commenced. It will be an electric road, and is to be in operation by December, 1893.

A newspaper dispatch states that on August 15th work was commenced on the construction of the Chicago and St. Louis electric railroad at Edinburg, Ill., and that the president of the proposed new road says that the building of the road will be pushed rapidly and that it will be in operation in a few months, as most of the right of way has been secured and much of the preliminary work done.

TELEPHONE.

A telephone line is being erected between Bristol and Brandon, Vt.

The telephone line between Gloversville and Johnstown, N. Y., is to be entirely reconstructed with complete metallic wires, and twenty men are now at work setting new poles. There will be two metallic loops between Gloversville and Johnstown, and new wires throughout the city, making about 100 miles of new wires in all.

One of the latest applications of the telephone is to diving apparatus. A sheet of copper is used in place of one of the glasses in the helmet, and to this a telephone is fixed so that the diver, when at the bottom of the sea, has only to slightly turn his head in order to report what he sees or to receive instructions from above.

In an interview in Chicago Alexander Graham Bell is reported to have expressed a doubt that telephoning under the ocean for long distances would ever be accomplished. "No successful telephonic connection under water has been successful at a greater distance than 200 miles," he said. "But there is no limit to the possibilites of telephone connection on land. By the time the World's Fair is opened there will be direct telephone communication from New York and Boston and it will be a success. As to improvements in the telephone service, I must leave that to the inventors. The system of communication in cities has been so loaded down with complications that it will require great genius to increase the efficiency of the service. Many cities require that telephone wires be put under ground. That system injures the telephone service."

TELEGRAPH.

A new district messenger service company has been organized to operate in Hyde Park, Chicago. The capital stock is fixed at $200,000, and it is understood that the company is under the protection of the Postal Telegraph company. The necessary franchise has been obtained for the work of construction, and pole planting will be commenced at once.

It is quite probable that the Baltimore & Ohio Railroad Company will be asked to sign a new schedule of wages by the Order of Railway Telegraphers. In the new list higher salaries are wanted by the men, and the advance wanted will average $10 per month more than the present rate. If the railroad company does not grant the advance, a strike along the entire line will probably be ordered. About 2,500 operators would be affected by the strike.

MISCELLANEOUS.

A Toledo hairdresser announces that he will curl hair by electricity.

The final arrangements for the consolidation of the electric lighting companies in Buffalo have been perfected.

A concession for an American district messenger service in the city of Mexico has been granted to Adrelio Ramos.

The University of California is about to erect a building for its mechanical and electrical department at Berkley.

It is proposed to increase the capital stock of the Eddy Electric Manufacturing company, from $100,000 to $225,000 and the number of shares from 4,000 to 9,000.

In describing a recent accident at the electric light station in Terre Haute, Ind., the *Express* of that city told its readers that "the accommodator on one of the dynamos burnt out."

There has been not a little curiosity as to the relations that exist between Siemens & Halske of Berlin and The Siemens & Halske Electric company of America, it being generally understood that the new company is practically an independent organization. It is now stated, authoritatively, that the Siemens & Halske company of America is a branch of the Berlin company, the same persons being in control of both organizations.

It is said that the plan of electrically transmitting power from the American river at Folsom City to Sacramento, Cal., will be in operation by October 1st. The power house will have a capacity of 1,000 horse power.

A delegation of railway telegraphers visited Scranton, Pa., last week to adjust with General Manager Halsted of the Delaware, Lackawanna and Western railroad the difficulty arising from the discharge of operators on the system at Elmira and other places in New York.

Writing to the *Chicago Tribune* of the Genoa exposition, a correspondent says: "There is practically nothing to be seen in electrical machinery. The field seems to be new, and while Genoa is lighted by electricity there seems to be but one use for it, that of lighting thoroughfares."

Thirty machinists employed in the factory of the Jenney Electric Manufacturing company at Indianapolis struck recently because the company declined to re-employ a machinist and member of the union who had been discharged for refusing to work with non-union men.

A large bath establishment in Cincinnati makes a feature of the "electric light bath." A cabinet lined with incandescent lamps is used to enclose the body with the exception of the head, and the temperature ranges from 10.40 to 10 80. This lasts for five or ten minutes, and is followed by a shower bath. The sensation is described as very pleasant.

At the recent convention of the National Association of Dealers in Gas and Electric Fixtures, L. B. Cross of Kansas City was re-elected president; W. E. Goodman of Milwaukee, vice-president; S. E. Dodd of Cincinnati, secretary; John Kelly of Pittsburg, treasurer, and E. Baggot of Chicago, a member of the executive committee. The next meeting will be held at Chicago in August, 1893.

TRADE NEWS.

The Pratt & Whitney Instrument company of Boston reports business as increasing, with a flattering outlook for fall trade.

The Electric Heat & Alarm company of Boston is receiving a steady call for its apparatus, which is about to be adopted by several of the largest manufacturing plants in the East.

The Ball Electric Light company of New York reports the sales of its new automatic dynamo as being unusually good having orders now on hand for delivery in October and November.

The Newton Rubber company of Boston is filling numerous orders for storage battery cells and is much gratified at the increase of its business over that of a year ago in this department.

The Redding Electric company of Boston is receiving numerous orders for its watchman's register clock, which seems to meet all requirements. Several orders have recently been received from Canada.

Since the Boston Incandescent Light company offered its new lamp for sale, flattering increase in the business has been noted, and it is now making arrangements for representation in several of the large cities in the West.

Romaine Mace, of the Interior Conduit & Insulation company, has been spending a few days with the Central Electric company, Chicago, which reports flattering prospects for a heavy trade the coming fall on the Interior Conduit company's specialties.

Wm. Hood & Co. received a large shipment of the Brilliant incandescent lamps last week, and have made some very satisfactory sales. Mr. Hood is an active, energetic salesman, and in his hands there is no doubt of the successful introduction of the lamp.

General Manager F. A. C. Perrine, of the Germania Electric company of Boston, reports that his company is doing 50 per cent. more business during the dull months of this summer than the busy ones of last year. The company has one of the finest plants in the East. Not a little credit must be given Dr. Perrine for the rapid progress of this concern.

The Security Insulator company of New York has made some large shipments of its well known insulators to Australia. This company supplied the insulators used in the wiring for electric lights for both the new railroad depots at Elizabeth, N. J. An important change has been made in the insulators now being placed on the market. The screw hole has been widened from $\frac{3}{8}$ of an inch to $\frac{1}{2}$ of an inch. The Electric Appliance company of Chicago and the Enterprise Electric & Construction company of New Orleans are both working up a large trade for these insulators.

BUSINESS.

The tenax splicing compound, manufactured by C. S. Knowles, of Boston, is being used extensively by leading central stations throughout the country.

The Shawmut Fuse Wire company, of Boston, will soon complete arrangements for a western representation at Chicago for its well-known tested fuse wire links.

The Cleverly Electrical Works, of Philadelphia, Pa., have just closed a contract with the Electric Protection company, of Philadelphia, for the manufacture of th plush protector which the latter company is placing on th

market as a protection from the dangers of the crossing of electric light wires.

The Samson Cordage company, of Boston, is busy filling orders for trolley cord and covered field magnets. Its western business in this department is in excess of that of a year ago.

Manion & Co., of New Orleans, have taken the agency for the sale of the well-known P. & B. insulating compound and manufactured by the Standard Paint company of New York.

Pepper & Register, Philadelphia, have secured the contract for the Easton, South Eastoo & Phillipsburg electric railways, now consolidated onder the oame of the Easton Transit company, work on which will begin not later than September 10th.

Swan & Lane is the firm name of a new electrical house located at 194 Summer street, Boston. They will make a specialty of the installation of electric light and power plants, wiring, etc., giving special atteotion to theatrical supplies, confining their efforts at present to the eastern trade.

L. K Comstock, Monadnock building, Chicago, has just finished the wiring of the new Athletic building on Michigan avenue, Chicago. The Interior Conduit & Insulation company's tubing was furnished for this building by the Central Electric company, Chicago. This company reports that the ten story Lakota building, Thirtieth street and Michigan avenue, is to be wired throughout with Okonite. Interior conduit will also be used. The company also reports having secured an order for ten miles of No. 6 Acme lead covered cable, tested for a 5,000 volt circuit.

The Massachusetts Electrical Engineering company of Boston has recently opened a Chicago office for business in the West. The position which this company occupies in respect to electrical matters is similar to that of the architect to the designing and erection of buildings. If electrical apparatus is to be designed, constructed, or installed, its method is first to consider its intended uses and location; then to submit plans and specificatioos to the purchasers for approval and to the various electrical and mechanical companies for contracts and bids; to personally supervise the work of installation, and finally to test the complete apparatus both electrically and mechanically, in order to insure the fulfillment of the conditions of the contract. In addition to such work in the designing and supervision of electric railway, electric lighting and power plants, the company carries on an extensive testing business at its laboratory in Boston. Particular atteotion has been paid to the electric transmission of power and the designing and installation of the lighting plants required for large office and public buildings. The company is now installing one of the largest transmission plants in the country. The Company's offices are at 4 Postoffice square. Bostoo, and at 201 First National Bank Building, Chicago.

Doubtless few of the visitors to New York duriog the past year have failed to avail themselves of the opportunity to view the city from the famous Madison Square Garden tower. Visitors are conveyed to the second loggia by a spacious Otis elevator. From that point an easy ascent is made to the fifth loggia, where, if one is fortunate enough to secure admission to the circular veranda, the highest electric railway in the world may be seen. The railway was conceived by Stanford White of McKim, Mead & White, architects of the Garden. It was devised to carry around the tower the projector built by the General Electric company. A perfected Crocker-Wheeler motor is used to propel the car, which is also furnished with a Crocker-Wheeler reversible regulator, so as to place the whole in perfect control of the operator. An insulated tangent screw is connected to the motor shaft, thus reducing the speed to a maximum of fifteen revolutioos per minute of the car wheels, it being thought that a speed greater than that would be dangerous in case of any carelessness of the operator. But even at that speed, and the projection of the light left on a plane, the wide circle of the far reaching beam would sweep the surrounding country like a flying specter. The projector carriage was especially designed for the purpose by Mr. Van Vleck, of the Edison Electric Illuminating company of New York, and his assistant, Wm. Erickson. At a pressure of 45 volts, the lamp will operate with the best results with 50 amperes of current to produce a light which will enable one to plainly distinguish objects at a distance of over three miles.

ELECTRICAL PATENTS.

Issued Aug. 16, 1892.

480,720. Holder for Arc Lamps and similar Globes. Frederick D'A. Goold, New York, N. Y.

480,721. Electric Arc Lamp. Frederick D'A. Goold, New York, N. Y.

480,722. Snap Switch. Frederick D'A. Goold, Schenectady, N. Y.

480,727. Armature Conductor and means for Insulating the Same. Emil Kolben, Schenectady, N. Y.

480,728. Ring Armature. Emil Kolben, Schenectady, N. Y.

480,729. Electrical Drop Annunciator. Thomas W. Lane, Boston, Mass.

480,739. Commutator for Electro-Magnetic Machines. Horace F. Parshall, Schenectady.

The conductors connecting the separate segments of the commutator are arranged in sections, one-half of which lie in one plane and the other half in another plane, whereby the conductors can be crossed without contact.

480,740. Armature for Dynamo Electric Machines. Horace F. Parshall, Schenectady.

The armature core is built up of alternating sections of notched and perforated plates.

480,745. Electric Light Fixture. James T. Robb, Mount Vernon.

480,747. Sprinkler System. William C. Shaffer, Milwaukee, Wis.

480,749. Standard. Lucius T. Stanley, Brooklyn, N. Y.

480,762. Veotilated Brush for Dynamos. Howard H. Cherry and Seward D. Younglove, Syracuse, N. Y.

The brush is made of perforated metallic layers retained together by a perforated metallic band extending the length of the layers.

480,766. Guide for Replacing Electric Trolleys. Charles Fortin, Florisant, Mo.

480,780. Commutator for Ring Armatures. Gustav Planokuche, Cleveland, Ohio.

480,782. Electric Lighting System. Michael J. Quirk and Christoph Bach, Jr., Milwaukee, Wis.

480,794. Arc Welding and Heating Apparatus. Philip I. Unwin and Henry Howard, Halesowen, near Birmingham, England. Filed June 14, 1892, Serial No. 436,670.

An accumulator is connected in multiple with the parallel circuits containing the welding devices and a resistance is included in each of these parallel circuits, the dynamo being adapted to charge the battery when the welding devices are not in use.

480,802. Electric Fuse. Otto T. Blathy, Buda Pesth, Austria, Hungary.

480,804. Electric Dispatch System. Andrew Bryson, Jr., New York, N. Y.

A carrier propelled by an electric motor is adapted to travel upon a way and its branches, and a guide is located at each of the branches and means are provided on the carrier adjustable at the option of the sender, to engage automatically with a predetermined guide.

480,805. Automatic Receiver for Pneumatic or other Dispatch Systems. Andrew Bryson, Jr., New York, N. Y.

480,813. Combined Gas and Electric Light Fixture. Alanson T. Enos, New York, N. Y.

480,845. Electric Elevator. Frank E. Herdman, Indianapolis, Ind.

480,846. Electric Elevator. Frank E Herdman, Indianapolis, Ind.

480,850. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa.

The invention embodies a working conductor of magnetic material, a supply conductor, a magnetically actuated switch to connect or disconnect the supply and working conductors, arranged close to the working conductor, and a magnet carried by the car having its North and South poles brought close together in proximity to the magnetically actuated switch.

480,883. Storage Battery. Edward P. Usher, Grafton, Mass.

A tablet of active material is enveloped with finely perforated lead foil.

480,884. Battery Cell. Edward P. Usher, Grafton, Mass.

The cell consists of an outer wall, or receptacle, a lining of acid proof gum and a thin shell embedded in the gum lining, the parts being permanently united by the hardening of the gum.

480,885. Storage Battery. Edward P. Usher, Grafton, Mass.

The invention embodies a sealing substance or compound in which the lower edges only of the plates are embedded, such substance or compound not adhering to the jar.

480,886. Battery Plate. Edward P. Usher, Grafton, and William F. Draper, Hopedale, Mass.

The unit of active material consists of a tablet of lead oxide, or its equivalent, formed of a wrapper of lead foil and a filling of dry powder, with a conducting strip embedded therein.

480,887. Battery Plate. Edward P. Usher, Grafton, Mass.

The plate consists of cross bars, perforated lead coil wrappers adhering by their edges to the bars, thus forming receptacles, and a filling of active material in the receptacles; the edges of the plate being sealed by an acid proof gum.

480,888. Electrical Measuring Instrument. Edward Weston, Newark, N. J.

A conductor in coil loop form moves bodily in an axial direction, and a body of diamagnetic material is actuated by the conductor and moves across the lines of a field of force, thus damping the movement of the inde xarm.

480,889. Apparatus for Retarding or Damping the motion of moving bodies in Electrical Instruments. Edward Weston, Newark, N. J.

Two conductors in coil or loop form are mechanically connected and bodily movable in an axial direction in a field of force, one of the conductors being in electrical circuit and the other closed on itself, whereby the current induced in the closed coil acts to damp the bodily movement of the conductors.

480,890. Electric Time Indicating Apparatus. Edward Weston, Newark, N. J.

The invention embodies means for transmitting time electrically by causing an electric impulse at predetermined time intervals to traverse a loop conductor disposed in a magnetic field, thereby causing vibration of the conductor and the consequent operation of a time indicating device.

480,891. Temperature Regulating Device for Electrical Circuits. Edward Weston, Newark, N. J.

A device for maintaining constant electrical resistance in a circuit despite changes in temperature, comprising a coil formed of an electrical conductor, the resistance of which varies directly with the temperature, and a conductor connected in series with the coil the resistance of which varies inversely with the temperature.

480,892. Rheostat. Edward Weston, Newark, N. J.

Two bodies of conducting material are supported in juxtaposition, and means are provided for regulating the pressure exerted by one body on the other, whereby the resistance is varied.

480,893. Rheostat. Edward Weston, Newark, N. J.

480,894. Electrical Measuring Instrument. Edward Weston, Newark, N. J.

Means are provided for causing augmented deflections on the index for equal increments of moving force applied, by causing a weighted arm to exert a constantly decreasing leverage upon the index.

480,895. Electrical Measuring Instrument. Edward Weston, Newark, N. J,

A flexible body of conducting material in an electrical circuit extends between abutments and means are provided for applying a stress at an angle to the body at a point between the abutments, and an index is adapted to move with the point

480,896. Electrical Measuring Instrument. Edward Weston, Newark, N. J.

480,897. Electrical Measuring Instrument. Edward Weston, Newark, N. J.

480,898. Electrical Measuring Instrument. Edward Weston, Newark, N. J.

480,899. Electrical Measuring Instrument. Edward Weston, Newark, N. J.

480,900. Adapter or Plug for Incandescent Lamp Circuits. Edward Weston, Newark, N. J.

480,915. Rosette for Electric Lighting. Elisha W. Buffinton, Fall River, Mass.

480,918. Electric Locomotive. Rudolf Eickemeyer, Yonkers, N. Y.

The electric motor is located upon the under side of the car body, so that the armature shaft may lie in substantially the same horizontal plane as the car axles, the armature shaft being connected with one of the axles by gearing through a counter shaft located between the axle and the armature shaft in the same horizontal plane.

480,920. Process of Recovering Tin from Tin Plate. Manuel R. Garcia, London, England.

480,947. Electrical Pressure Indicator. John W. Howell, Newark, N. J.

The indicator has a resistance sensitive to changes of current and another such resistance normally not in use, but reserved for a test resistance, and a switch constructed to throw either of the resistances in circuit.

480,948 Snap Switch. Joseph Hutchinson, New York, N. Y.

A circular track for a switch arm has a series of double inclines, and contact plates in the alternate depressions formed by the inclines.

480,954. Incandescent Electric Lamp. George F. Melick, Metuchen, N. J.

The lamp has several filaments connected in series, and a short circuiting switch mounted on a metal sleeve on the base of the lamp.

480,968. Electric Arc Lamp. Rupert Schaefbauer, Paterson, N. J.

Means are provided for automatically cutting off the solenoid of the lamp and bringing a resistance coil in circuit when the carbons have been consumed, thus adapting the lamp for use in series of high tension currents without interfering with the remaining lamps.

480,981. Dynamometer. Ernest P. Warner, Chicago, Ill.

480,988. Adapter for Incandescent Lamp Sockets. Henry P. Ball, Schenectady, N. Y.

481,019. Incandescent Electric Lamp and Lamp Socket. Bruce Ford, Gloucester, N. J.

481,025. Joint for Electric Wires. Walter E. Harrington, Atlantic City, N. J.

481,030. Method of Electric Welding. Henry Howard, Halesowen, near Birmingham, England.

481,042. Electric Train Signal. George Merritt, San Francisco, Cal,

481,047. Incandescent Electric Light. Eugene McQuat, Boston, Mass.

This method of making incandescent lamps consists in uniting to the interior of an adhesively hot glass tube two platinum wires causing the tube to collapse by heat so that the edges of the tube shall seam together drawing the wires away from each other and outwardly, dragging the adhering glass with them so as to leave the glass in a form for resisting fracture.

481,048. Microphone. Eloy Noriega, Mexico, Mexico.

A carbon for microphones is formed of charcoal, graphite, boric acid and water.

481,049. Telephone. Eloy Noriega, Mexico, Mexico.

481,050. Microphone. Eloy Noriega, Mexico, Mexico.

A mass of carbon filaments is placed between a vibratory carbon plate and a fixed carbon plate.

481,062. Electric Control of Railway Trains. Robert C. Sayer, Bristol, England.

481,075. Electric Battery. Peter Stiens, Charlottenburg, Germany.

481,114. Combined Telegraph Key and Circuit Closer. William F. Lott, Philadelphia, Pa.

481,120, Electric Annunciator. Frank A. Pickernell, Newark, N. J.

The annunciator is self restoring, having an auxiliary electromagnet organized to restore the shutter by shortening or reducing the resistance of the magnetic circuit, including the core and armature of the electro-magnet,

481,132. Insulator. William J. Bowen, Norwalk, Ohio.

481,138. Telephone. Frederick H. Brown, Chicago, Ill.

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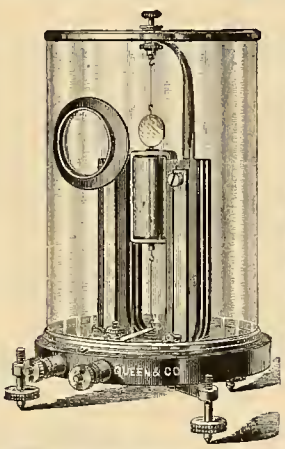

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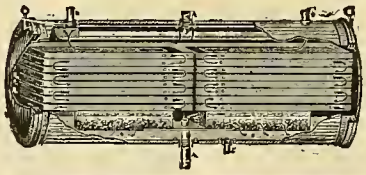

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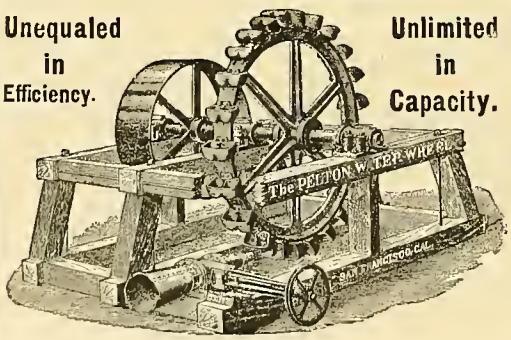

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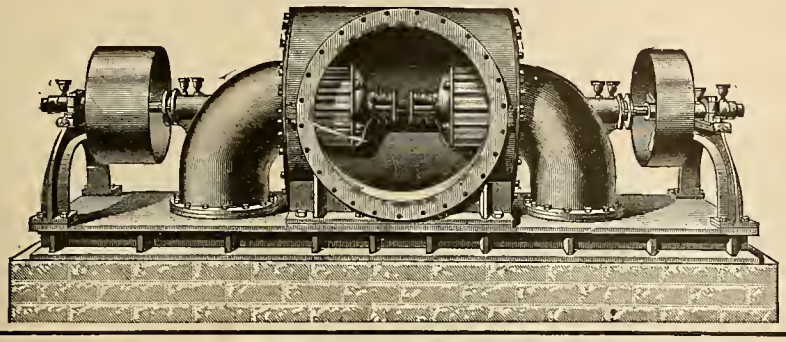

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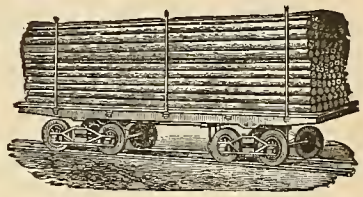

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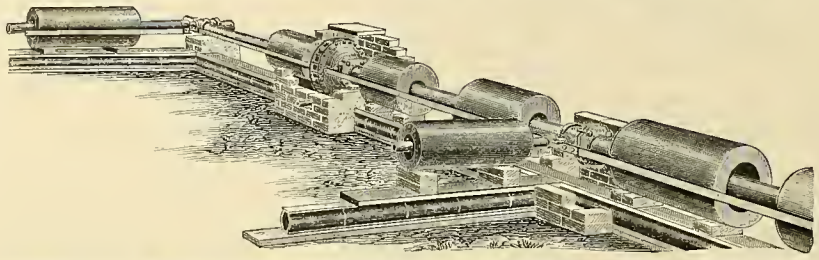

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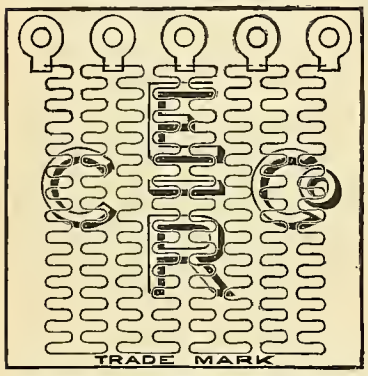

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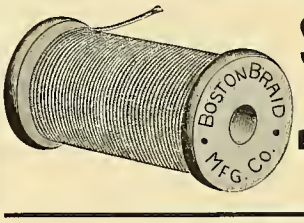

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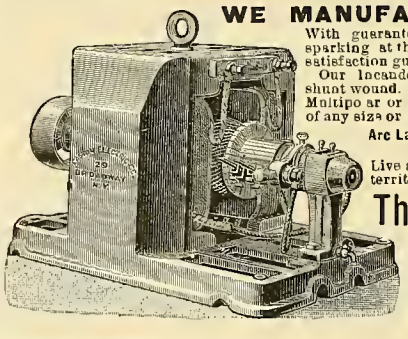

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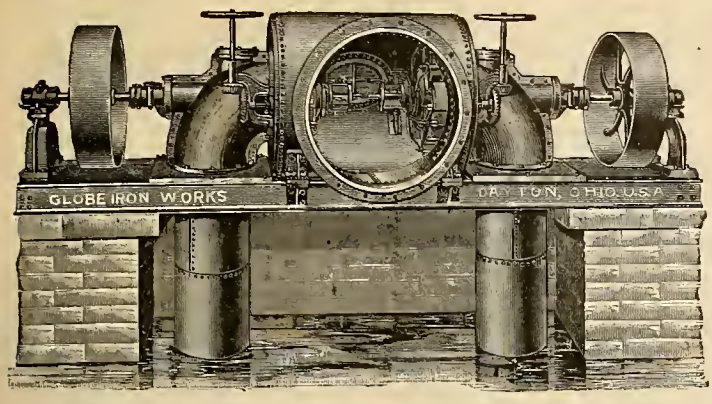

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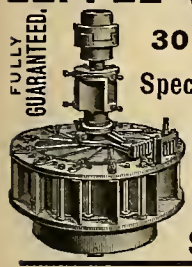

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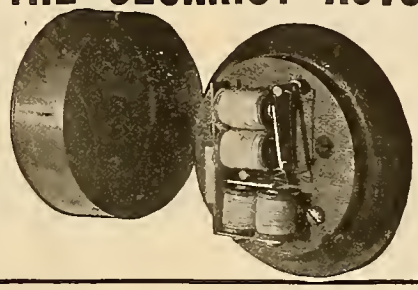

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Brooklyn City & Newton R. R. Co.	1st "	Brooklyn, N. Y.,	330
" " " "	2d "	" "	330
" " " "	3d "	" "	330
" " " "	4th "	" "	330
Allegheny County Light Co.,	49th "	Pittsburg, Pa.,	330
" " "	50th "	"	330
Ramford Bros. Silk Mfg. Co.,	4th "	Paterson, N. J.,	200
St. Louis Smelt'g & Refining Co,	6th "	St. Louis, Mo.,	130
Newport News Ship Building and Dry Dock Co.,	9th "	Newport News, Va.,	130
East End Electric Light Co.,	22d order,	Pittsburgh, Pa.	130
Brookline Artificial Ice Co.,		Brookline, Mass.,	85
Drexel Institute,	4th "	Philadelphia, Pa.,	85
Alliance Mill & Elevator Co.,		Milnor, N. Dak.,	85
Solvay Process Co.,	1st "	Syracuse, N. Y.	65
" " "	2d "	" "	65
Arlington Hotel,	1st "	Hot Springs, Ark.,	65
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J. P. Curtiss,		New Britain, Ct.,	65

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Thomas D. Whitaker,	34 order,	Bonneville, N. J.,	200
Detroit Motor Co.,	2d "	Detroit, Mich.,	200
Dunnell Mfg. Co.,	41st "	Pantucket, R. I.,	150
American Sugar Refining Co.,	10th "	S. Boston, Mass.,	150
Morris Machine Works,	6th "	Baldwinsville, N. Y.,	100
St. Louis Smelting and Refining Co.,	7th "	St. Louis Mo.,	75
W. E. Peck & Co.,	1st "	New York,	75
" "	2d "	" "	75
Chicago & N. W. R'y Co.,	1st "	Chicago, Ill.,	75
" " "	2d "	" "	75
John Bromley & Son,	8th "	Philadelphia, Pa.,	75
Ramsdell Paper Mills,	9th "	Salisbury Mills, N. Y.,	75
*Linden Paper Co.,	1st "	Holyoke, Mass.,	60
" "	2d "	" "	45
Jarvis Paper Co.,		Claremont, Jn N. H.,	45
O. G. Cowles,	2d "	Oeccolo, N. Y.,	45

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			H. P.
Rio Grande Smelting Works,	4th order,	Socorro, N. Mex.,	45
S. D. Warren & Co.,	25th "	Cumberland Mills,	35
Westinghouse Machine Co.,	18th "	Pittsburgh, Pa.,	35
Dunnell Mfg. Co.,	42d "	Pawtucket, R. I.,	35
St. Nicholas Building,	1st "	Pittsburgh, Pa.,	25
Chicago & N. W. R'y Co.,	3d "	Chicago, Ill.,	25
Westinghouse Air Brake Co.,	29th "	Wilmerding, Pa.,	25
C. G. Boult,		Ahnapee, Wis.,	25
East End Electric Light Co.,	23d "	Pittsburgh, Pa.,	15
James Stewart & Co.,		St. Louis, Mo.,	15
St. Nicholas Building,	2d "	Pittsburgh, Pa.,	10
Rich Electric Heating Co.,		Mt. Vernon, N. Y.,	10
Crane & Co.,	3d "	Dalton, Mass.,	10
Morris Machine Works,	7th "	Baldwinsville, N. Y.,	10
West End Street Railway Co.,		Boston, Mass.,	5

Total, 31 Engines, aggregating, 1,845

JUNIOR ENGINES.

			H. P.
Pencoyd Iron Works,	12th order,	Pencoyd, Pa.,	50
B. F. Stoner,		Bellwood, Pa.,	50
Macatawa Park Association,		Holland, Mich.,	35
R. F. Livengood,		Delavan, Minn.,	35
Engler & Handke,		Bristol, S. D.,	35
Franklin Glazier & Son,		So. Gladstonbury, Ct.,	35
M. B. Potter & Co.,		Hitchcock, S. D.,	35
John L. Ominger,		Amsterdam, N. Y.,	25
Agent,		Sydney, Australia,	25
David Bradley Mfg. Co.,		Chicago, Ill.,	25
Whitall, Tatum & Co.	5th order,	Millville, N. J.,	25
Pencoyd Iron Works,	13th "	Pencoyd, Pa.,	25
Agent,		Sydney, Australia,	
Jackson Pulp Co.,	2d order,	Jackson, Mich.,	10
Texas Elevator and Compress Co.,		Dallas, Texas,	10
Agent,		Sydney, Australia,	10
Albert Hermann,		Paris France,	10
Jules Sean,		Lyons, France,	10
Agent,		Paris, France,	10
Fontaine Crossing Co.,	5th "	Detroit, Mich.,	5
Crystal Ice Co.,		Youngstown, O.,	5

Total, 21 Engines, aggregating 485

Grand Total for July,.....71 Engines, aggregating 5,810 H. P.

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			Stokers.
Carnegie Steel Co.,	10th order,	Pittsburg, Pa.,	16
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Westinghouse Air Brake Co.,		Pittsburg, Pa.,	12
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Pittsburg Plate Glass Co.,	5th "	Pittsburg, Pa.,	8
Allegheny County Light Co.,	3d "	" "	8
Kerr Thread Co.,		Fall River, Mass.,	7
Paige Tube Works,		Cleveland, Ohio,	6
Niagara Falls Paper Co.,		Niagra Falls, N. Y.,	5
Linden Paper Co.,		Holyoke, Mass.,	4
National Rice Milling Co.,		New Orleans, La.,	4
Chicago Cold Storage Exchange,		Chicago, Ill.,	4
Rumford Falls Paper Co.,		Ramford Falls, Me.,	3
Otis Falls Pulp Co.,		Otis Falls, Me.,	3
Decatur Gas Light Co.,	3d order,	Decatur, Ill.,	2
Pittsburg Water Works,		Pittsburg, Pa.,	2

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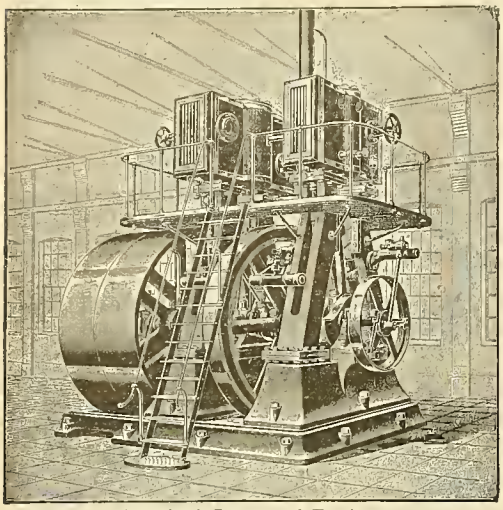

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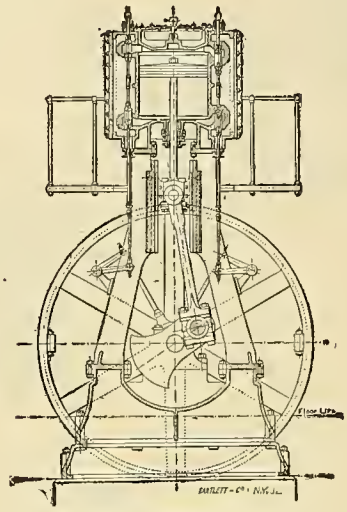

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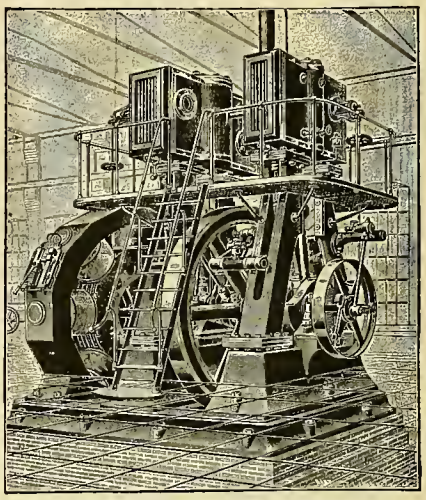

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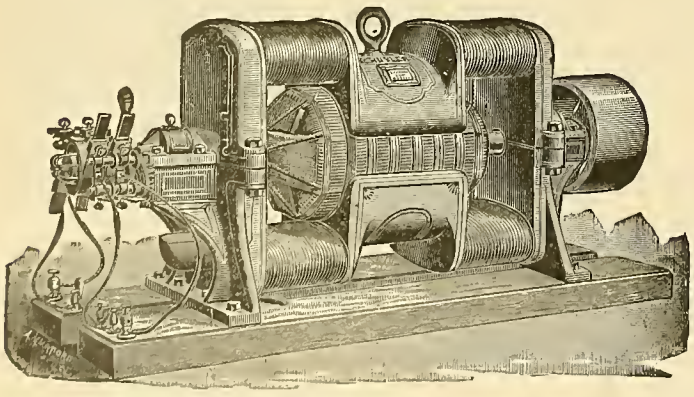

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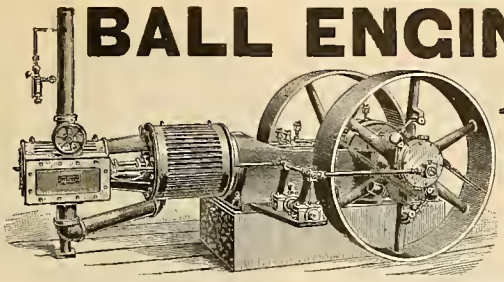

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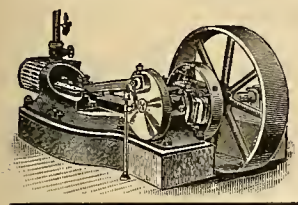

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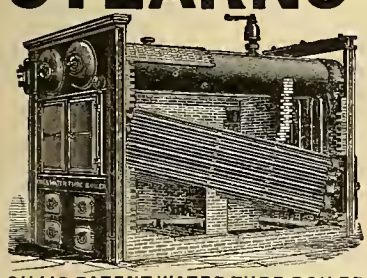

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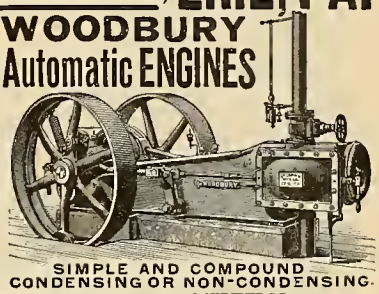

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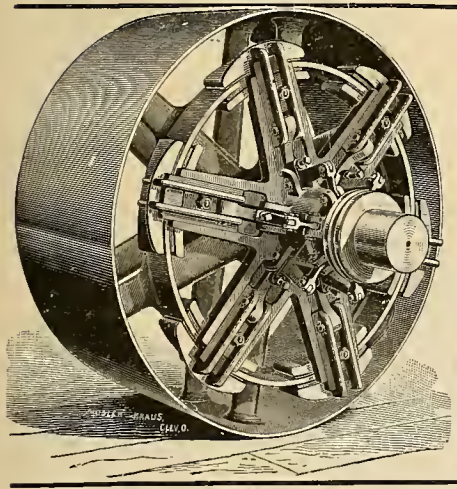

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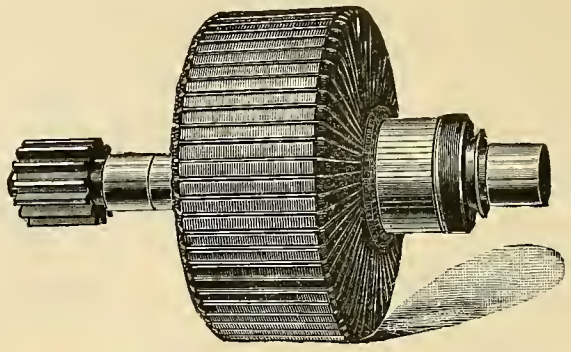

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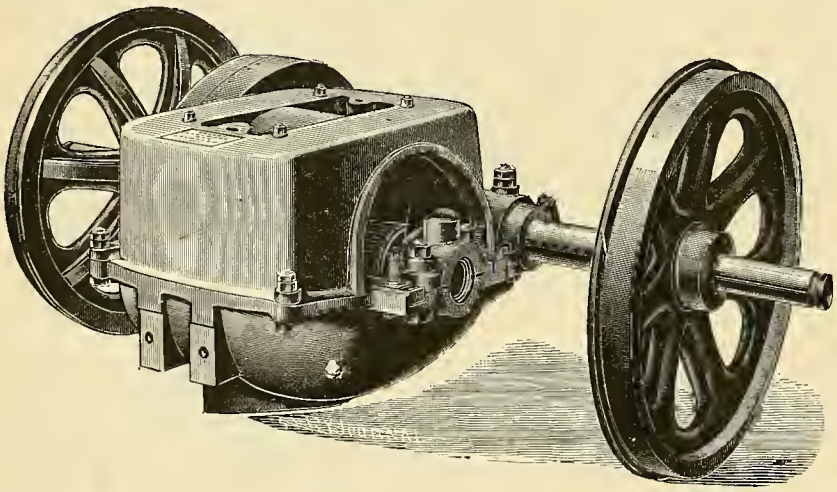

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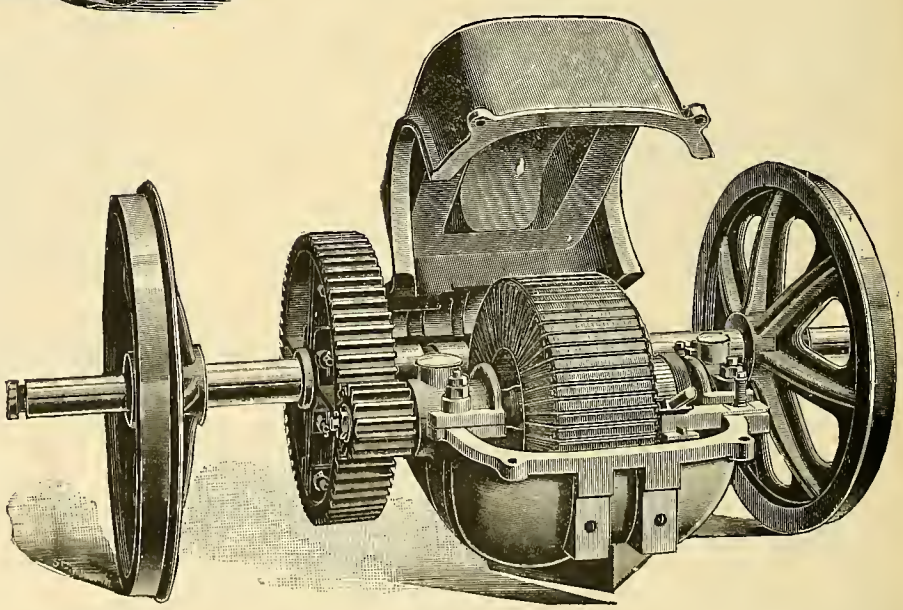

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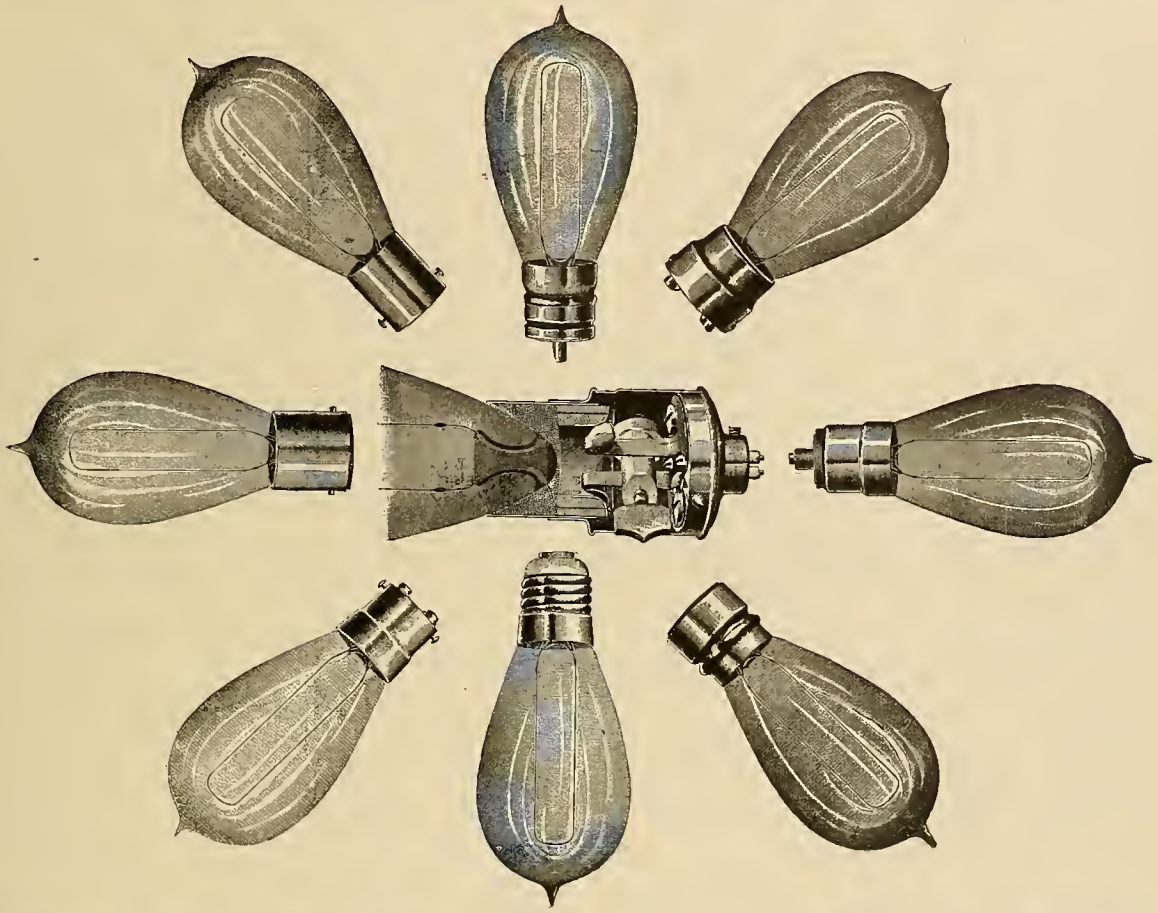

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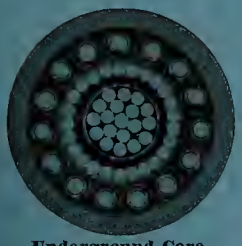
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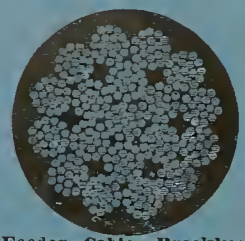
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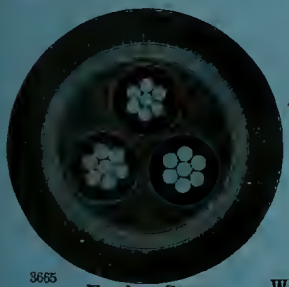
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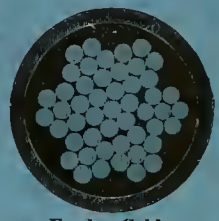
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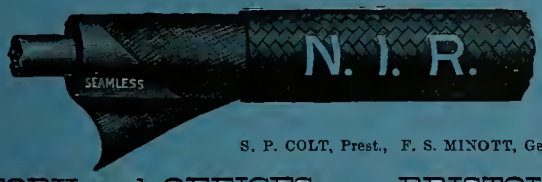

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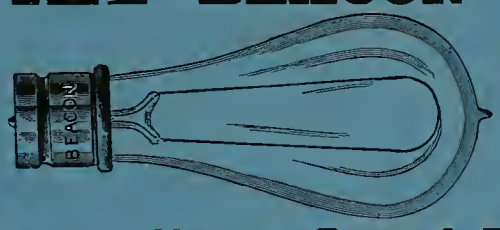

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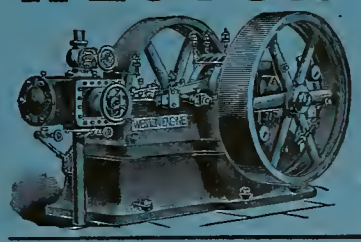

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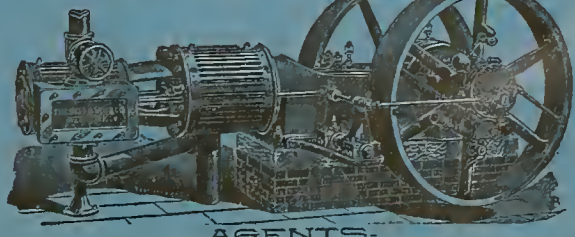

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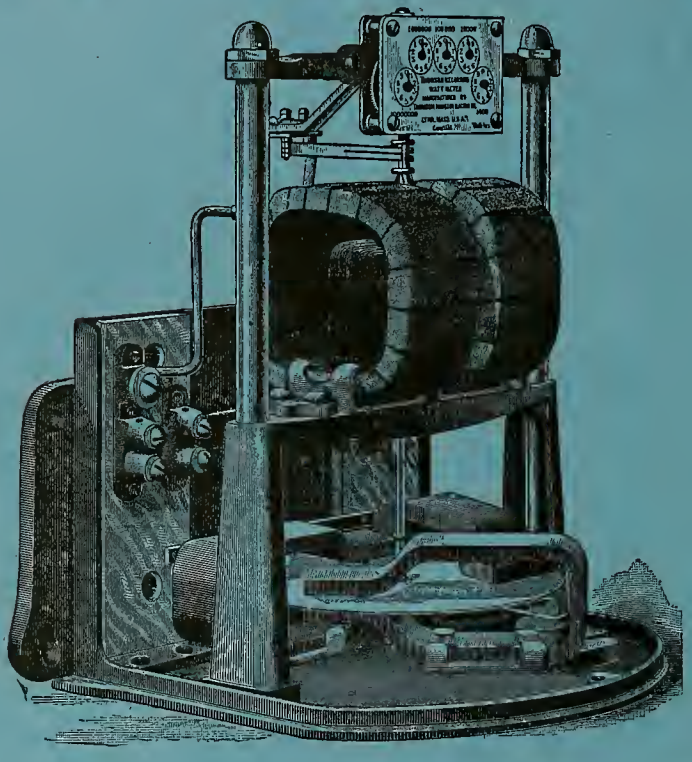

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(Signed) Chas. M. Allen, Supt.

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Yours truly,
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(Signed) E. F. Cooley, Supt.

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173 Adams Street, Chicago, Ill.

INDEX AND CLASSIFICATION OF ADVERTISEMENTS.

ALPHABETICAL LIST.

American Battery Co..... ix
American Desk & Seating Co..—
American District Steam Co.... x
American Electrical Mfg. Co..—
American Engine Co..... xii
Andrae, Julius..... xii
Andrews & Co., A. H..... xiv
Babcock & Wilcox Co., The.... i
Baggot, E xiv
Ball Electric Light Co..... xvi
Ball Engine Co..... xix
Ball & Wood Co., The ..... t
Beacon Vacuum Pump & Elec. Co.i
Becker Mfg. Co., John.....—
Beggs, J. E., Mch. & Supply Co. x
Bernstein Electric Co..... ..iv, xiii
Boston Braid Mfg. Co..... xvi
Bowers Bros..... xvi
Bridgeport Mach. Tool Wks.. xii
Bristols' Mfg. Co..... .. i
Brookfield, Wm..... xii
Brush Electric Co viii
Bryan, W. H.. xiv
Bryant Electric Co.....—
Buckeye Electric Co., The..... ix
Carpenter Enamel Rheostat Co. xvi
Central Electric Co..... ... v
Chicago Rawhide Mfg. Co..... xix
Crescent Ins. Wire & Cable Co. xiii
Crocker-Wheeler Electric Co.. xiii
Cushing, F. W..... vii
Cutter, Geo.....—
Cutter Electrical & Mfg. Co... iv
Dayton Globe Iron Works Co..xvii
Densmore Typewriter Co.....——
Detroit Electrical Works..... xxiv
Diamond Electric Mfg. Co.... —
Dixon Crucible Co., Jos..... xix
Dudley & Co., W. W..... xvi
Duplex Electric Co., Ltd..... xii
Eastern Electric Cable Co..... xiii
Easton Electric Co.....—
Eastman Kodak Co..... xiv
Edison General Electric Co.....viii
Electric Cons. & Supply Co... vi
Electric Engr'g & Supply Co.. ix
Electrical Mfg. Co., The..... vi
Electric Secret Service Co..... xix
Electrician Pub. Co..... xv, xvi
Electrical Construction Co. The.xiii
Electrical Eng. & Supply Co.The. v
Electrical Supply Co., The ... xxii
Elektron Mfg. Co.....—
Empire China Works x
Enterprise Electric Co..... xv
Falls Rivet & Machine Co..... ix
Ferracute Machine Co.....—
For Sale Advertisements. x, xiii, xiv
Fort Wayne Electric Co..... xxiv
General Electric Co..... iv
Gravity Purifier Co..... xvi
Great Western Elec. Supply Co. xv
Greeley & Co., The E. S.....1
Gregory, Chas. E..... xiv
Hart & Hegeman Mfg. Co..... xvi
Heisler Electric Co..... xviii
Hill Clutch Works.....—
Hine Eliminator Co..... xii
Holmes, Booth & Haydens.... xiv
Hood & Co., Wm..... vi
Hughes Bros. Mfg Co..... xiv
Illinois Electric Lamp Co..... xv
India Rubber & G. P. Ins. Co. xxiii
Institute of Technology..... xvi
Interior Conduit & Insulation Co. x
International Okonite Co..... i
Jewell Belting Co..... i
Johns Mfg. Co., H. W.....—
Kartavert Mfg. Co..... xvi
Kelly Brothers xix
Klipstein, A.....—
Knapp Electrical Works..... xxi
Lake, J. H. & D., Co .....—
Lake Erie Engineering Works.xviii
Lane & Bodley Co..... iv
La Roche Electric Works .....—
Leclanche Battery Co., The .. xvii
Lefmann, Julius xvi
Leffel, & Co., Jas xvii
Leonard & Co., H. W..... iv
Link Belt Machinery Co..... xvi
Loud, H. M. & Sons Lumber Co. xiv
Lovell Mfg. Co., Ltd..... xiii
Mather Electric Co..... iv
Moore, Alfred F..... i
Morse & Co., A. M..... .. xv
Munsell & Co., Eugene.....xiii
National Carbon Co..... xiv
National Electric Mfg. Co.... v
National India Rubber Co.... i
New York Insulated Wire Co. xv
N. Y. Safety Steam Power Co. x
New York & Ohio Co..... i
Ostrander & Co., W. R..... xvi
Page Belting Co.....—
Partrick & Carter Co..... ——
Pearson & Co., W. B.....xviii
Pelton Water Wheel Co..... xiv
Perkins Elec. Switch Mfg. Co.—
Phoenix Glass Co.....—
Pioneer Armature Co.....xiii
Porter-Leavitt Elec. Motor Co.——
Queen & Co..... xiii
Racine Hardware Mfg. Co..... xii
Railway Equipment Co..... ix
Redding Electric Co..... x
Ries Electric Specialty Co..... x
Roebling's Sons Co., J. A iv
Rose Elec. Light Supply Co...—
Royal Electric Co..... xii
Samson Cordage Works..... xii
Sawyer-Man Electric Co..... xi
Schuyler Electric Co.....xviii
Sechrist, Albert..... xvii
Shultz Belting Co.....—
Siebert, G..... xiii
Siemens & Halske Electric Co. xiii
Sioux City Elec. Supply Co., xvi
Sioux City Engine Works.... xix
Smith, A. T..... xv
Smith, Thos. G. Jr..... xix
Somoff, J. L..... xv
Sperry Elec. Mining Mach. Co. xvi
Standard Electric Co..... vi
Standard Paint Co x
Stanley Electric Mfg. Co.....—
Star Electrix Co... xv
Stearns Mfg. Co..... xix
Sterling, W. C..... xv
Stilwell & Bierce Mfg. Co. xiv, xv
Sunbeam Incand. Lamp Co....xxiii
Taylor Engine Co..... x
Thomson-Houston Elec. Co.. ii, xx
Union Hardware Co..... xii
Utica Elec. Mfg. & Supply Co. x
Van Nuis C. S.....—
Vulcanized Fibre Co..... xv
Waddell-Entz Company..... xii
Wannopee Pottery Co..... xix
Want Advertisements... xiii, xiv
Western Electric Co.....xiv
Westinghouse, Church, Kerr & Co..... xvii
Westinghouse Elec. and Mfg Co xi
Weston Engine Co..... i
Woodhouse & Rawson, Ltd.... xvii
Worthington, Henry R.....—

CLASSIFIED LIST.

Annunciators.
Central Electric Co.
Detroit Electrical Works.
Electrical Supply Co., The.
Knapp Electrical Works.
Ostrander & Co., W. R.
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Knapp Electrical Works.
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Detroit Electrical Works.
Greeley & Co., The E. S.
Knapp Electrical Works.
Partrick & Carter Co.
Western Electric Co.

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Electrical Supply Co., The.
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Bryan, W. H.
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Detroit Electrical Works.
Diamond Electric Mfg. Co.
Edison General Electric Co.
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Lake Erie Engineering Works.
Lane & Bodley Co., The.
La Roche Electric Works.
Lefmann, Julius.
Leonard & Co., H. W.
Mather Electric Co.
Morse & Co., A. M.
N. Y. Safety Steam Power Co.
Pearson & Co., W. B.
Racine Hardware Mfg. Co.
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Siemens & Halske Electric Co.
Sioux City Engine Works.
Smith, Thos. G. Jr.
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Enterprise Electric Co.
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Knapp Electrical Works.
Moore, Alfred F.
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Electrical Supply Co., The.
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Cutter, Geo.
Cutter Electrical & Mfg. Co.
Electric Engineering & Supply Co.
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Electrical Supply Co., The.
Enterprise Electric Co.
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Hood & Co., Wm.
Knapp Electrical Works.
Perkins Elec. Switch Mfg. Co.
Redding Electric Co.
Sechrist, A.
Utica Elec. Mfg. & Supply Co.
Van Nuis, C. S.

Dynamos.
Ball Electric Light Co.
Brush Electric Co.
Detroit Electrical Works.
Diamond Electric Mfg. Co.
Duplex Electric Co., Ltd.
Easton Electric Co.
Electrical Eng. & Supply Co., The.
Fort Wayne Electric Co.
General Electric Co.
Great Western Electric Supply Co.
Gregory, Chas. E.
Heisler Electric Co.
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Standard Electric Co.
Waddell-Entz Company.
Western Electric Co.
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Smith, A. T.

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Detroit Electrical Works.
Edison General Electric Co.
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Leonard & Co., H. W.

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Electrical Supply Co., The.
Greeley & Co., The E. S.
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Electrical Intelligence.
Bryan W. H.
Leonard & Co., H. W.

Electrical Specialties.
Andrae, Julius.
Bryant Electric Co.
Cutter, Geo.
Cutter Electrical & Mfg. Co.
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Ries Electric Specialty Co., The.
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Cutter Electrical & Mfg. Co.
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Klipstein, A.
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Bryant Electric Co.
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Electric Engineering & Supply Co.
Electrical Supply Co., The.
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Cushing, F. W.
Cutter, Geo.
Detroit Electrical Works.
Eastern Electric Cable Co.
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Electrical Supply Co., The.
Enterprise Electric Co.
Great Western Electric Supply Co.
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International Okonite Co., The.
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Moore, Alfred F.
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Edison General Electric Co.
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Electrical Manufacturing Co., The.
Electrical Supply Co., The.
Hood & Co., Wm.
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Somoff, J. L.
Sunbeam Incandescent Lamp Co.
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Van Nuis, C. S.

Magnet Wire.
(See Insulated Wires.)

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Medical Batteries.
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Mica.
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(See electric railways.)

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Detroit Electrical Works.
Western Electric Co.

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Electrical Supply Co., The.
Greeley & Co., The E. S.
Knapp Electrical Works.
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Transformers.
Diamond Electric Mfg. Co.
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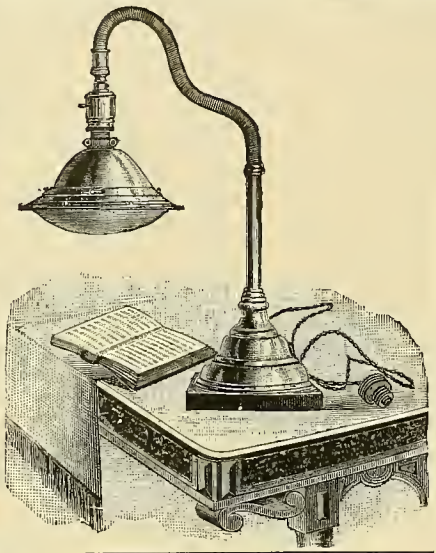

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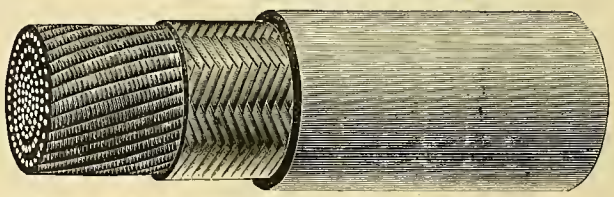

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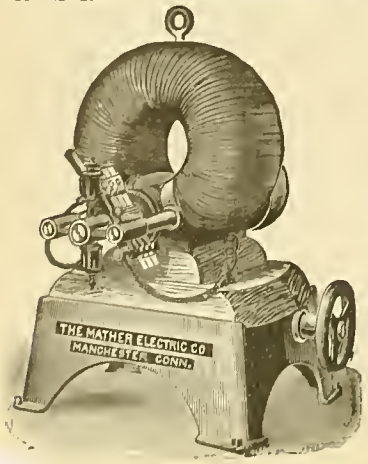

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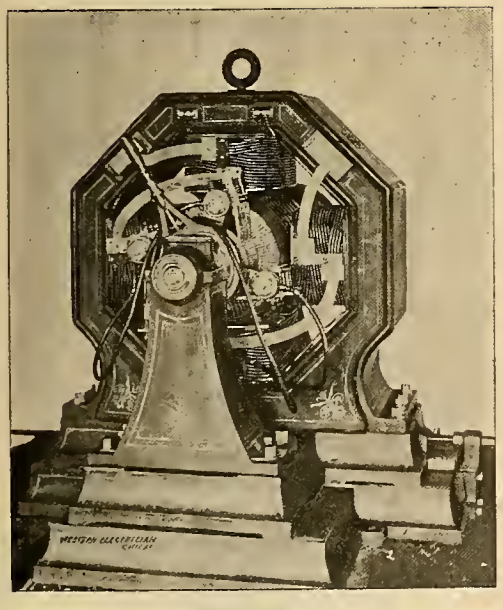

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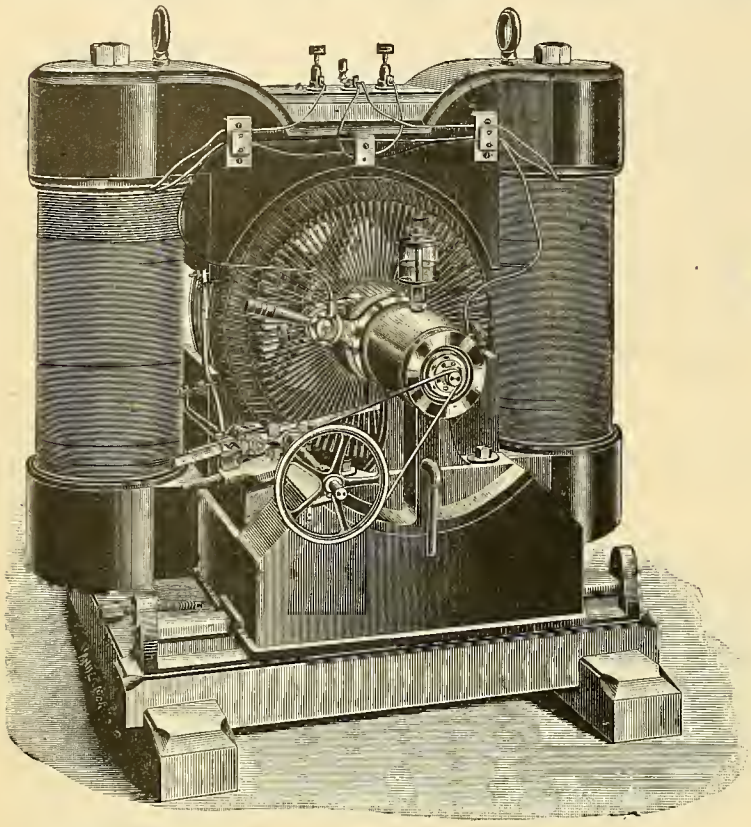

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BRILLIANT! BRILLIANT! BRILLIANT!

HIGH GRADE INCANDESCENT LAMPS.

THE ELECTRICAL MFG. COMPANY, OCONTO, WIS.

Lamps for all Systems. Any Voltage or Candle Power.

DIRECT CURRENT LAMPS.
ALTERNATING CURRENT LAMPS.
RAILWAY CIRCUIT LAMPS.

FILAMENTS WITH OR WITHOUT HOOKS.
MINIMUM CURRENT CONSUMPTION, with
MAXIMUM CANDLE POWER AND LIFE.

Before purchasing elsewhere send in a trial order for Brilliants. Lamps furnished to consumers in quantities at factory prices.

CHICAGO OFFICE, Wm. Hood & Co., Managers, 239 LA SALLE ST.

MANUFACTURERS

ORGANIZED 1881.
INCORPORATED 1883.

ARC LAMPS

FOR INCANDESCENT AND STREET RAILWAY CIRCUITS.

AN ESTABLISHED FACT: THE ONLY ARC LAMP THAT WORKS SATISFACTORILY ON AN INCANDESCENT CIRCUIT.

SPECIAL APPLICATIONS:
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THE ELECTRIC CONSTRUCTION & SUPPLY CO.

UNITY BUILDING, CHICAGO.

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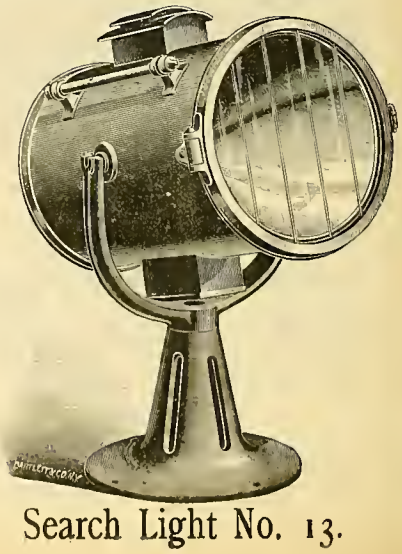


Search Light No. 13.

12,672,000 Feet.

The largest order ever given in this country for high grade insulated wire. The New York Central Railroad has just ordered

300 Miles of 8 Conductor

Kerite Insulated Cable for their block signal system between Albany and Buffalo.

THIS MEANS SOMETHING.

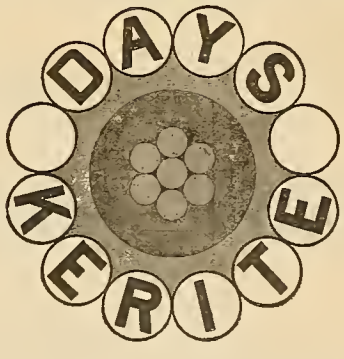
THE BEST INSULATION IS

THE OLDEST RUBBER COVERED WIRE ON THE MARKET IS

The Old Reliable.

THE MOST ACID-PROOF INSULATION IS

THE INSULATION THAT HAS STOOD THE LONGEST LIFE TEST IS



W. R. BRIXEY, General Manager and Eastern Agent,
166 FULTON STREET, NEW YORK.

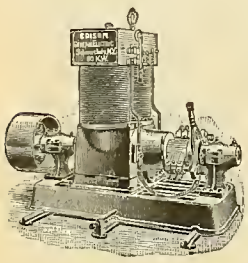
F. W. CUSHING, General Western Agent,
225 DEARBORN STREET, CHICAGO.

EDISON GENERAL ELECTRIC CO.,

44 BROAD ST., NEW YORK

INCANDESCENT LIGHTING.

THE ONLY SATISFACTORY SYSTEM, GIVING GREATEST RESULTS FOR LEAST OUTLAY



GENERATORS. *Highest Efficiency. Electrically and Mechanically Superior to all Others.*

COMPACT. DURABLE. PERFECT.

LAMPS. *The only Incandescent Lamps which have secured Universal Approval.*

MILLIONS SOLD AND MILLIONS SELLING.

Electrically Illuminated Signs and Decorative Displays.

Safety Devices, Measuring, Indicating and Regulating Instruments.

ELECTRIC LIGHTING SUPPLIES.

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MANUFACTURERS OF

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Incandescence Electric Lighting Apparatus, Electro-platers.

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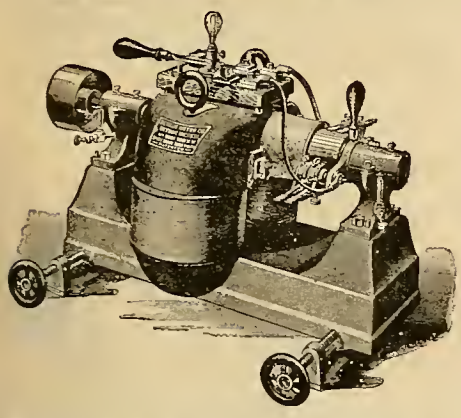

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INCANDESCENT LIGHTING.
ARC LIGHTING.
ELECTRIC POWER.

COMPLETE EQUIPMENTS
FOR CENTRAL STATIONS
AND ISOLATED PLANTS.

Manufacturers of { ELECTRIC SUPPLIES .. AND FIXTURES .. } of every description.

Dynamos, Motors, Lamps, Sockets, Wire, etc.

Gas, Electric and Combination Fixtures.

Complete Electric Railway Station and Line Appliances.

Batteries, Push Buttons, Bells, etc.

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AMERICAN BATTERY COMPANY,

MANUFACTURERS OF

THE MORRISON PLANTÉ

STORAGE BATTERY.

DRY BATTERIES, BATTERY SUPPLIES, ETC.

The Best Traction Battery in the World.

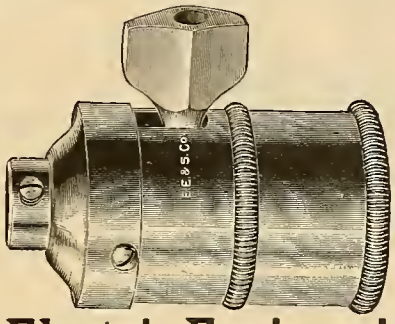
Storage Batteries for Street Cars, Electric Lighting, Electric Launches, Electric Fans, Phonographic and Surgical Use, Etc., Etc.

Electromotive Force High; Life Long.

This Battery is made by the Planté process, no oxides being used, either mechanically or applied in the form of paste, paint or cement.

AMERICAN BATTERY COMPANY,

Office: Rooms 23 and 24, 177 La Salle St., CHICAGO, ILL.



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SOCKETS

For all Standard Systems.

Porcelain or Rubber Key.

PRICES ON APPLICATION.

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SYRACUSE, N. Y., U. S. A.

NEW YORK OFFICE:
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Send for Catalogue of our Specialties.

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Electric Railway Supplies

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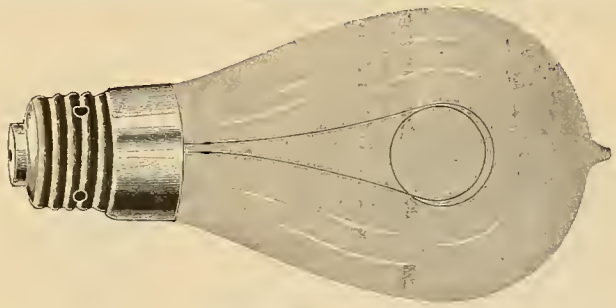

Busy bees for drones providing
Gather honey;
"Buckeye" lamps for Central Stations
Gather money.

Special Information Concerning Fall Purchases.
Write us BEFORE you buy.

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CHICAGO,
437 "The Rookery."

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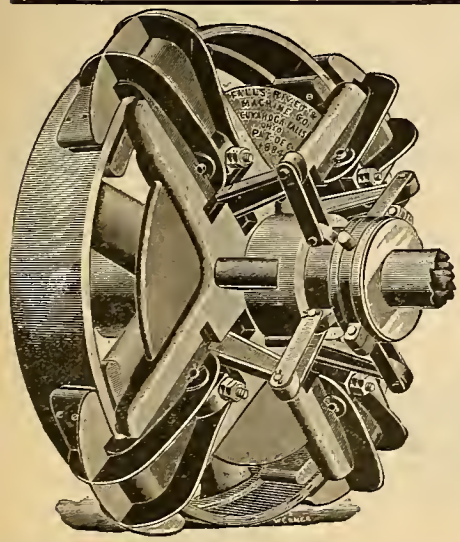

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Special attention given to the Complete Equipment of Electric Plants.

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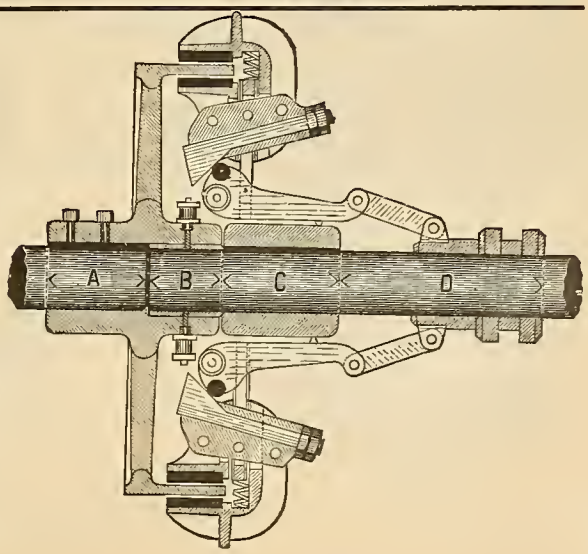
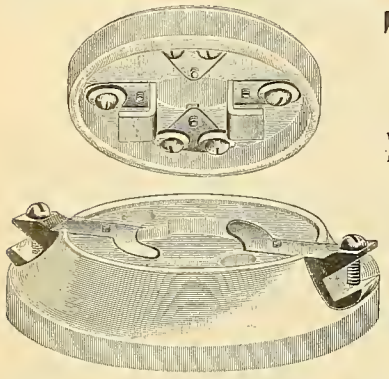


THE RIES REGULATING SOCKET

FOR ALTERNATING CURRENT INCANDESCENT LAMPS, IS BEING UNIVERSALLY ADOPTED.

THE RIES ELECTRIC SPECIALTY CO., Sole Patentees and Manufacturers, BALTIMORE, MD.



THE "IONA" CEILING CUT-OUT.

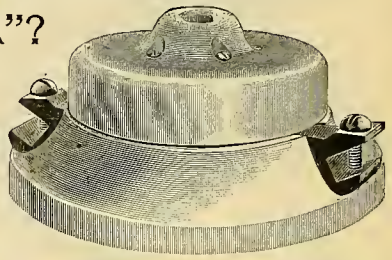
Have You Ever Used a Cut-Out That Exactly Suited You?

HAVE YOU TRIED THE "IONA"?

No Screw—Positive Connections. Reasonable Prices.

Ask Your Dealer for Them or Write us.

Sockets, Switches and General Supplies at Manufacturers' Prices.

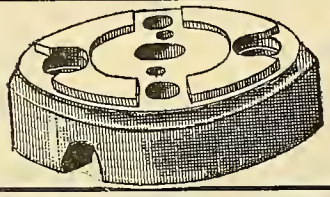


REDDING ELECTRIC CO., 41 Federal St., Boston, Mass.

Non-Conductive Blocks, Rosettes and Bases for Cut-Outs and Switches.

Also Insulators, Cleats, Lamp Trimmings and other Electrical Supplies.

Our production is a dense body. The glazing and body of our ware are of same composition, and are baked alike, which are the features of True Hard Porcelain.



EMPIRE CHINA WORKS,

144 to 156 Green St., Green Point, BROOKLYN, N. Y.

FOR SALE CHEAP.

Two 300 Amp. Shuntwound U. S. Dynamos.
Two 200 Amp. Shuntwound U. S. Dynamos.
Two 500 Lt. T. H. Dynamos, compound wound, with base, rheostat and ammeter.
Two 25 Lt. American 2,000 C. P. Arc Dynamos.
One 50 Lt. Sperry 2,000 C. P. Arc Dynamo.
Twelve 12 Lt. Knowles Dynamos, with lamps.
Nine 30 Lt. Westinghouse Arc Dynamos.
Twelve 50 Lt. Schuyler Dynamos, 2,000 C. P.
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Two 150 Lt. Brush Incandes. Machines, 95 Volts.
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One 100 H. P. Ball Engine.
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MANUFACTURERS OF

"HERCULES" SWITCHES for Arc and Power Circuits.
"UTICA" QUICK BREAK—ABSOLUTE LOCK—KNIFE SWITCHES for any voltage and amperes.
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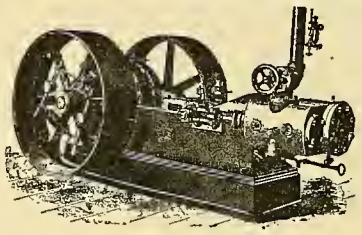
MAST ARMS and POLE STANDS.
CARBON BRUSH HOLDERS for Generators, Motors and Dynamos.
CARBON HOLDERS, CIRCUIT JUMPERS and CONNECTORS.
Also General Dealers in ELECTRIC LIGHT and POWER SUPPLIES.

NEW YORK SAFETY STEAM POWER CO.,

Builders of High Grade Engines and Boilers.



Electric Light Engines a Specialty.

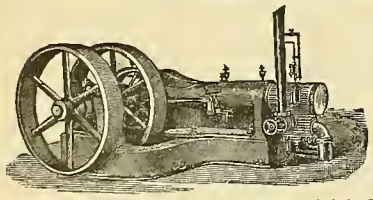
Complete Steam Plants Installed.

WESTERN WAREROOMS:
64 South Canal Street, CHICAGO, ILL.
MILTON THOMAS, Agent.
Also 30 Cortlandt Street, New York City.

TAYLOR ENGINE COMPANY,

CHAMBERSBURG, PA.,

MANUFACTURERS OF



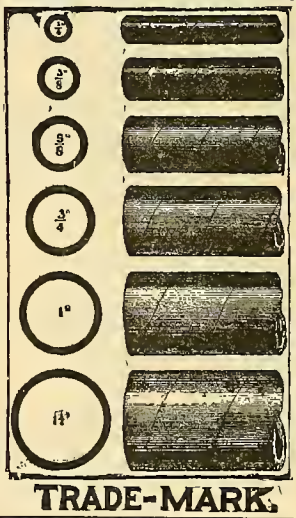
High Grade Automatic ENGINES,

HORIZONTAL and VERTICAL.

Two horse power to three hundred horse power.

Western Department: 26 and 28 Randolph St., CHICAGO. - H. S. WALKER, Manager.

INTERIOR CONDUITS



TRADE-MARK.

The Solution of the Problem of Safe Guarding ELECTRIC CONDUCTORS

Wherever and for whatsoever purpose employed, is to be found in the

CONDUIT SYSTEM.

INTERIOR AND UNDERGROUND CONDUITS

MANUFACTURED BY

INTERIOR CONDUIT AND INSULATION CO.,

WORKS: 527 to 531 W. 34th St., 525 to 528 W. 35th St.,

General Offices: 42 & 44 Broad St., New York.

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Mountain Electric Co., Denver Colo.
American Elect. Supply Co., 226 Pearl St., Buffalo, N Y.
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Chas. Gabriel, Saginaw, Mich.
Southern Electrical Mfg. & Supply Co., 110 Baronne St., New Orleans, La.
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P. AND B.

Insulating Compounds, Tape and Armature Varnish.

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Chicago Office: 542 "The Rookery."

SOLD BY

THE ELECTRICAL SUPPLY CO., Chicago.
NOVELTY ELECTRIC CO., Philadelphia,
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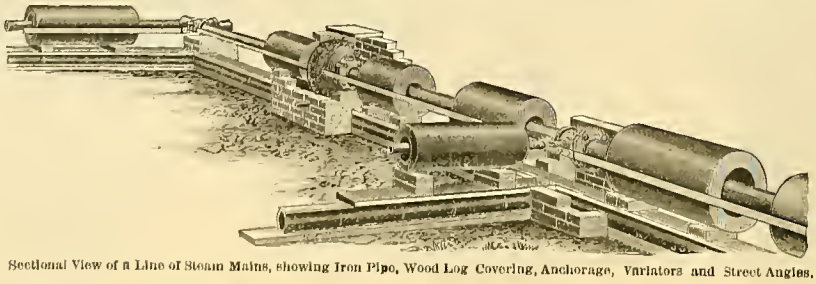
And Supply Houses Everywhere.

Holly System of Underground Steam Supply,

FOR THE UTILIZATION OF EXHAUST STEAM AT ELECTRICAL STATIONS.

For pamphlets and particulars regarding Electrical Companies who are using the "Holly System" and converting a waste product into money, address



Sectional View of a Line of Steam Mains, showing Iron Pipe, Wood Log Covering, Anchorage, Variators and Street Angles.

The prudent manager will not throw away his exhaust steam which he can sell for $3,000 to $5 000 per annum for each 100 H. P. thereby materially increasing his net revenue.

AMERICAN DISTRICT STEAM COMPANY, LOCKPORT, NEW YORK.

WESTINGHOUSE ELECTRIC & MFG. CO.,

PITTSBURGH, PA.,

MANUFACTURERS OF APPARATUS FOR

Arc Lighting, Incandescent Lighting,

LONG DISTANCE TRANSMISSION OF POWER,

Street Railway Generators, Motors and Appliances.

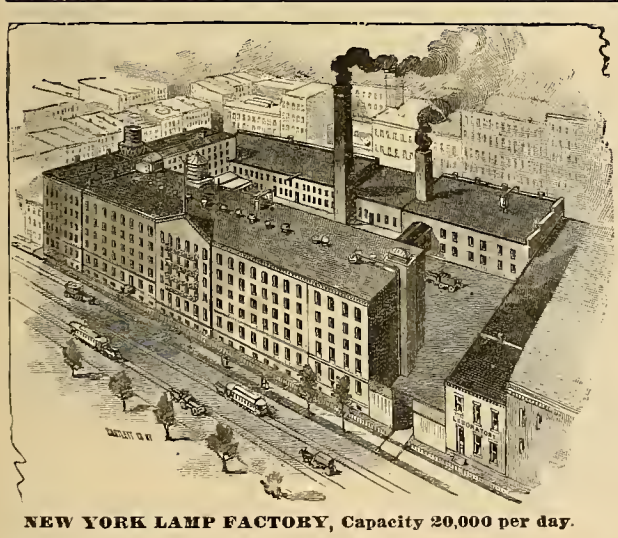
Our alternating current incandescent apparatus is in use in 430 central stations. 1,000 isolated plants. Our arc apparatus is in use all over the world.

We are now transmitting light and power various distances up to 28 miles from the source.

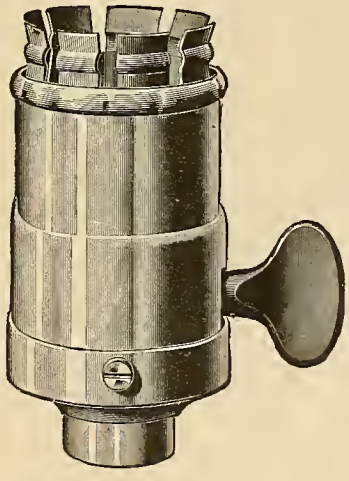
Our multipolar railway generators, and noiseless single reduction motors have worked a revolution in the electric railway field in two years.

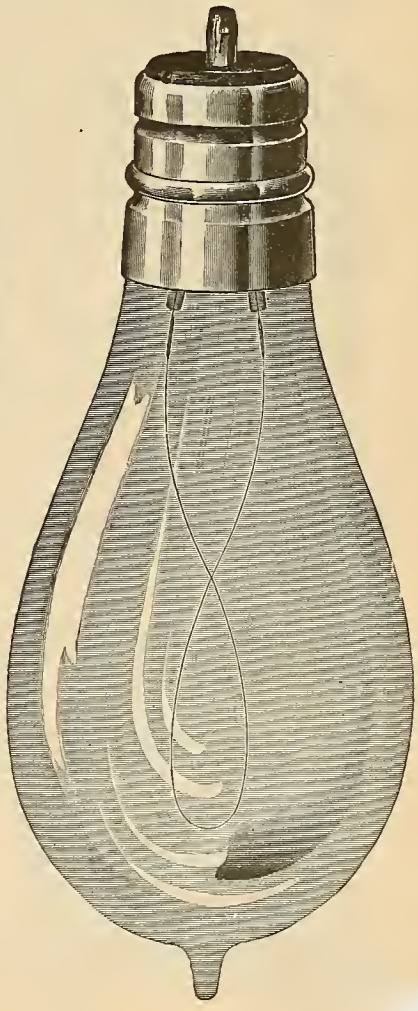
Orders for APPARATUS, REPAIRS and SUPPLIES formerly furnished by the United States Electric Lighting Co., Newark, N. J., should now be sent to this Company, where they will receive prompt attention.

BRANCH OFFICES IN ALL THE LEADING CITIES.
AGENTS FOR CANADA: AHERN & SOPER, OTTAWA, ONT.



NEW YORK LAMP FACTORY, Capacity 20,000 per day.





LAMPS,

8 C. P. to 150 C. P. 45 Volts to 125 Volts. To Fit Principal Sockets.

SOCKETS, SWITCHES, CUT-OUTS

AND GENERAL ELECTRICAL SUPPLIES.

WRITE FOR CATALOGUE.

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620 Atlantic Avenue, **BOSTON.**
510-534 West 23d St., **NEW YORK.**
Pullman Building, **CHICAGO.**

STANDARD SCREW GLASS INSULATORS

MANUFACTURED BY

WM. BROOKFIELD,

BUSHWICK GLASS WORKS. 83 FULTON STREET, NEW YORK.

EVERY ONE KNOWS

ANDRAE.

We can furnish at bottom prices

Leclanche, Andrae Carbon, Laclede, Samson and Law Batteries.

Bells, Wire and Pushes.

Agent for SUNBEAM LAMPS.

JULIUS ANDRAE,

MILWAUKEE, WIS.

The Pioneer House of the Northwest.

SAMSON BRAIDED CORD.

Is the most durable for hanging Arc Lampe, Trolley Cord, Covering Field Magnets, Sash Cord, etc., etc.

Send for Samples and Prices.

SAMSON CORDAGE WORKS,

115 CONGRESS STREET, BOSTON.

Royal Electric Co.,

911 & 913 South Washington St., PEORIA, ILL.,

MANUFACTURERS OF

Alternating and Continuous Current Dynamos and Motors,

AND ELECTRIC MACHINERY.

THE MOST COMPLETE ALTERNATING SYSTEM NOW ON THE MARKET.

Agents Wanted for Exclusive Territory.

TURRET MACHINES

Bridgeport Machine Tool Works

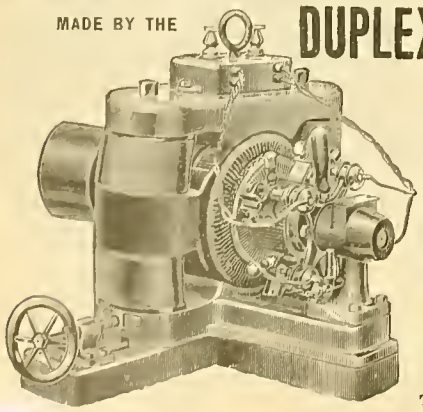
E. P. BULLARD PROPR. BRIDGEPORT, CONN

THE LATEST AND BEST

SLOW SPEED, MULTIPOLAR DYNAMO.

ADVANTAGES: Slow speed, small floor space, direct driven, self-oiling bearings, little external magnetism, etc.

MADE BY THE



DUPLEX ELECTRIC CO.,

Limited,

CORRY, PA.

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Chicago Office—R. J. Randolph, Manager, 1325 Monadnock Building.
Kansas City, Mo., Office—L. C. Bair, 806 Walnut Street.
New York Office—W. H. Gordon, Manager, 115 Broadway.
Philadelphia Office—Otis K. Stuart, Manager, 21 City Trust Bldg.

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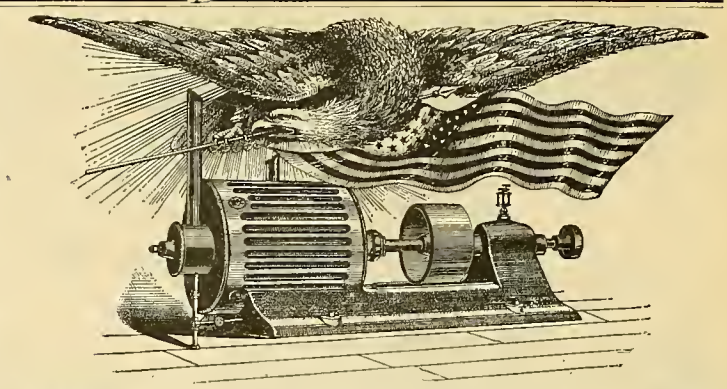
Lincoln, Neb.—Big Iow Electric Supply Co., 112 S. 13th st.
Providence, R. I.—Drake, Payson & Whittier, Cor. Washington & Eddy Sts.
Tarpon Springs, Fla.—W. D. Wilson.



AMERICAN HIGH SPEED ENGINE.

This Engine revolutionizes the manner of applying steam in generating power. It can be regulated so as to run at any speed desired, up to

1000 OR MORE REVOLUTIONS PER MINUTE !

It is not a rotary Engine, yet the motion of its parts is such that there are no "dead centers." It takes steam and exhausts four times at each revolution. For

SPEED, SIMPLICITY AND ECONOMY,

this Engine has no equal. It possesses many striking advantages over all other Engines, either slow speed or so-called high speed. Its speed is closely regulated by a sensitive and reliable automatic governor. Built of any required size,

FOR ALL STATIONARY AND MARINE PURPOSES.

It can be **coupled directly** to dynamos, fans, blowers, fire engine and other rotary pumps; in fact, to **any** machine requiring great velocity. It is smooth running and **noiseless.** Being light and compactly built, it takes up less room than any other Engine of equal power. No heavy foundations are required. This Engine is

THE ACME OF SIMPLICITY.

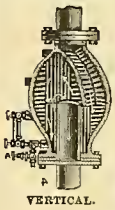
No skilled engineer is required.

☞ For further particulars and Illustrated Catalogue, call upon, or address

AMERICAN ENGINE COMPANY,

72 Raritan Avenue. BOUND BROOK, N. J.

HINE'S ELIMINATOR.



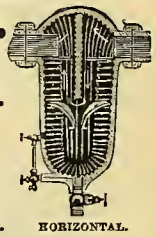
VERTICAL.

THE ACKNOWLEDGED SUPERIOR OF ALL

Steam Separators and Oil Extractors.

In twelve trials in the "Cornell" Separator test, it averaged 98 7-10 per cent Dry Steam. Outstripping all competitors.

Send for Circular and Cornell test report.



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HINE ELIMINATOR CO., 106 Liberty St., NEW YORK.

This advertisement appears every other week.

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UNION HARDWARE CO.,

PUSH-BUTTON

SHELLS.

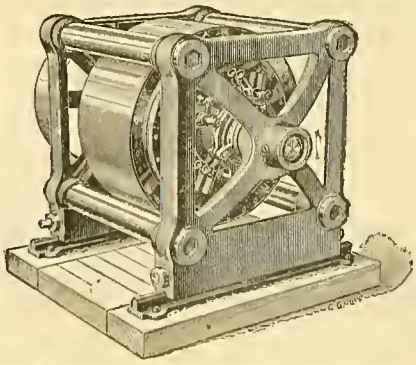
TORRINGTON, CONN.,

—AND—

95 CHAMBERS STREET, NEW YORK.

The WADDELL-ENTZ COMPANY,

203 BROADWAY, NEW YORK.



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Western Electrician.

EVERY SATURDAY.

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Electricity at the World's Fair.

Work on the electricity building is not progressing as rapidly as the World's Fair officials desire, but there is every reason to believe that the structure will be ready in time for the opening exercises. The work of finishing the towers is rapidly approaching completion, as will be seen from the accompanying illustration, which is a reproduction from a recent photograph of the building.

The work of allotting the space in the Electricity building was finished last week. The total space available in the building is 185,000 square feet. The total number of square feet applied for was 448,000. The space applied for by foreigners was 95,000 square feet; the space allowed them was 68,700. The plans which were submitted to the director-general allots 182,000 square feet, leaving 3,000 square feet for emergencies.

In connection with the plans which have been approved by Chief Barrett, there will be presented to the director-general blank forms of permits for space and blank forms of acceptance. It may be said in this connection that the department of electricity is making every effort to live up to the promises of a great and striking display. Every care is being taken in the allotment of space to do justice to exhibitors according to the relative importance of each exhibit. With the knowledge that the space available in the building is 185,000 square feet, and that the department has received applications which, if it were possible to allow them all, would aggregate 448,000 square feet, it will be readily seen that it has been no easy matter to fairly and impartially carry out, so to speak, the boiling down process. The applications, according to Secretary Hornsby, from parties desiring space in which to exhibit small and comparatively unimportant articles have been very numerous. The effort has been made, though, to have such exhibitors make their display in conjunction with that of some firm or company which is rightly entitled to a large space. By adhering to this plan the number of those who will appear as exhibitors has been greatly reduced, but the display will be the same. Each exhibitor will be called upon, before the final permit is issued, to furnish drawings of the display he proposes to make in his space. This plan will be followed in order that the department may have a definite idea as to how the space allotted will be utilized.

News of an exciting nature relative to electrical matters pertaining to the World's Fair was a scarce article this week. But no news is often good news, and so it was in this case, for that progress has been the watchword among the electrical workers is plainly evident to any one visiting the grounds.

The Westinghouse company, through its energetic representatives, is making creditable headway with its large contract, and Superintendent E. E. Keller is giving the large force of draughtsmen plenty to do. The plans for the wiring and the arrangement of lights in the Administration building have been approved. This building will be wired in Vulca tubing. All switches and cutouts have been located in closets at various points throughout the building; the closets used, though, for the most part, are in the janitors' rooms. On the ground floor of the Administration building there will be set up eight standards, each carrying a bunch of fifty incandescent lamps. These standards will be each about eighteen feet high to the center of the cluster, and the eight standards will fill the eight corners of the octagonal rotunda. The standards, in fact, will be nothing more nor less than huge lamp posts set up on the mosaic floor. In each of the four entrances to the building will be two clusters of twenty-five lights each. Within, at the level of the mezzanine floor, about eighty-five feet from the ground floor, is the rotunda gallery. In each alternate post of the gallery there will be placed a seven light standard. This arrangement will require 420 lights in all. On the cornice, about 130 feet from the floor and just at the base of the dome, a circle of lights, about 400, has been placed. These are arranged in rosettes. Just above the false dome, in the space between it and the dome proper, a dozen arc lamps have been located. The position of these lamps is such that they illuminate the interior of the dome proper from behind the false dome in such a manner as to best reveal the beauty of its decoration. The light is shed through the opening in the false dome by reflection, the lamps being out of sight. The effect is one of diffusion rather than the usual painful brilliancy. In the four pavilions at the corners all lobbies and loggias will be wired in ducts; all the offices in the pavilions will be wired in moulding. The total number of lamps on the inside is about 3,700.

The work on the Administration building is about half finished; that on the Art building has just been commenced, while on the Connecticut State building, 120 lights; the Massachusetts building, 176; the Pennsylvania building, 600; the Wisconsin building, 240, the wiring work has been finished.

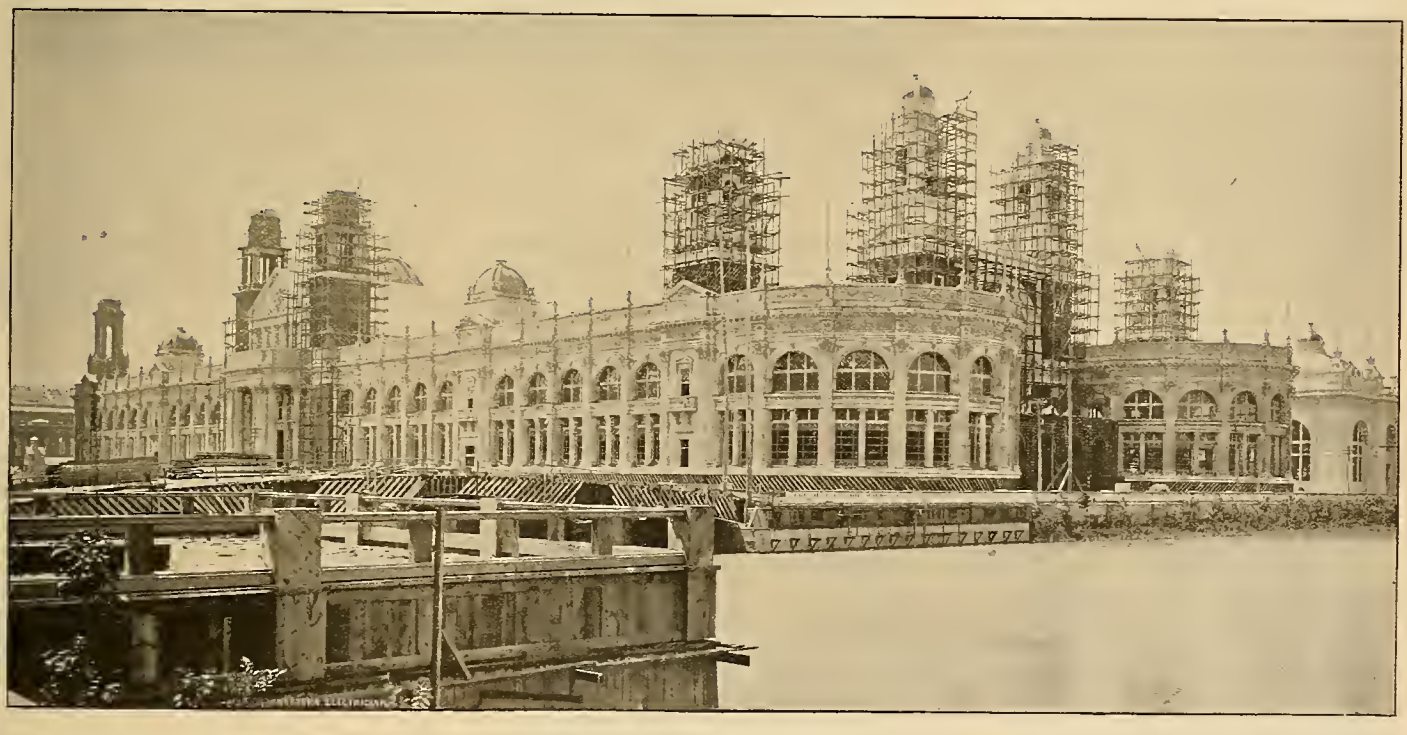
On Saturday evening last General Barney entertained a party of newspaper men at Jackson Park. A trip by moonlight on the Electra was greatly enjoyed. General Barney left for the East Monday to arrange the preliminaries for the submission to the construction department of several styles of boats to be operated on the lagoons. In these boats the general style of the Electra will be followed in all the essential features.

Manufacturers of electrical apparatus, especially those who have been interested in the contract for lighting the buildings at the World's Fair, will be interested in the estimates made by a Pittsburg paper on the cost to the Westinghouse company of furnishing the apparatus and installing the plant. According to this paper it is claimed by outsiders that "it will cost the Westinghouse company $800,000 to fulfill its contract, and that consequently it is bound to lose heavily, while Mr. Westinghouse claims there will be at least a fair profit on the work."

The conditions of the specifications require that the contractor is to install, operate, maintain and remove all generators and station apparatus; all conducting and distributing appliances, including lamps and sockets.

Thus, it will be seen that the generators are to be removed when the fair is over, or, in other words, the apparatus is going to revert to the Westinghouse company. Now ten months' use of this apparatus will lessen its market value but little, and as for its real value hardly any. With a little revarnishing and perhaps a little repairing, the entire plant can be sold for more than its cost to the Westinghouse company, which will surely cover the factory cost and the interest on the money invested in the plant for that time.

It is further estimated that the cost of lamps and sockets



ELECTRICITY AT THE WORLD'S FAIR.

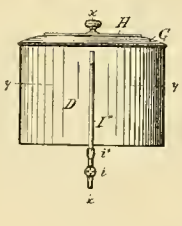
will be about $163,200, leaving over $320,000 for wiring and labor. It would appear from this that the possibilities of a direct profit are very good, while, of course, the indirect gains cannot be estimated in dollars and cents, but will undoubtedly be large, as the advertising benefits will be immense.

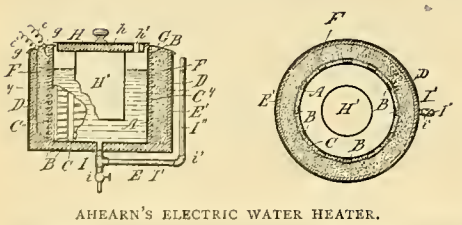
Ahearn's Electric Water Heater.

In the article entitled "The Electric Heater in Canada" which appeared in a recent issue of the WESTERN ELECTRICIAN, reference was made to a number of forms of electric heating apparatus that had been devised and put into service in Ottawa, Ont., by T. Ahearn. The extent to which Mr. Ahearn has carried out his experiments was doubtless a surprise to many of those on this side of the line, who fondly imagined that the electricians of the United States were foremost in all lines of electrical engineering. The article referred to, however, caused an awakening, and a number are now watching most respectfully for details and reports as to the continuous practical working of the Ahearn apparatus. On this account the accompanying sketches showing diagrammatically the internal arrangements of Mr. Ahearn's water heater will be of interest.

Referring to the three cuts of the device—an exterior view, a vertical section, and a horizontal section—the details of this particular form of heater will be clearly understood.

A is an open vessel, metallic and a good conductor of heat—such as copper, tin, or thin cast-iron—adapted to hold water. Upon this are placed strips of insulating material *B*, such as asbestos. Upon this insulation is wound a coil of wire or strip *C* of refractory material having a high electric resistance—such as German silver—and the terminals are connected with leads *c c'* of an electric circuit. The vessel thus insulated, coiled, and connected, is placed in a vessel *D*, which is large enough to leave an annular space all round the inner vessel *A* and also to leave a space between the two bottoms. The latter space is packed with a good non-conductor of heat and electricity *E*—such as asbestos—and the annular space is filled with powdered whiting, fire-clay, or other refractory material *F*, which is also a non-conductor of electricity. The interior of the vessel *D* is also lined with asbestos or other non-conductor of heat *E'*. The top of the annular space is made up with a ring cover *G*, provided with insulators *g g*, through which the leads *c c'* are passed. The inner vessel *H* is provided with a removable hollow cover *A*, the





AHEARN'S ELECTRIC WATER HEATER.

interior of which is packed with asbestos *h*. An opening *h'* is provided in the cover convenient for filling the vessel.

To the interior of the cover *H* there is attached a closed water-tight vessel *H'* of such a size as to reduce the water-space in the vessel *A* and form an annular space around vessel *H'* and a space between its bottom and that of the vessel *A*.

I is the draw-off pipe, secured in the bottom of the vessel *A* and passing through the bottom of the container *D* and provided with a suitable faucet *i*. To pipe *I* there is attached a branch *I'*, provided with an elbow *i'*, in which a gauge-glass *I''* is secured. The outer vessel *D* is further packed externally with a non-conductor of heat and suitably lagged with wood or other material. The vessel *A* is filled with water, the level of which may be readily observed in the gage-glass *I''*. A switch being provided in the leads *c c'* at a suitable point, the current may be turned on or off when desired. The coil *C* is of such a sectional area that it is heated by the passage of a current without being fused. The heat thus created in the coil is conducted by the filling *F* to the vessel *A* and by it communicated to the water in the vessel. The water-level in the vessel *A* is maintained uniformly by an automatic regulating device.

An Incandescent Cigar Lighter.

The accompanying cut represents a new electric cigar lighter of German manufacture. The device is introduced by R. Frister of Berlin, and it is claimed that a number are actually in use. The apparatus is quite simple and consists essentially of an incandescent lamp socket with a suitable handle connected by flexible lamp cord with wires carrying a 100 or 110 volt current. The outer end of the socket is supplied with a plug containing a spirally wound platinum wire, and this is brought to a state

INCANDESCENT CIGAR LIGHTER.

of incandescence when the circuit is closed by means of the push-switch shown in the handle. This glow is sufficient to ignite a cigar when aided by a few vigorous puffs. Sufficient resistance is introduced in the handle of the lighter to suit the requirements of the current.

Search Light Signaling from Mount Washington.

On August 22d an interesting search light experiment was made at Mount Washington, N. H. A message was telegraphed by means of flashes from the mountain to Portland, a distance of about 85 miles, and was read by an operator on top of the Western Union building in Portland. The source of the light itself was not visible from the Western Union building, but its needlelike beam shot across the heavens and was clearly outlined. Telegraphic communication had been established between the mountain and the roof of the Western Union building, and at 9:30 o'clock the electric light was turned on and the beam directed toward Portland. The operator at Mount Washington telegraphed over the wires:

"Can you see the beam of light in the air?" and the answer came back:

"Yes, I can see it directly overhead."

Then the Mount Washington operator wired:

"I am going to telegraph by flash light; send back instantly by wire the word as you will get it."

Then the key which operates the flash light was used, and by the code system of dots and dashes the name "Mount Washington" was flashed across the sky. Instantly after the completion of the last word the little ticker repeated the words which were sent back by wire by the Portland operator. Then the flash light shot the word "Congratulations" into space, and it was read without hesitation. "Good-night" was the final aerial message, and it was repeated as the others had been.

It must be borne in mind that the operator in Portland could not see the direct rays of the light. He read the signals as they were flashed through the air over his head. The light was directed at an angle of forty-five degrees from the air line between the summit of Mount Washington and Portland, in order to avoid low-lying clouds. Taking the latter as a base line, it was figured that the beam of light which was seen by the Portland operator was at least 80 miles above him, and was in itself 110 miles long at the point where it reached his vision. It was so sharply defined, even at that distance, that the flashes could be read with ease.

At first it was designed to prove that signaling could be carried on by means of the direct rays if it so happened that no clouds intervened between the light and the eye, but the experiment here described has demonstrated that communication can be established even if the beam is eighty or a hundred miles above the eye which reads the message it conveys.

During the last week there have been superb weather conditions, and many features with regard to the light's penetrating power have been developed. At Maplewood, twenty miles distant, it was possible to read print. On another occasion a lady read a letter on the piazza of Sunset pavilion, North Conway, by the light of the big flash light. That was covering a distance of twenty miles. At Littleton, twenty-five miles away, it was possible to read a book, and the flash was seen on another night as far away as Pigeon Cove, Mass. The light was in charge of electrician L. H. Rogers of Boston.

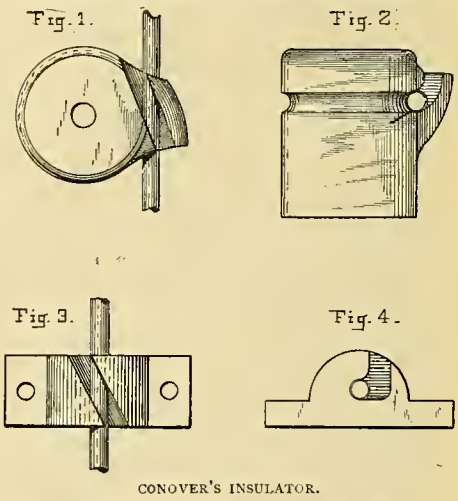
Conover's Insulator.

In the accompanying cuts are shown views of an insulator devised by Chauncy E. Conover of Cincinnati, O. They may be made of glass or porcelain. Fig. 1 is a top view, Fig. 2, a side elevation, and Figs. 3 and 4 are respectively a top view and side elevation of a modified form.

In Figs. 1 and 2 a central hole furnishes means for securing the insulator upon a pole, cross-bar, or other object, and in Figs. 3 and 4 two holes are provided.

A groove or seat for the line-wire is provided, over which groove ears are projected, one upon each side of line wire groove. The extensions are not placed directly opposite each other, one being forward of the other in the direction of the line wire leaving a groove or space between the ears diagonal with the line wire groove. This diagonal groove is made a little larger or wider than the wire to be used thus enabling it to be placed in the insulator by giving to the wire a slight bend in the direction of the groove without making a permanent bend, and also while the wire is drawn comparatively tight. The line wire will, as soon as it is below the angular projection of the ears, assume its position in its groove or seat, while the angular projections retain it. The wire can be quickly inserted or removed and requires no other fastening.

By means of the construction shown in Figs. 1 and 2 the advantages of the old form of insulator are retained, with the additional advantage of the line wire seat, thus taking the weight of the line wire from the tie wire and at the same time obviating the use of a tie wire on every insulator, thereby effecting a saving in the amount of tie



CONOVER'S INSULATOR.

wire required, as well as a saving in the time used in fastening it upon the insulator.

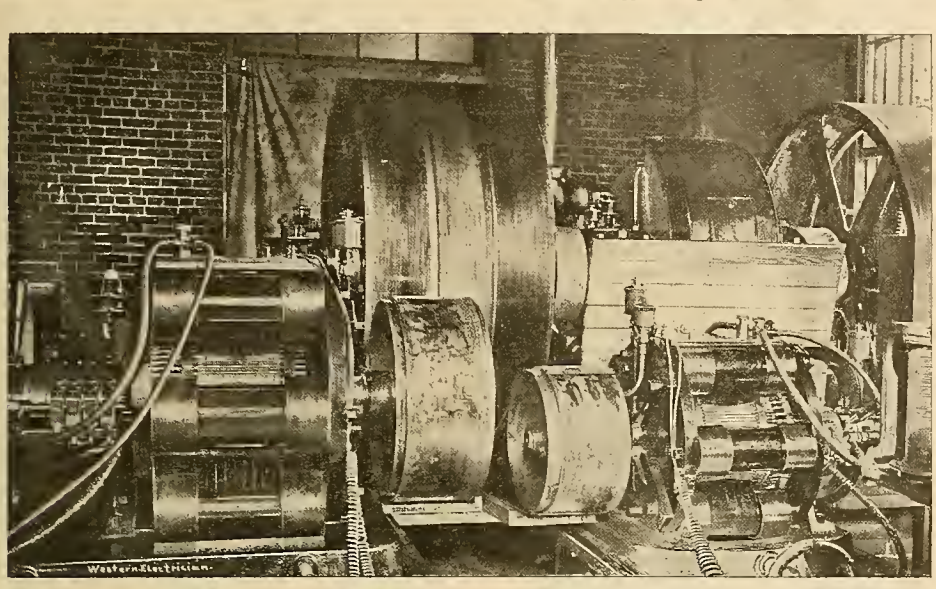
The line wire can be pulled tight before placing it within the insulator and be put in while tight instead of threading it through a hole and pulling it tight afterward. Moreover a secure seat is provided for the support of the line wire regardless of any tying wire. The modification shown in Figs. 3 and 4 may be used in a horizontal or perpendicular position.

Western Union and Postal Telegraph.

There has been considerable talk in Wall street lately about a proposed consolidation of the Western Union and Postal Telegraph companies, but little reliable information is obtainable. Men who are prominent in the management of the Western Union Telegraph company decline to either affirm or deny the report that they are negotiating for a closer combination with the Postal Telegraph company. The impression, however, prevails in the minds of outsiders that Mr. Mackay has really received an offer for a large block of Postal shares. Some of Mr. Mackay's friends declare their disbelief in any willingness on his part to dispose of his control of the enterprise. One of the Wall street stories is to the effect that the president of Western Union recently sent a trusted representative to have a talk with Mr. Mackay with reference to a virtual consolidation of the two companies.

Concord & Montreal Railroad Station Plant.

Probably one of the most compact lighting plants in the country is that of the Concord & Montreal railroad company for lighting its shops, depot and yards, in Concord, N. H. The dynamo and engine room, which is shown in the accompanying illustration, is but 14 by 20 feet and contains one Thomson-Houston arc dynamo of 50 lamps capacity and two Standard incandescent machines of 800 lamps, driven directly from a 115 horse power Armington & Sims engine, and a 250 light incandescent machine called the



CONCORD AND MONTREAL RAILROAD PLANT.

"Shawhan," driven by a Junior Westinghouse engine. The L. P. & D. transmitter is used here, a double one driving two dynamos from one pulley, as shown in the cut, and a horizontal one driving the arc machine. The station is in charge of H. A. Conant, electrician for the railroad, and was installed by Kendall & Slade of Boston, Mass.

Charging Accumulators in England by Wind Power.

Americans have done very little in the line of devising apparatus through which wind power might be made available to do the work of charging storage batteries. Prof. J. Blyth, of England, however, has been experimenting with the view of stealing a share of Nature's waste forces, and the cut presented herewith is a reproduction of a photograph showing his new form of windmill with which he charges a battery of accumulators.

In a recent address made before the British association, Prof. Blyth thus refers to his plant:

"No sooner was the accumulator invented than windmills for electric storage began to be thought of. At the York meeting of the British association, Sir William Thomson suggested the construction of cheap windmills to run dynamos for charging accumulators, but, so far as I know, no practical trial was made till the summer of 1887, when I erected my first electric windmill in the village of Marykirk, Kincardineshire. At that time I procured a set of 13 accumulators and constructed a windmill of the old English type, having four arms and canvas sails. The length of the arms was about 14 feet, and the sails were 8 feet by 3 feet. The mill was provided with beveled gearing at the top, a vertical shaft, and beveled gearing below, so arranged that the driving wheel moved always in the same vertical plane, no matter in what direction the wind shaft pointed. The mill was turned into the wind by hand, having no tail or other gearing for keeping automatically head to wind. The dynamo was driven by a belt from the driving wheel, and with this I was able on two or three windy days, to store my cells.

"Although the experiment was not on a very large scale, it was sufficient to show me that accumulators could quite well be charged, when the electrical connections were properly made, by a dynamo driven at the irregular speed characteristic of a windmill. Sails I found were not a great success, especially since I had no way of reefing them. To prevent them being torn to pieces the mill had to be stopped when the wind was high, that is, just at the time when it should have been going at its best.

"I remedied this partially. I altered the wind-wheel from the English to the American type, having a number of arms and blades of sheet iron. I also introduced the further improvement of doing away with the driving wheel being always made to go in the same plane. This is absolutely necessary if the wind-mill is to drive a saw-mill, a corn mill, or anything of that sort, but for electrical purposes the dynamo can quite easily be attached to the wind-shaft platform so as to turn with the mill as the wind changes. In this way all gearing is avoided, as the dynamo can be driven with ropes from a large wheel keyed directly on to the wind-shaft. This I found to answer very well so long as the wind had a moderate speed, but like all other windmills, I soon found that it had either to be made self-reefing or stopped altogether when a breeze came. This is obviously very unsatisfactory, as the best of the wind for storage purposes is lost, and hence this problem presented itself, viz., how to construct a windmill that would satisfy the following requisites:—

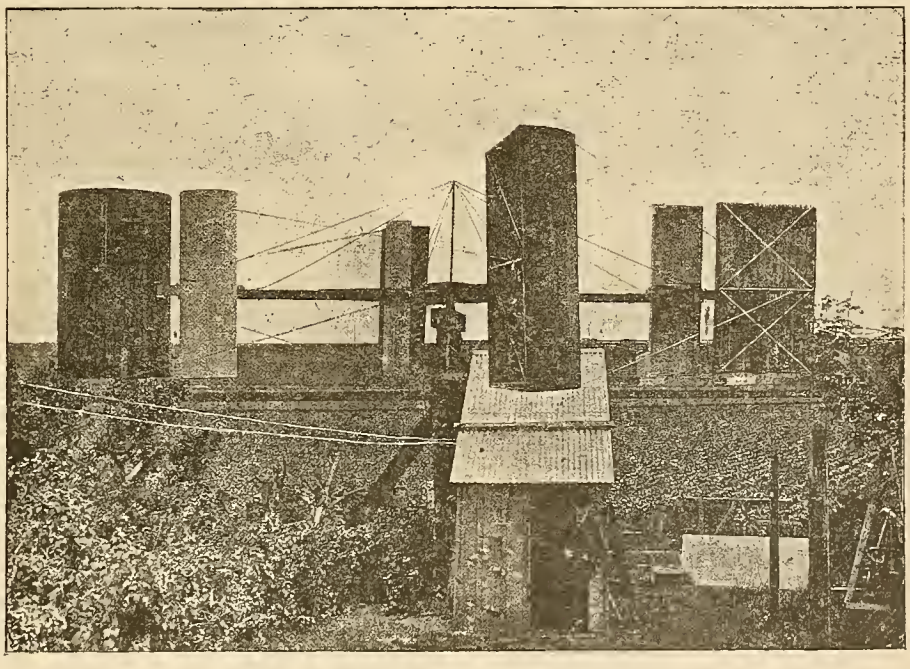
1. It must be always ready to go.
2. It must go without attendance for lengthened periods.
3. It must go through the wildest gale, and be able to take full advantage of it.

"A possible solution of the problem is presented in the Robinson anemometer, which consists of four hemispherical cups attached to four arms, and moving in a horizontal plane about a vertical axis. From the theory of this instrument, which is, however, only approximate, it appears that whatever might be the speed of the wind, the speed of the cups attained a certain terminal value, such that the couple due to the wind pressure was exactly equal to that produced by the resistance to the motion through the air, and the friction on the bearings.

"Last summer I erected a machine of this kind, which has been considerably improved within the past three months. The cups are replaced by semi-cylindrical boxes attached to four strong arms, each about 26 feet long—the opening of each box is 10 feet by 6 feet, and the vertical shaft is a long rod of iron 5 inches in diameter. At the lower end it carries a massive pit wheel, which actuates a train of gearing, and drives a flywheel, 6 feet in diameter, with the requisite speed for driving a dynamo connected with it by a belt in the ordinary way. This machine worked most satisfactorily, and with a fair wind speed, gave about two electrical horsepower. I also tested it in a strong gale, by allowing it to run with no load, and the result was perfectly satisfactory, as a safe terminal speed was attained, and all racing avoided. Hence I think that electrical windmills, at least for small installations, are likely to assume this form, as there is no limit to the size and strength with which they may be constructed, and, if necessary, several could be placed in any well exposed position, each having its own dynamo and set of accumulators. During the past few months I have increased the power of the machine by adding an auxiliary box to each arm with a gap between it and the previous one. This I find to be better than merely increasing the size of the previous box. As the whole is a case of vortex motion, the theory is very difficult Information can only be got from models and applying the principle of dynamical similarity.

"Regarding the electrical connections necessary I may say a word. All that is needed is that the circuit be broken when the dynamo is running at less than the storage speed. This is easily managed by a governor attached to the dynamo shaft, and which makes and breaks contact in a mercury pool at the required speeds. I have also tried a form of governor which throws a greater or less number of cells into the charging circuit as the wind varies; and in this way the machine is always doing some work."

The cut is reproduced from the London *Electrical Review*.



CHARGING ACCUMULATORS IN ENGLAND BY WIND POWER.

Electric Light for Microscopic Study.

In an article on the use of the electric light for illumination in microscopic work the New York *Advertiser* says that Dr. Henry G. Piffard, who, in his photomicrographic studies, has made use of nearly all the known methods of artificial illumination, has invented a new lamp which embodies the best features of modern practice in microscope illumination. The ordinary electric incandescent lamp in domestic use has an illuminating value of sixteen candles, and its filament is brought to incandescence by a current having an intensity of about half an ampere under a pressure of about 110 volts. The light is obtained from a filament five inches in length. Such a light is not desirable for microscopic work, in which the light rays should be more condensed by the use of a shorter and thicker filament. The life of such a lamp, however, on an ordinary circuit would be brief, as a certain length of filament is required to withstand the pressure of the current from the main Dr. Piffard has overcome this difficulty by devising a lamp of fifteen candle power, requiring a current of about three amperes at a pressure of fifteen volts. The peculiarity of this lamp is that instead of having a filament of the ordinary horseshoe form and of the usual length (four to five inches), its carbon is but three-quarters of an inch in length, while the rest of the apparent filament is composed of copper wire, arranged so as to hold and support the carbon in a vertical position.

When the carbon, which is broader and thicker than that of the ordinary domestic electric lamp, is rendered incandescent by the passage of current, a vertical streak of light

of intense brilliance, about three-quarters of an inch long and apparently an eighth of an inch wide, is given. The minified image of this light is focussed by mirror or condenser on the object to be examined and constitutes "critical" illumination, the portion of the object within the area of the streak having its most intimate structure thoroughly revealed. A pleasing testimony to the value of the electric light in work involving great strain of the muscles of the eye is afforded by the fact that Dr. Piffard, who was compelled to relinquish his microscopic labors for some years in consequence of the effect of the light on his eyesight, was enabled by the use of the electric light to resume microscopic investigation, which he now carries on with ease and comfort.

A Dutch Ship Lighting Outfit.

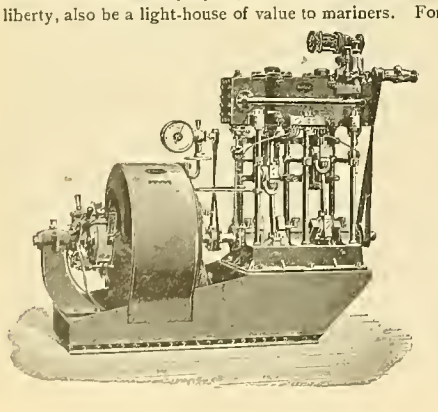
Combinations of engine and dynamo on one base for electric lighting on shipboard, where it is desirable to economize space, are possessed of no particular novelty, but the one shown in the cut seems to be unusually compact, and possesses the further advantage of having been installed on ships of war, where the demands on the electric lighting service are severe. It comes, moreover, from Holland—a country from which little in the way of electrical development is heard in the United States.

The engine and dynamo were made by Willem Smit & Co., of Slikkerveer. Four of these combinations have recently been supplied for the Dutch colonial warships Sumbana and Lombok. The object aimed at in designing these generators was the production of a light but strong machine for running at low speeds. The dynamo has a large Gramme ring with internal stationary magnets. The output is 150 amperes, at 70 volts, with 190 revolutions per minute. The machine will, however, give 225 amperes without undue heating. The armature is 36 inches outside diameter and 10 inches long, the iron being 2½ inches thick. The Gramme ring is made up of disks of charcoal iron .03 inch thick, bolted on a bronze spider. It is unusual to use punchings of this size in dynamos, as it is very costly, owing to the great waste, unless the inner blanks can be used for smaller machines. Nevertheless it admits of a very strong mechanical arrangement, and Smit & Co. have, therefore, preferred to use 3 foot disks, 2 inches broad, rather than wire or built up segments. The armature has 480 turns of .14 inch round wire, and 120 commutator sections. The field magnet has four poles, and as cross connections would be awkward in such a machine, four brushes are used to collect the current.

The engine is of the ordinary type, with 6½-inch cylinders and 8-inch stroke, and is supplied with steam at 160 pounds per square inch. The dimensions of the plant are: Length, 7 feet 4 inches over all; height, 6 feet, and breadth, 3 feet 4 inches, and the total weight, including the wrought-iron bed-plate, is 2½ tons. The cut and description were taken from *Industries* of London.

Proposed Illumination of the Statue of Liberty.

Perhaps before long the Staten Islanders who use the night ferry boats from the Battery in New York will be able to discern something more than the mere outlines of Bartholdi's great statue. It was always intended that the Statue of Liberty in New York harbor should serve more than a sentimental purpose, and while being a beacon of liberty, also be a light-house of value to mariners. For

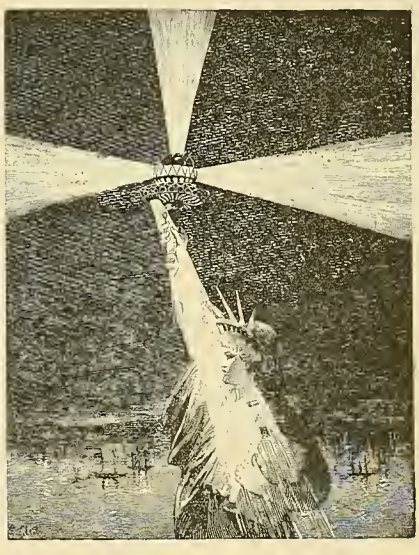


A DUTCH SHIP LIGHTING OUTFIT.

such a useful purpose, however, the statue has been a failure. Some time ago Major Heap, of the Engineer Corps of the army, was asked to design a method by which the statue could be properly lighted, and therefore serve the utilitarian purpose as well as the sentimental. Major Heap has just reported to the Light-house Board, and proposed that the present lights of about 2,000 candle power be so treated that a belt of flame shall be seen instead of the small portion as at present. "The effect I desire to produce," says Major Heap, "is a powerful white light in the focal plane, and a beam of colored light seen by reflection from the haze or dust in the air, so that the general appearance shall be somewhat like a flame." In the head of the statue, over the forehead, is a coronet consisting of twenty-five windows. In front of each window Major Heap proposes to place two 100 candle power incandescent lamps, protected from the weather in glazed lanterns, the backs of which shall be reflectors. At present the statue, owing to its dark color, is invisible at night, as the reflected light from the lamps in the salients of the fort is too feeble to be seen at any distance. To partially overcome this, Major Heap proposes to place an arc light of 2,000 candle power under the balcony of the torch, with the reflector throwing the light directly on the head, as shown in the cut, which is reproduced from *Harper's Weekly*. This beam of light will be so powerful and will be so near the head that the latter will probably be visible to vessels passing close to the statue.

Platinum Pyrometers.

A demand exists among certain classes of manufacturers for a reliable and accurate pyrometer that will indicate very high temperatures without deterioration. In a paper read before the Iron and Steel Institute, England, by H. L. Callendar, reference is made to the air pyrometer and the electrical resistance pyrometer. Mr. Callendar's remarks on the latter form of instrument, are worthy of reproduction. With reference to the air pyrometer its great advantage, he says, is due to the fact that it permits of the calculation of temperature approximately on the absolute scale. For theoretical work this is extremely important. For practical purposes, however, it is by no means essential, and the air pyrometer has several disadvantages. It is difficult for several reasons to make it read with sufficient delicacy and accuracy at high temperatures. It is necessarily fragile, unwieldy and difficult to manipulate. There is always the trouble of making air-tight joints, and of finding a material for the bulb which remains sufficiently rigid and impervious at high temperatures.



PROPOSED ILLUMININATION OF THE STATUE OF LIBERTY.

The second form of pyrometer, the electrical resistance pyrometer, is, in his opinion, much better suited for practical work. It is much more sensitive and constant than the air thermometer, and also much easier to read and manipulate. The action of the electrical resistance pyrometer depends on the measurement of the change of electrical resistance of a wire. Electrical resistance thermometers are generally made of platinum wire, owing to its infusibility and freedom from liability to chemical change. For this reason they are often called simply "platinum pyrometers," which is the name by which he refers to them in what follows.

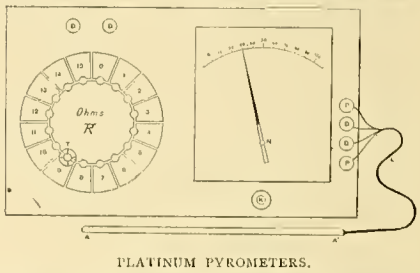
Matthiessen showed many years ago that the resistance of a wire of almost any pure metal increased nearly in proportion to the absolute temperature. The resistance of a pure platinum wire increases by about 34 per cent. between 0° and 100° C. At 1,000° C. its resistance is about four times as great as at 0° C. Not only is the increase of resistance very large, but it can be very accurately measured. The measurement of resistance is much the most simple and exact of all electrical measurements, and there can be no doubt that thermometers constructed on this principle can be made much more sensitive and accurate than any other kind. They have a great advantage in this respect over thermo-couples. The electromotive force of a thermo-couple is by nature very small, and could not in any case be measured with the same ease and accuracy as a resistance.

The merit of having worked out the platinum pyrometer in a practical form, and of having introduced it into general use, undoubtedly belongs to Sir W. Siemens. In his Bakerian lecture in 1871, he explained the theory of the method, and described instruments capable of indicating temperatures up to 1,000° C. The great convenience and advantage of the method was at once realized, and a committee of the British association was appointed to test the instruments, and report upon them. Their report, however, which was published in 1874, disclosed a most serious practical defect. The committee experimented chiefly with a pyrometer in an ordinary fire at moderate temperatures of about 800° C., and they found that the resistance of the pyrometer increased continuously with continued heating, and that the wire underwent rapid deterioration. They also made some experiments and suggestions with a view to remedy this defect, but they did not succeed in overcoming it. This continuous change of zero is certainly the most serious practical defect that a pyrometer can have, and there can be no doubt that the report of the British association did a great deal to destroy confidence in this method of measuring temperature.

About seven years ago, when Mr. Callendar began making experiments on this subject at the Cavendish laboratory, Cambridge, he was at first very much surprised to find that the platinum wires which he used did not undergo continuous change, even when subjected to much more severe tests than those applied to the Siemens pyrometer by the committee of the British association. By making further experiments, however, with a sort of imitation Siemens pyrometer, he succeeded in reproducing at pleasure the effects they had observed, and in proving to his own satisfaction that these defects were not inherent in the method, but merely incidental to the particular form of instrument on which they experimented. He found that if the wire was properly protected from strain and from contamination, the pyrometers could be made practically free from change of zero, even at very high temperatures. Now, since he claims to have succeeded in constructing pyrometers on this principle which are free from this defect, he feels that it is incumbent upon him, in order to restore confidence in the method, to explain the particular defects of construction of the Siemens pyrometer to which its changes of zero are due, and to show how they may be avoided.

The construction of the Siemens pyrometer has not, so far as he is aware, undergone any material change since 1874. The coil of platinum wire, which forms the sensitive part of the instrument, is wound on a clay cylinder, and packed in an iron tube from five to eight feet long and about an inch or so in diameter. He has in his possession the fine wire and the clay cylinder from a pyrometer which was recently in use at the Royal arsenal, Woolwich. He was informed that it had never been heated above 900° C., or 1,600° F., but its resistance had increased some 15 per cent., corresponding to an error of about 100° F. in the temperature measurements. When the instrument was taken to pieces, it was found that the wire was quite rotten and brittle in some places and sticking to the clay cylinder. This was thought to be sufficient evidence that the clay, or some impurity contained in it, attacks the wire, otherwise the local nature of the action could not be explained, unless the quality of the wire used was very inferior.

Mr. Callendar has tried several materials on which to

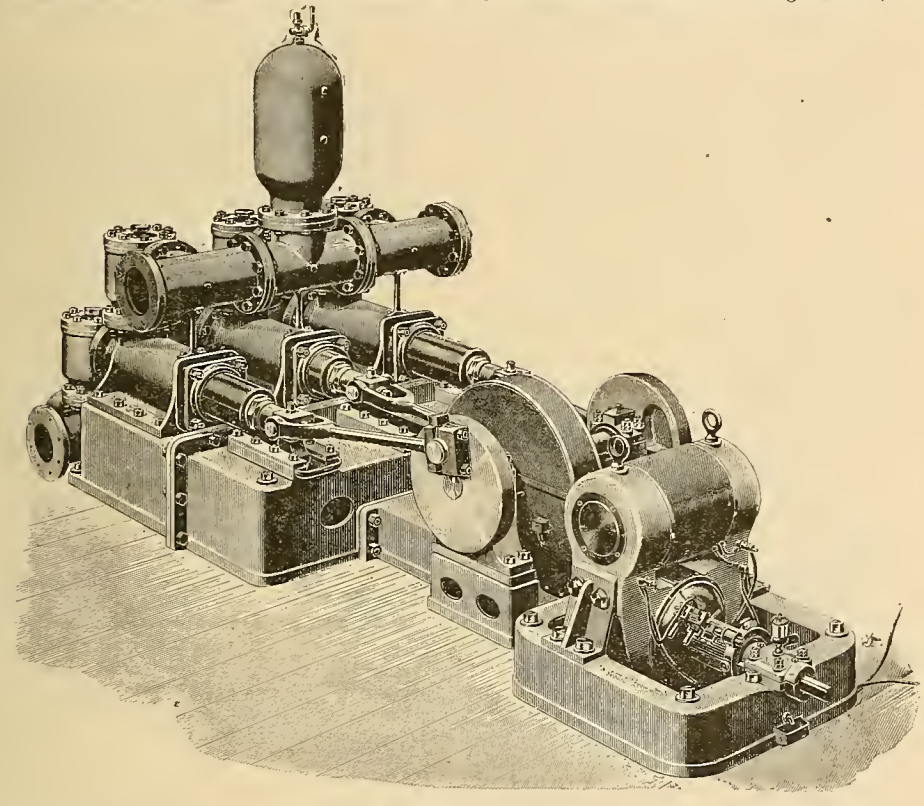


PLATINUM PYROMETERS.

wind the wire, but has found nothing that answers so well as mica. The plan he generally adopts is to double the wire on itself and wind it round a very thin plate of mica, in such a way that it only touches the mica at the edges. This method gives very good insulation, even at high temperatures, and, so far as can be discovered, the mica has no action on the wire, even at temperatures of 1,200° C. Another defect of the Siemens pyrometer is the iron containing tube. Metallic vapors of any kind will attack the wire readily, and will ruin the pyrometer. It is not probable that the iron itself will be appreciably volatile at

temperatures below 1,000° C., but it is very likely to contain several more volatile impurities. Vapors of copper, tin, zinc, etc., rapidly render the wire brittle and useless. A comparatively small trace suffices. Here, for instance, is a pyrometer with copper electrodes, which has been kept at a temperature of about 850° C. for an hour or so in a porcelain tube. The discoloration of the mica in the neighborhood of the copper leads shows that the copper was appreciably volatile at this temperature, 150° C. below its melting point. The resistance of the platinum coil was in this case increased by nearly ½ per cent., owing to the action of the copper. For this reason copper or silver leads cannot be used in pyrometers for high temperature work. The pyrometer has silver leads, and is intended for working up to temperatures of 700° or 750° C. only. It is inclosed in a tube of very hard glass, which does not begin to soften till nearly 800° C.; that is to say, at a bright red heat.

For work at high temperatures it is essential to use leads of platinum, which must be fused—not soldered—on the fine wire of the coil. Solder of any kind is quite inadmissible, and screw contacts, such as are used in the Siemens pyrometers, are clumsy and liable to change their resistance with repeated heating. Glass cannot, of course, be used for the containing tube in high temperature work. A hard glazed porcelain tube does very well to protect the wire, at least up to temperatures of 1,200° C. A silica tube would probably do even better, but such tubes are difficult to make of the requisite size. The instruments inclosed in porcelain tubes have been made with platinum leads. This particular pattern is intended for laboratory work, and for testing small samples; but it will be understood that they can readily be made of any other pattern to suit furnace work. For some kinds of rough work it is convenient to protect the porcelain or glass tube with an outer tube of iron, and to make the instrument much larger.



ENGLISH ELECTRIC PUMPING PLANT.

So far Mr. Callendar has described only the construction of the pyrometer itself. The construction of the indicating portion of the apparatus, and the method of measuring the resistance, is a question of almost equal importance. The resistance of one of these pyrometers can, of course, be measured by any of the usual methods, but the sensitiveness and accuracy attainable depend very largely on the selection of a suitable method and apparatus. In the case of the Siemens pyrometer, the differential galvanometer method has been adopted. A resistance box is used reading to $\frac{1}{10}$ of an ohm, which corresponds to about 3° Fahr., and a table is issued giving the resistance for every 20° Fahr. The disadvantages of this method are (1) that the readings are discontinuous, (2) that it is necessary to refer to the table, and do an interpolation sum to find the temperature. The differential galvanometer method is, moreover, for other reasons, unsuitable for accurate work. It is essential to use the Wheatstone bridge method. For use with his own pyrometers Mr. Callendar has adopted the most accurate modification of the latter method, in which a bridge wire is used for reading the fractions. The advantages of this method are (1) its superior accuracy; (2) that the readings are continuous; (3) that the divisions of the wire may be made to correspond directly to degrees of temperature. The principle of the method has been described and explained in a paper published in the *Philosophical Magazine* for July, 1891.

Most people who are not practical electricians find a mirror galvanometer rather difficult and troublesome to work with. For ordinary purposes a needle galvanometer is sufficiently accurate, and certainly much easier to read. The cut represents the arrangement of the apparatus for working with a needle galvanometer at any temperatures up to 1,500° C. AA^1 represents the pyrometer in its containing tube connected by the flexible leads $L\,L$, which may be of any convenient length to the terminals $P\,P$, $C\,C$ of the indicator. A common Leclanche or dry battery is connected to the terminals $B\,B$. By means of suitable switches, not shown in the diagram, any number of different pyrometers in different places may be alternately switched on the same indicator. The needle N of the galvanometer is furnished with a long fine index, which moves over a scale divided into 100 parts. R is a resistance box, preferably of dial form, and mounted on the same base as the galvanometer. The traveling plug T can be inserted in any one of the holes so as to vary the resistance in the circuit. The resistance of the pyrometer is adjusted so that a change of 1 ohm corresponds to 100° C. or Fahr., whichever may be preferred. The remaining coils and resistances forming the Wheatstone bridge are contained in the galvanometer case. The connections, etc., are not shown in the diagram, to avoid unnecessary complication.

In taking an observation, the temperature is generally known beforehand to within 100°. The plug T is inserted in the corresponding hole. The key K is then depressed, and the needle of the galvanometer at once indicates the odd degrees and fractions. In the position shown in the diagram the temperature indicated is 930°. When the needle falls below 0 the plug T must be shifted backwards. When it rises above 100 the plug is shifted the other way. An arrangement is also provided for keeping the key permanently depressed when the temperature is to be indicated continuously. The use of this form of instrument requires no special electrical knowledge or skill. The observations are such as any intelligent workman can readily make. It is many times more sensitive than any of the ordinary forms of pyrometers, its readings are also much more constant and trustworthy, and there are no calculations to be made or corrections to be applied. For many kinds of rough work, and particularly for work in furnaces and blast pipes, it is not necessary to read with this degree of accuracy throughout the whole scale. In many cases the temperature is only required roughly, say to 5° or 10°. For this purpose the auxiliary resistance-box R may be dispensed with, and the whole temperature indicated by the deflection of the galvanometer. This, of course, makes the apparatus much simpler and cheaper, as the resistances are expensive and difficult to adjust. By suitably adjusting the scale of the galvanometer it can be made to cover any desired range, such as 0° C. to 1,000° C. or Fahr., instead of 0° C. to 100° C. In cases where greater accuracy is required, but only over a small range, such as 1,000° C. to 1,300° C., the resistance box may also be dispensed with, the pyrometer and the galvanometer scale being adjusted so as to start reading at the desired point. One great advantage of these pyrometers lies, in fact, in the ease with which they can be adapted to suit any particular kind of work.

Another advantage of these pyrometers is that different instruments, when properly adjusted, agree in their indications very closely indeed throughout the whole scale.

For practical purposes it is comparatively little use to endeavor at present to reduce the indications to the scale of the air thermometer, because the latter instrument cannot at present be made to read with certainty even to 10° C. or 20° C. at 1,000 C. To the practical man it does not really matter whether the scale of his instrument be Centigrade or Fahrenheit, or absolute or arbitrary. What he wants is an instrument which will always give the same indication at the same temperature, so that, having once discovered the temperature necessary or most suitable for any particular process, he can make certain of reproducing the same conditions at will at any future time. This desirable result can, I believe, be most perfectly attained, as far as our present state of knowledge goes, by the use of platinum pyrometers. Since different platinum pyrometers can be made to agree very closely in their indications, the results obtained by different observers will then be fairly comparable if expressed on the platinum scale. If the greatest accuracy is desirable the readings can be still further reduced to the scale of some particular standard pyrometer. In this way we shall at least be able to secure uniformity in place of the bewildering discrepancies at present existing. The platinum pyrometer will preserve the standard, and if at any future time it becomes possible to make more accurate measurements with the air pyrometer, all the observations previously made will not be simply wasted, as they are under the existing want of system, but can at once be expressed in terms of the new standard.

English Electric Pumping Plant.

The accompanying cut is one of many illustrations coming from across the water, which go to prove that our English cousins are making greater progress than is generally supposed in the manufacture of heavy electrical machinery.

This outfit was built by Scott & Mountain, limited, of the Close Works, Newcastle-on-Tyne, for the North Seaton colliery. These pumps were designed to deliver 250 gallons of water per minute, through 1,300 yards of 8-inch pipe, against a head of 50 feet. The motor which drives them gives 20 horse power when running at its nominal speed of 720 revolutions per minute. This speed is reduced to the thirty revolutions at which the pump shaft runs by worm gearing, as indicated in the engraving. The worm, which runs in an oil bath, is of wrought iron and the worm wheel is phosphor bronze. A thrust bearing is employed to take up the pressure in the worm spindle. The pumps, as will be seen, are three in number. The rams are of gun metal 9 inches in diameter, and the stroke is 15 inches. The crankshaft and connecting rods are steel. The dynamo which supplies the current to the motor does so through a cable 2,700 feet long. A special switch is used at the motor end to prevent sparking at the terminals when starting. The dynamo is belt driven, being designed to run at 800 revolutions per minute, at which speed its output is 65 amperes at 300 volts. It can be used for electric lighting when not working the pump. The engine which drives the generator is of the vertical type, having a single cylinder 13 inches in diameter with a 10 inch stroke. It is intended to run at 200 revolutions per minute.

At a recent meeting of the directors of the Buffalo, Kenmore & Tonawanda Electric railroad the contract for the construction of the electric railroad was let to the Field Engineering company, New York. The cost of the road will be $125,000. The officers of the road are D. F. Callahan, president; William F. Strasmer, secretary; John L. Donovan, treasurer; George H. Frost, attorney; N. E. Mack, J. F. Sheehan, L. P. A. Eberhardt, William W. Judd, J. A. Selleck, Frank S. Oakes, Alexander Martin, Martin Riesterer, Charles N. Brayton, Senator McDonald of Massachusetts, and James J. Bird of New York, directors. The work of construction will be begun at once.

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CORRESPONDENCE relating to electricity, or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

	PAGE.
Electricity at the World's Fair. Illustrated	121, 122
Ahearn's Electric Water Heater. Illustrated	122
An Incandescent Cigar Lighter. Illustrated	122
Search Light Signaling from Mount Washington	122
Conover's Insulator. Illustrated	122
Western Union and Postal Telegraph	122
Concord & Montreal Railroad Station Plant. Illustrated	123
Charging Accumulators in England by Wind Power. Illustrated	123
Electric Lighting for Microscopic Work. Illustrated	123, 124
A Dutch Ship Lighting Outfit. Illustrated	124
Proposed Illumination of the Statue of Liberty. Illustrated	124
Platinum Pyrometers. Illustrated	124, 125
English Electric Pumping Plant. Illustrated	125
Editorial	126
American Association for the Advancement of Science	127
Incandescent Lamps for Mines	127
Unscientific and Scientific Divining Rods. By George M. Hopkins. Illustrated	127, 128
New Regulating Switch. Illustrated	128
Double Point Tack Driver. Illustrated	128
Stillwell's Close Heater. Illustrated	128
Milwaukee Street Railway Litigation	128

DEPARTMENTS.

Correspondence	128, 129, 130
New Incorporations	130, 131
Electric Lighting	131
Electric Railways	131
Telephone	131
Miscellaneous	131
Trade News	131, 132
Business	132
Electrical Patents	132

A MOVEMENT is on foot in Baltimore for the burying of all electric wires. It is proposed that the city build a conduit and charge a rental sufficient to pay interest on the debt contracted for constructing the subway and to provide a sinking fund. The city officials claim that they have a right to place the wires under ground, and the mayor is in favor of providing a place for them in subways. There is considerable opposition, not only on the part of the electric companies, but many taxpayers as well, who maintain that the city funds should not be used for such a purpose. Some of the advocates of the measure hope to shut out the railway companies that are preparing to introduce rapid transit, but it is believed by the latter that their franchises will stand the test of the courts, and that they will be able to introduce the trolley system.

"ORGANIZED labor" seems to have lost its fascination in one instance at least for the men engaged in one line of electrical work. For some time representatives of the "National Brotherhood of Electrical Workers" have been engaged in "missionary work" in the New England states. An effort has been made to organize the employes at the Thomson-Houston works, Lynn, and a preliminary meeting was held in that city Aug. 21st. The attendance was very small and the indications are that the plan of organization will be abandoned. Since the establishment of the Thomson-Houston plant, there has never been a serious rupture between the company and its skilled help. The larger number of workmen employed are skilled mechanics and they fear that a general organizing of the employes would in time sever the friendly relations between the corporation and its large force of men. There are no differences between the Thomson-Houston company and its employes, and all disagreements are settled without the intervention of labor unions. The insignificant number of responses to the call issued for the meeting is explained by the statement that there is a general feeling prevalent in the ranks of the Lynn electrical workers which is very much opposed to labor unions as ordinarily conducted.

MATTERS at the World's Fair grounds were quiet last week, the work going on steadily and there being no new developments. Chief Barrett has, however, completed the work of the allotment of space in the electricity building and his report will be submitted as early as possible to the director general. It is interesting to note that although the available space in the building was 185,000 square feet the total space applied for amounted to 448,000 square feet. The extent to which the demand exceeded the space available for electrical exhibits is accounted for by the fact that many applicants wanted space in which to exhibit some small and comparatively speaking unimportant electrical specialty or fixture. It has been the aim of the department to have small exhibtors arrange to combine their displays with those of others who really require considerable space. Before the final permit for the space is allowed each exhibitor will be required to submit to the department drawings of the exhibit he proposes to make. This action will put into the department's possession information that will enable it to judge accurately as to the attractive value of each exhibit.

IT is most amusing to those to whom the electric railway is no novelty, to watch the squabble that is now on in Brooklyn, N. Y., between the street railway people and the telephone company. It is the same old story. The telephone subscribers have begun to register their complaints, and the telephone company, reluctant to relinquish its usual modest claim of owning the earth both above and below the surface, lays the blame, of course, upon the railway companies. These latter aggressive bodies fortify themselves behind the well-worn suggestion "use metallic circuits." And thus the fight goes merrily on.

How much better it would be for all concerned, not to mention the "dear" public, if the Brooklyn railway men and the telephone people would come together, arrange to split the difference, so to speak, of what will be the telephone company's additional expense in the maintenance of first class service, and leave the lawyers out in the cold. This plan has been followed in other places with satisfaction to all concerned and if the Brooklyn people stop to think a moment they will see that it is a good one. The telephone company has its place in this great world and it controls a princely share of it, and the electric road is also a most valuable and necessary improvement. But both are needed and wanted by the people of Brooklyn, so the sooner the squabblers come together and arrange their differences amicably the better it will be for everybody.

SOME very interesting experiments are being conducted at Mount Washington, N. H., with an electric search light. It is believed that these experiments will lead to radical changes in the methods of signaling. Reports from various parts of New England have been received telling of the practical value of the light as a means of communication when wires are not at hand or have been severed by one cause or another. The distance between Mount Washington and Portland is about eighty five miles, yet even at that distance a message was flashed through the air, which was read by a telegrapher on the top of the Western Union building in Portland. The source of the light itself was not visible, but its beam was clearly outlined across the heavens. The search light was mounted on the summit of Mount Washington, and in the experiment on August 22d, already referred to, telegraphic communication was established between that point and Portland. Messages were flashed by the search light, the system of dots and dashes being used, and the operator at Portland repeated the message word for word after the operator at Mount Washington. The operator in Portland could not see the direct rays of the light. He read the signals as they were flashed through the air over his head. The light was directed at an angle of 45 degrees from the air line between the summit of Mount Washington and Portland, in order to avoid low-lying clouds. Taking the latter as a base line, it is estimated that the beam of light which was seen by the Portland operator was at least eighty miles above him, and was in itself 110 miles long at the point where it reached his vision, yet it was so sharply defined, even at that distance, that the flashes could be read with ease. Another use to which it is hoped to put the search light is to illuminate cities by erecting towers several hundred feet high and using a number of search lights with diverging lenses. The experiments thus far have been far more successful than was anticipated. They have opened up a new field for the electric search light, and it is expected that it will be of great importance in the army and navy.

ALTHOUGH it has been announced that the executive committee of the American Street Railway association will not change the date of the Cleveland meeting, earnest protests continue to be made by street railway managers, as well as the manufacturers and dealers in apparatus and supplies. Many of them have entirely abandoned their preparations for representation at Cleveland, while others will give it much less attention than they would at any other time. It cannot be expected that the Cleveland convention will rank with that at Pittsburg last year, or at Buffalo the year before, either in point of attendance or interest in the proceedings. The heads of the big corporations will be at Chicago and there too will be found the manufacturers and supply men. It is to be regretted that such a condition should exist, especially as there is no good reason why the convention should not be postponed a week or two. The objection that the weather would be too cold during the last week of October is not worthy of serious consideration. Many of those who attend the meetings of the American Street Railway association are members of the National Electric Light association, and they have never found fault with the arrangement for holding midwinter conventions. As a matter of fact the most enjoyable conventions of the Electric Light association have been those in February, and the attendance at these meetings has always been much larger than at the summer gatherings. It is not improbable that a change in the date of the convention would even now result in a largely increased attendance at Cleveland.

DESPITE the frantic opposition of the calamity howlers of the daily press of New York, Mayor Grant has approved the action of the city council granting permission to equip several street railway lines in the annexed district with the overhead trolley system. There was no reason why the mayor should withhold his approval of the measure. It was demanded by the best interests of the city and it was his duty to give it his official sanction. The action of the mayor is all the more noteworthy and commendable in view of the fact that the sensational New York papers, led by the *World*, have bitterly opposed the improvement. These attacks, inspired by malice, cupidity or ignorance, are a disgrace to American journalism.

On the other hand, it is a relief to read a word of encouragement and commendation for the trolley in the New York *Sun*. In a recent editorial that paper said: "There has been a great deal of dishonesty and nonsense in what some newspapers have printed about the trolley system." This is certainly true. It might be added that the big metropolitan papers are largely responsible for the opposition to the trolley system and much of the matter published by them on this subject has been extremely unjust to the electrical concerns. Moreover, it has been of such a character as to be an insult to the intelligence of the readers of these papers.

Referring to these attacks the *Sun* says:

We have had no sympathy with the widespread condemnation by the newspapers of the trolley, because it seemed to us to be mainly rhetorical and to lack scientific and practical substance.

We have always held that there was only one sound and serious objection to taking a current of a high voltage from overhead wires in a city, and that was that in case of fires it would probably seriously interfere with the work of the firemen. We must admit, however, that it would be a very simple affair to introduce a device whereby the firemen could control or ground the current at any point where it threatened to affect their operations. Our elevated railroads are sometimes brought to a standstill by the firemen occupying the tracks with hose, but the trolley lines need not necessarily be stopped in their entire length, since it should be a simple thing to divert the current, let it make a detour and return to the main line at a point where it would not interfere with the firemen.

We commend this statement to the careful attention of the opponents of the trolley in New York and elsewhere. In many cases advocates of electric railways have had much trouble in securing franchises because of the erroneous statements of the New York newspapers. In Baltimore, for instance, the trolley system has been met with determined opposition on this account. In an article on the subject the Baltimore *World* says: "Paragraphs from the New York *World* denouncing the trolley have been read, but what do they amount to? The same ground was covered by the New York *Times* over a year ago and the stories were notoriously false."

American Association for the Advancement of Science.

At the Rochester, N. Y., convention of the American Association for the Advancemeat of Science, Prof. J. E. Kershner read a paper on "Electric Lights for Astronomical Instruments." Prof. Kershner said his attention was first attracted to the subject by an article in a German scientific journal in which a number of interesting experiments were described. He related how he manufactured the light for his own use by means of a gravity battery. The general excellence of the light and its steadiness for delicate experimentation was shown.

"The cost", said Prof. Kershner, "is unfortunately much more than it ought to be compared with the prices paid for light when furnished by a dynamo, and this keeps the majority of scientists from using what they really desire." Prof. Kershner exhibited a number of photographs which showed the conveniences and inconveniences as well in the use of the lights. The only real objection raised by Prof. Kershner was that of expense.

George E. Hale of Chicago read a paper entitled "The Spectroheliograph of the Kenwood Astro-Physical Observatory, Chicago, and Results Obtained in the Study of the Sun." He described the ingenious apparatus which he

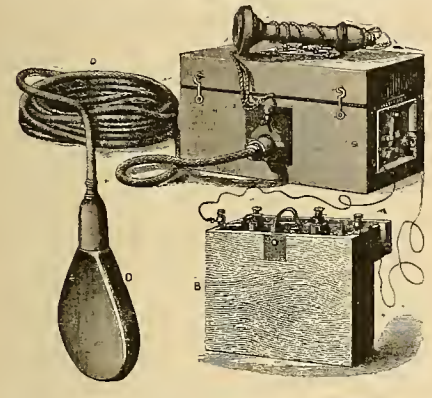


FIG. 5. UNSCIENTIFIC AND SCIENTIFIC DIVINING RODS.

had invented and perfected for photographing the faculæ and protuberances of the sun. This apparatus has successfully photographed the bright spots, showing faculæ which the eye cannot detect. Means were devised for taking on the same plate at one exposure both the faculæ and the protuberances, and Mr. Hale exhibited the first complete picture of the sun ever taken. An observation of unusual interest was made on July 15, 1892. A photograph of the sun showed a large spot. A few minutes later another photograph was taken, which when developed showed that the bright band had appeared since the last exposure. Twenty-seven minutes thereafter another photograph showed that almost the entire spot was covered with brilliant faculæ, which by the end of an hour had entirely disappeared, leaving the spot as at the first exposure. This indicates an eruption proceeding with indescribable and inconceivable velocity. This disturbance seems to be connected with magnetic disturbances and the brilliant aurora noted the next day. Mr. Hale's observatory, in which these researches and experiments were made, and the electrical equipment which he described in his paper were fully illustrated and described in the WESTERN ELECTRICIAN, June 27, 1891.

Incandescent Lamps for Mines.

Considerable attention is being drawn to the question of lighting the breast, rooms, and headings of coal mines by means of the incandescent lamps, not only on the score of a great effulgence of light, but also on account of the extra safety which is claimed on its behalf. The matter has been frequently discussed, says the *Black Diamond*, and has given rise to the suggestion that some definite test should be made to determine the exact status of the incandescent lamp in case of breakage in a mine where dangerous gases are present. Of course it is not proposed that the risk of an explosion should be invited before the subject has been solved beyond dispute, but it should be a comparatively easy matter to attain this solution in the laboratory, where every facility is at hand for the performance of such an experiment. It would be highly interesting, for if it can be shown beyond doubt that the incandescent lamp possesses attributes of a lighting agency far beyond any of the known existing lamps, its general advent in the mines throughout the length and breadth of the land will only be a matter of a short space of time. It is already being used in many expensive plants in Pennsylvania and Colorado and has given unequivocal satifaetion. So far, however, there is no record of such a lamp being broken in a gaseous mine, but it may on other grounds be conceded considerable merit, for gas that might penetrate another lamp could not penetrate the incandescent (unless it was broken) since the vacuum is a safe preventive. There is so much at stake in safety of lives and the security of property that coosiderable profit may reasonably be anticipated to accrue from such investigation.

Unscientific and Scientific Divining Rods.[1]

BY GEO. M. HOPKINS.

Notwithstanding the tendency of scientific knowledge and general enlightenment to dissipate superstition, the proportion of believers in certain kinds of demonstrations attributed to the supernatural is beyond belief; yet when we find, on investigating the subject, that many coincidences have occurred which seem to establish the claims of the advocates of such beliefs, it is no wonder that some of

Fig. 4.—MINER'S COMPASS.

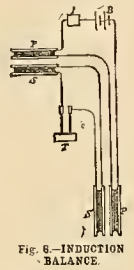


Fig. 6.—INDUCTION BALANCE.

FIGS. 4 AND 6. UNSCIENTIFIC AND SCIENTIFIC DIVINING RODS.

these notions gain credence, especially in view of the fact that the majority of unsuccessful experiments are never made known.

The divining rod—so called—is a very ancient device, but the belief in its efficiency is as strong to-day as it ever was, yet there is no scientific reason why it should be of any use whatever for any of the purposes to which it is applied. The ancient divining rod, Fig. 1, consisted of a forked twig of hazel, apple, or any fruit-bearing tree. It was held in the hands with the branches both lying normally in the same horizontal plane, with the crotch pointed either toward or away from the body of the operator. It was carried in this position over the ground, and whenever the forked twig bent downwardly it indicated proximity to water, minerals, or metals. The same performance is gone through with in these times, and we often hear of remarkable successes attained by modern operators. These successes are due partly to the good judgment of the operator, but mostly to sheer luck or chance. The dipping of the rod is not due to the action of the water or minerals, but to the voluntary or involuntary movement of the muscles of the hands and arms. If we assume that the operator is honest, we must admit the movements to be involuntary. In using the rod the hands are held in a strained, unnatural position, which renders it very difficult

FIG. 7. UNSCIENTIFIC AND SCIENTIFIC DIVINING RODS.

to hold the twig for any great length of time in the prescribed position without causing the muscles to twitch and thus compel the branch to dip.

The mineral rod illustrated in Fig. 2 is formed of a tube preferably, though not necessarily, of bamboo, with compartments at its ends. In one compartment is placed a piece of loadstone, and the other is partly filled with quicksilver. Both ends are corked and the instrument is held as shown in the cut. When the loadstone end dips it is supposed to indicate iron, but when the quicksilver dips it is taken as indication of precious metals.

Although it does not seem advisable to multiply the accounts of these unscientific and worthless instruments, still, to convey an idea of the variety of devices of this class in existence, one more example is illustrated. The instrument consists of a small bottle suspended by a string and covered with thin cloth tied around the neck of the bottle. A specimen of the metal or mineral sought for is placed in the bottle. The string by which the bottle is suspended is held by the hands as steadily as possible. The bottle first revolves in one direction and then in the other. When it stops it begins to oscillate like a pendulum. The line of vibration is supposed to point to the object sought. The operator carries the device in the direction indicated until vibration ceases; the point where this occurs is the spot where the mineral or other substance looked for is to be found. If several different substances are looked for, a sample of each must be put in the bottle.

It is needless to say that all these devices and methods are devoid of any scientific principle, and if they ever give indications that lead to a find, it is either accident or coincidence. In the case of the last instrument described, the string naturally untwists when the downward pull of the weight comes upon it, and the acquired momentum of the revolving bottle causes it to continue to revolve after the string is untwisted, and twists the string in the opposite direction. The torsion thus produced revolves the bottle in the opposite direction, and so on until equilibrium is established. This will take some time; perhaps a half hour or more. At the expiration of this time the hands of the operator are so tired as to be incapable of holding the string steadily, and as a result the oscillations follow.

As to the scientific divining rods—if such a term can be applied to scientific instruments—the simplest of these is the miner's compass, shown in Fig. 4, and familiar to most readers of this article. It is simply a magnetic compass needle arranged to swing in a vertical plane. Its pivots being jeweled, it swings freely and points to any body of iron or magnetic ore contained in the earth. It is

Fig. 1.—FORKED TWIG DIVINING ROD.

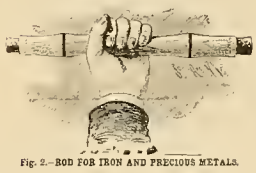


Fig. 2.—ROD FOR IRON AND PRECIOUS METALS.

Fig. 3.—GOLD FINDER.

FIGS. 1, 2 AND 3. UNSCIENTIFIC AND SCIENTIFIC DIVINING RODS.

operative for a considerable distance, and has been used for years for locating iron mines; but it is of no use whatever for other than magnetic metals or ores.

In Fig. 5 is shown an instrument devised by the writer, in which a coreless induction coil of peculiar construction is used in connection with the telephone for indicating the presence of metals. The induction coil consists of a primary coil, preferably of rectanglar form, made of coarse wire, No. 18, and connected with a rapid automatic circuit breaker and battery. The secondary coil is made of fine wire, No. 36, and is arranged exactly at right angles to the coarse wire coil. A telephone is connected with the secondary coil. If the primary circuit is continuously and rapidly interrupted while the coil is not in the vicinity of any metal or magnetic material, no sound will be heard in the telephone, as all the inductive influences are equal and opposite; but when the coil is held in proximity to a body of metal or magnetic ore, this equilibrium is disturbed and the sound is heard in the telephone.

The distance through which this instrument is operative depends upon the diameters of the coil and the strength of the current used in the primary coil. The larger the coil and the larger the current, the greater will be the penetration of the inductive effect. As the induction is effective for only a few inches in an ordinary coil of 6 or 8 inches in length, the instrument is useful for minerals lying near the surface. It may be used to advantage on the sea bottom, along cliffs, in well and borings, and upon ground abounding in metals lying near the surface, by simply causing it to pass over or near such surfaces. When it is to be used under water, it must, of course, be inclosed in a water-proof casing of non-metallic material.

This instrument, which is an induction coil pure and simple, should not be confounded with the induction balance described below.

The induction balance invented by Professor D. E. Hughes has had a number of useful applications, one of which is the electric submarine detecter of Captain McEvoy. Professor Hughes demonstrated the extraordinary sensitiveness of the apparatus to the presence of small pieces of metal when brought near to one or the other pair of coils.

The arrangement of the balance will be understood from Fig. 6, where $P\,S$ and $P^1\,S^1$ are the four coils of the balance, arranged in pairs separated from each other and connected by insulated wires. The coils, P and P^1, are joined together through a battery, B, and a key or interrupter, I, thus constituting the "primary" circuit of the balance. The coils, $S\,S^1$, are connected through a telephone T and constitute the secondary circuit of the balance. The interrupter, I, may be either manipulated by hand or automatically, so as to give a continuous action. Whenever the primary circuit is closed by its means, a current traverses the primary coils, $P\,P^1$, and induces a corresponding current in the secondary coils, $S\,S^1$. This current is, of course, audible in the telephone, T, but by reversing one of the secondary coils, say S^1, the current induced by the primary coil, P^1, in the coil, S^1, is made to oppose the current induced by the other primary coil, P,

1 From the *Scientific American*.

in the other secondary coil, S, so that it is possible to cause these two induced currents to annul one another and produce silence in the telephone.

This is done by making the two primary coils and also the two secondary coils alike in all respects, and placing the secondary, S, at the same distance from P that S^1 is from P^1. The final adjustment to produce silence in the telephone can be made by altering the distance between a secondary coil and its primary, say the distance of S from P, or it can be made by means of a small piece of metal adjusted near one pair of coils, as was originally shown by Professor Hughes. To employ this arrangement for detecting metal masses it is only necessary to obtain a sufficiently good balance in this way, and explore the field where the metal is supposed to lie by moving about the pair of coils, S^1 P^1. Then, if these coils come near a piece of metal, the inductive disturbance which its presence creates will upset the existing balance, and the telephone, before silent or nearly so, will give out distinctly audible sounds, owing to the predominance of the induced currents in the secondary S^1, over those in the secondary S.

The idea of applying the balance to the detection of metals has been worked out by Captain McEvoy, who has reduced it to a thoroughly practical form. This apparatus is illustrated in Fig. 7, where A is a portable case containing the adjustable coils, P S, and the interrupter, I; B is a voltaic battery of two cells, which may be replaced by a small magneto-electric machine giving alternating currents; T is the telephone in the secondary circuit; C is

DOUBLE POINT TACK DRIVER.

an insulated cable conveying the wires connecting up the two pair of coils; and D is the detecting or exploring case containing the two secondary coils, S^1 P^1. The coils P S, inside the box, A, are separated by a layer of soft India rubber, and an ivory screw passes through both coils and the rubber washer between. An ebonite head to the screw is adjusted by hand so as to press the coils together or let them further apart by regulating the pressure between them and the India rubber. The simple device adjusts the balance of induction and reduces the telephone to silence.

The interrupter is a special device which consists of a small iron reed or tongue kept in vibration by a small double-poled electro-magnet, thereby interrupting a current a certain number of times per second, so as to give out a definite note which is easily recognizable in the telephone.

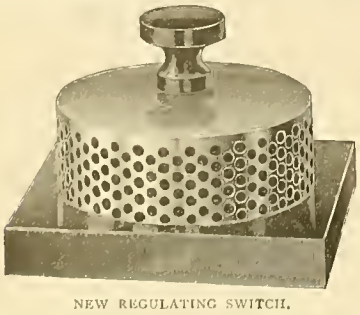
A switch, E, at the box turns the current from the battery on and off the interrupter at a moment's notice. The telephone is the ordinary speaking receiver of Bell.

The cable, C, is insulated with India rubber having its pores filled up with ozokerit or black earth wax forced in under pressure and when in a hot fluid state. It is further protected with an outer braided sheathing, and is fitted to the box, A, by an ingenious socket, which in an instant establishes connection between the corresponding primaries and secondaries, and locks them together. The detecting case, D, is made of wood soaked with paraffin wax. It is water-tight, and contains two exploring coils, S P, Fig. 6. When it is lowered into the water by the cable, C, and moved about, or dragged over the bottom, the instant it comes against a piece of metal, such as a torpedo case, a chain, or a submarine cable, it disturbs the balance, and the note, heard in the telephone very faintly until now, becomes unmistakably loud and clear. It is indeed, somewhat surprising to find so marked an effect.

If there is any objection to this instrument, it is that a body of metal lying in the plane of the coil will not affect it.

New Regulating Switch.

Very little has been accomplished in the direction of popularizing electric lights for use in the home. That the incandescent lamp is the ideal for domestic use goes without argument, but it is yet devoid of many auxiliary features. A degree of flexibility of control must be produced in order to meet the varying demands on a lamp used in the household. A step in this direction is the little regulating switch illustrated herewith.



NEW REGULATING SWITCH.

This device is neatly constructed and mounted on a polished marble base. The arrangement is such that the light can be graduated from full candle power to no light at all. In this respect it is intended to take the place of the ordinary one light switch. For many uses in the household this is an extremely convenient device. It was designed by Charles Wirt and is manufactured by the Electrical Supply company, Chicago.

Double Point Tack Driver.

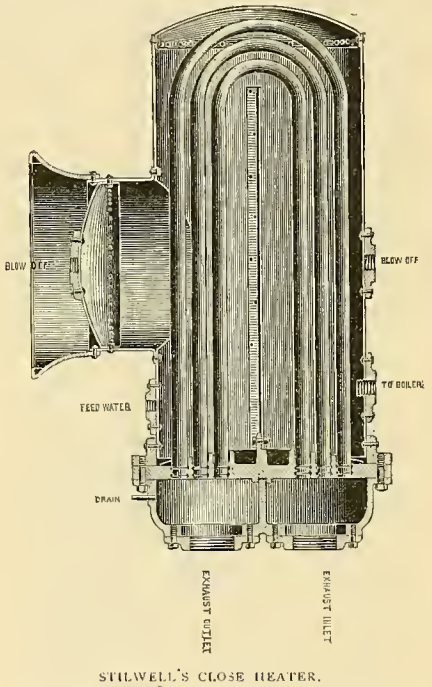
The Dandy double point tack driver, illustrated herewith, is used in driving double pointed tacks into corners and places where an ordinary hammer cannot be employed. The use of this tool greatly facilitates the wireman's work. Telephone companies and other large wiring companies where double-pointed tacks are used, find the driver very convenient. The Central Electric company, Chicago, is putting it on the market.

Stilwell's Close Heater.

For more than a quarter of a century the Stilwell & Bierce Manufacturing company of Dayton, O., has made a specialty of introducing devices for heating and purifying the feed water for steam boilers. Their latest contribution is the Stilwell patent close heater, illustrated herewith.

In this device the heating tubes are seamless brass, U-shaped, and are so fastened into the tube sheet as to be absolutely tight. The base on which the heater stands serves also as a mud well or settling chamber, for the deposit of impurities, which can readily be blown off. Deposits of impurities in this settling chamber do not diminish the heating power of the device.

The cold feed-water enters the heater near to the steam-exit end of the tubes, thus offering the most favorable conditions for extracting the most heat from the exhaust steam. The diaphram, which separates the shell into two



STILWELL'S CLOSE HEATER.

equal sections, compels the feed-water to traverse the entire length of the heating tubes, and its exit from the heater is made at a point in close proximity to the incoming exhaust steam, thus insuring the highest possible temperature of the feed-water.

The construction of the heater admits of its being taken apart if necessary for cleaning; the tubes and tube sheet can be readily removed from the shell for that purpose.

Milwaukee Street Railway Litigation.

Another phase of the long-drawn out Milwaukee Electric railway litigation has been decided. In the case of the Merchants' Exchange Bank against the Milwaukee Electric Railway company, Judge Austin, of the Superior Court, granted the request of Francis E. Hinckley of Chicago to be made defendant. The bank sought to enforce the payment of a note for $20,000. The note was made payable to the order of Charles F. Pfister, and was signed by Mr. Pfister as president of the company, and by Carl Landsee as secretary. It was dated January 15, 1892, and was to become due one day after date. The court held that under the circumstances the officer of a corporation was incompetent to enter into a contract with the company. The circumstances, the court held, appeared upon the face of the note, and the bank should have taken cognizance of them. The court intimated that it was very probable that the note was void. The plaintiff's resistance to Hinckley's motion to be allowed to be made a defendant, the court held, showed that the bank had notice before taking the note that it was given without consideration. Judge Austin said that it would be manifestly unjust not to allow the Chicago man to defend.

CORRESPONDENCE.

New York Notes.

NEW YORK, Aug. 27.—"Ho, the Noisome Trolley!" is the amusing wail of the New York *Herald* as it witnesses the advance of the electric system into the upper district of New York City. The daily press can mould public opinion to a certain extent, but now it might as well try to find out what is good in the system and stop the everlasting harping on the dangers of a system that is, practically speaking, as safe as any other that could be obtained to perform the same work. All the talk about the terrible "octopus," it seems, has gone for naught, for Mayor Grant on Friday approved the action of the Board of Aldermen giving permission to the Union Railway company (the Huckleberry) to build a number of new routes in the annexed district. This gives the company power to operate its road with any other than locomotive steam power, and it will use the trolley system. It also gives it a franchise that will soon be a very valuable one, and one for which the city will get no return until the average daily earnings for a period of six months shall be $1,700.

"The Twenty-third and Twenty-fourth wards," said the mayor, "are very much in need of increased transit facilities, and that the people are in favor of the trolley system is proved by the consents of the property owners to its use upon the railroads there. The subject of electricity as a motive power on street surface railroads was before the Board of Electrical Control some time ago. It was discussed at length, and it was decided to be advisable to permit its use in place of horses north of the Harlem river. I do not regard that action, however, as at all binding in regard to the territory south of the Harlem."

On July 5th Alderman Wand presented the Union Railway company's petition for new double-track roads to connect with the tracks already constructed and in operation. It asked for branches and extensions which are practically new lines, as follows: From Macomb's Dam bridge on Jerome avenue, along the avenue to the city line; through Morris avenue, from its intersection with Third avenue north to Fordham landing; through Willis avenue, from Harlem river to its intersection with Melrose avenue, through which the road will pass to Webster avenue, and through Webster avenue to the intersection with the Bronx river road, which it will follow to the city line; through Tremont avenue, from the city line at the Bronx river to the intersection of Tremont with Webster and Burnside avenues, thence along the latter avenue to its intersection with Sedgwick and Cedar avenues, and through Cedar avenue to its intersection with the Riverview terrace, thence through the terrace to its intersection with Sedgwick avenue, and west along Dock street, from its intersection with Riverview terrace to the tracks of the New York & Northern railroad.

Another line will begin at the intersection of Olin and Webster avenues and run along Olin avenue to the city line; another will start at Washington bridge on Boscobel avenue and extend through the avenue to Jerome avenue; another will begin at the terminus of the tracks of the Harlem bridge, Morrisania & Fordham Railway company at Fordham, and extend across the bridge of the New York & Harlem railroad to King's bridge road, and through the latter road to High Bridge road, to Bailey avenue, and to the intersection of Bailey avenue with Broadway at King's bridge; still another line will begin at Sedgwick and Jerome avenues and run through Sedgwick avenue to the city line.

On Tuesday last the Board of Aldermen granted the franchise, and Mayor Grant's approval will secure rapid transit over twenty-seven miles of streets and avenues, from the Bronx to the Harlem, and up to the city limits. The franchise was endorsed by a vote of 21 to 2. The privileges allowed are considered to be second in value only to the Broadway franchise. The provision that the road shall pay nothing to the city until its receipts average $1,700 a day, it is thought, will exempt it from expense for ten years.

About $2,000 was realized from the sale of the remains of the plant of the old Julien Electric Traction company. The stuff was auctioned off on Monday at the New York real estate exchange and auction salesroom by Richard V. Harnett. The auctioneer acted for the Mercantile Trust company, which recently foreclosed the mortgage on the stock and fixtures of the company. The sixteen cars and trucks were sold for $500, and the remaining $1,500 came from the sale of the electric plant at Eighty-fifth street and Madison avenue, and office furniture. The

Storage Battery Supply company bought most of the stock for junk.

The troubles of the Brooklyn railway men, it seems, did not end with the securing of the right to string overhead wires. History repeats itself, so the Brooklyn roads are now wrestling with the telephone men. There is the same plaintive cry from the telephone company, and the same "Let them get metallic circuits, then they won't be troubled by our wires," from the railway companies. It looks as though the "dear" telephone subscriber will come in for his share later on.

There is a squabble on, too, between the railway people and the municipal authorities. Up to the present time the trolley companies have been amenable to no one, and have strung their wires where and when they saw fit. Now the new Subway commissioners, Frederick R. Lee and Prof. George W. Plympton, have taken the matter up and have insisted upon exercising the same control over the trolley wires as they do over the telegraph, telephone and electric light and power wires. The law creating these commissioners has caused them to be known technically as Subway commissioners, and their chief business is to see that electric wires in all parts of the city are buried or placed in suitable subways, but they also claim that that work cannot be properly accomplished unless they have control over the wires while they are still above ground. They claim the right to permit or prohibit the stringing of additional wires on any certain street, and especially along thoroughfares in which subway conduits have been or are about to be constructed. When, however, they attempted to exercise that power in regard to the trolley roads they were repulsed and politely told to go about their business. They have referred the legal side of the question to Corporation Counsel Jenks, and he has decided, after a careful study of the subway law, that all electric wires within the city limits are subject to the supervision of this commission. The probabilities are that the matter will have to be settled in the courts.

After the period of nearly six months of depression, during which the board of managers have succeeded in liquidating the greater portion of the indebtedness of the New York Electric club, it is a pleasure to notify the members that the restaurant and other full service of the club will be resumed on September 1st.

W. F. O.

New England News.

BOSTON, Aug. 26.—The work of putting the Boston fire alarm wires under ground is now well in hand. The first connections made will be with fourteen of the most important boxes in the business section of the city. It is expected that these will be in working order by the first of September. The system will run from the City Hall to Northampton street, and the conduits of the New England Telephone company will be used. There will be about 183 miles of wires. The Charlestown, East Boston, the Roxbury, Dorchester and Brighton lines will not be buried, but will enter the cable conduit at the bridges.

Mr. Flanders, inspector of wires, hopes to operate the fire alarm system by an electric current from a dynamo instead of primary batteries. Thus far his experiments appear to have been successful, and he believes it will not only make the system more efficient, but will save a great deal of work at the headquarters also. Mr. Flanders says he can take current from the Edison station or from the West End company's dynamos.

A citizen of Lynn, Mass., recently deceased, feeling that the city containing such extensive electrical manufactures should present to public view some unique and handsome electrical feature, left $2,500 to be devoted to the erection of an electrical fountain in some central spot. The plan has been made. It provides for a fountain with a convex mirror basin 25 feet in diameter. The water will spray from a two-inch pipe, and, descending, will fall through iridescent rays produced by prisms surrounding a 4000 candle power electric light. The city council favors the plan and the fountain will probably be placed in front of the City Hall.

The Inter-State electric railroad connecting Attleboro, Mass., with Pawtucket, R. I., has been formally opened for travel. The first car was run over about a mile of the road and contained Electrician Tregoind and other officials of the road and a number of men who, fifty years ago, used to walk over the line of the present road daily.

The Worcester, Mass., *Gazette* published a statement that the New York, New Haven & Hartford railroad is making arrangements to operate its lines by electricity. Lucius Tuttle, vice-president and general manager of the road, denied the statement and stamped it as ridiculous, saying: "It's nothing but romance, pure and simple romance, without the slightest ground for truth!" In its answer to this denial the *Gazette* reiterates its first statement and says "Perhaps Mr. Tuttle is not in the secret. It is not generally known on the road. Our information comes from a somewhat more prominent official than Mr. Tuttle. Unless our informant has gone suddenly insane—and we have his statement in writing—our assertions about the N. Y., N. H. & H. were literally and absolutely correct. Of course the change is not going instantly into operation." This statement seems to be backed by official authority, but if Mr. Tuttle is, as he says, ignorant of what is contemplated, it would seem to be peculiar railroad management that would keep general managers in the dark concerning as important a move as this. However this may be, it is a fact that the road is constructing a four-track line, and the two central tracks are the ones on which it is said electricity is to be the motive power. These are to carry the passenger and freight cars over that portion of the line between New Haven and New York, a distance of 74 miles. When the plant is ready this distance is to be covered in one hour. It is probable that a light locomotive will be used and that the power will be taken from an overhead wire. These central tracks will be fenced in and there will be no grade crossings. The arrangements at stations will be similar to those of the New York elevated roads. A passenger cannot cross the tracks except by a tunnel or bridge. Concerning this scheme O. T. Crosby, general manager of the railroading department of the Thomson-Houston Electric company, says: "I think it is perfectly practicable. The practicability of a speed of 115 miles an hour has been demonstrated, the trolley system being used. There might be some trouble with the ordinary flexible trolley But on a railroad of this sort there would be no passing except by the cars, and the trolley line might be put in any convenient position and be made perfectly rigid. The trolley wheel might require changing for such high speed, but this could easily be done, or there might be no wheel at all, simply the contact of a brush with the wire or a substitute of more rigid resistance. The friction caused would not be material. The first expense would, of course, be in excess of that required for steam equipment, but the running expenses would be considerably less, which would make up for the extra first cost of power stations."

The electric street car system is gaining ground fast in New England this summer, and especially in Connecticut. At Norwich electricity is the only motive power used. The New Britain city council is about to be petitioned to allow the use of electricity on the "bob tail" cars now running. It is also proposed to extend the line to Plainville, following the general line of the New York & New England railroad. At New Haven electric cars have been put on the line to West Haven and Savin Rock. A syndicate has been formed to build an electric road from the Savin Rock terminal of the New Haven & West Haven road westward to the Woodmont station on the Consolidated road and thence to Merwin Point. The New Haven Street Railway company is to build a large power house which will be one of the finest in the state. The Fairhaven & Norris Cove railway is reported to have closed a contract for the equipment of its three miles of road with electricity. Bridgeport people are clamoring for the swift substitute for the creeping horse cars, and a petition is being largely signed in Waterbury.

The new Boston third district station of the Edison Illuminating company will soon be in operation. In it there is a temporary plant of eight 1,000 light machines feeding into the regular mains. The permanent plant will consist of 650 and 1,500 horse power vertical engines.

The Worcester, Mass., Electric Light company has contracted with the Westinghouse company for a 250 horse power generator.

The Natick & Cochituate Street Railway company has finished equipping its line with electricity and has resumed business.

Wm. H. Aikins, superintendent of the Boston Edison Illuminating company, is spending his vacation at Old Orchard Beach.

The Wakefield Street Railway company is putting electricity in operation on 2½ miles of its road.

An order for 30 search lights to cost $3,000 each has been given the Schuyler Electric company of Middletown, Conn., by the government.

The Norwich, Conn., croquet club is to light its grounds by electricity so games can be played at night.

One of the results of the granite workers' strike in New England has been the invention of an electric granite polisher.

The Worcester Consolidated Street Railway company has recently added to its electric power plant a generator of 500 volts with a horse power of 250 and capacity of 450 amperes.

Rockville, Conn., has voted to discontinue the use of electricity for street lighting on account of the local company's advancing rates from $75 to $80 per year per lamp.

If the new management of the Union Street Railway of New Bedford can secure permission from the board of public works the road will be converted to an electric line.

Manchester, N. H., is to be connected with Lake Massabesic by an electric road four miles in length.

Stoughton, Mass., has voted to buy and maintain an electric light plant.

Lawrence, Mass., is following Boston's example and placing its fire alarm wires under ground.

The Holbrook, Mass., commercial club has appointed a committee to make arrangements with the Holbrook Light & Power company to light the streets of that town.

An effort is being made to organize the electrical workers of Boston and vicinity under the auspices of the National Brotherhood of Electrical Workers of America.

So many new electric roads have been started this season in the country districts of New England that great trouble is being experienced in keeping the tracks clear of the grass and weeds which grow around the rails. In a few cases an effective mode of clearing the rails of this nuisance has been put in operation. This is called an electrical vegetable destroyer. It consists of a wire brush which is like an ordinary scrubbing brush in appearance. It is connected by wire with the nearest dynamo, and when a powerful current is turned on the grass is killed by simply dragging the brush over it. Some of the steam railroads are also using this device.

A new cable has been put in connecting Fisher's Island with New London, Conn. It is much stronger than the old one, weighs three pounds to the foot and consists of six insulated copper wires. It is about three miles long, weighs 26 tons and cost $5,000.

J. C. E

Milwaukee. Wis.

MILWAUKEE, August 27.—In the case of George Hiles against the Milwaukee Light & Power company, Judge Ludwig of the Superior Court has granted a judgment of foreclosure. Mr. Hiles, it will be remembered, loaned the company $25,000, secured by a mortgage on the plant. The mortgage, not being paid when due, he instituted proceedings for the appointment of a receiver and the foreclosure of the mortgage.

The Pabst Brewing company has taken out a building permit for the first two stories of its power house on Broadway. The two stories and basement will cost $25,000. The ground dimensions will be 59 by 121 feet. The basement walls will be 30 inches thick, and the walls of the first two stories 21 inches thick. The first floor will sustain a weight of 1,000 pounds to the square foot. When completed the building will be six stories high, the upper floors to be connected with, and be a part of, the Pabst Hotel.

A few days ago a delegation of Oshkosh aldermen and the mayor of that city visited Milwaukee to inspect its electric street railways. Mr. Payne of the Villard syndicate, placed the palace car at the disposal of the visitors, and Manager Lynn and Chief Engineer Bentzen took them over the lines. The Oshkosh Street railway has recently been purchased by E. R. Gilman & Co. of Chicago, who will convert it into an electric system.

The Chicago & Milwaukee Telegraph company will soon complete the work of putting its wires underground, in accordance with a recent order from the common council.

The Milwaukee Street Railway company has been enjoined by the Fond du Lac Plank Road company from proceeding with the work of building a line on Fond du Lac avenue beyond Twenty-seventh street. Beyond that point the plank road company claims the road is its private property. Pending the litigation, the railway people will complete the rest of the Fond du Lac avenue line.

The Villard syndicate's Sixth Avenue line has been opened for traffic. It runs from Greenfield avenue on Sixth avenue to Windlake avenue, and thence to Grant street. It is a part of the Third Street Greenfield avenue line, on which cars will be run five minutes apart, alternating on Sixth and Greenfield avenues.

Work has been commenced on the extension of the National avenue line. Before the state fair opens it will be built to the west line of section 35, from which point 'busses will convey passengers to the fair grounds. The company is doing work on Brady and Michigan streets and several other places.

The building of an electric railway on the Janesville plank road is being agitated. Most of the abutting property owners, it is understood, favor the project.

Already the suburb of Wauwatosa is connected with

the city by an electric line, a dummy line, and the St. Paul railway, and yet there is talk of another electric road. People residing in the Menominee valley have called upon Mr. Payne and urged him to extend the Chestnut street line along the valley, which is rapidly filling up with manufacturing plants. Mr. Payne promised to consider the matter. It is not improbable that the road will be built next year.

The Milwaukee & Wauwatosa Rapid Transit company, which operates an electric line, will double track its road before winter sets in. The company carries about 1,500 passengers a day. The line is now operated with power furnished by the new plant at Wauwatosa.

The Racine common council has decided to allow the street railway company to lay T rails on certain streets, providing the company keeps the pavement between and along the tracks in repair. The company has been required to give a bond in the sum of $5,000.

The largest clock in Milwaukee will be located in the tower of the new Pabst block. There will be four dials each 11 feet and 8 inches in diameter, and they will be illuminated at night by electricity.

Willis L. Moore, the Milwaukee weather forecast official, has just sued the West Side Street Railway company to secure $500 damages. He claims that during May last he was driving on Wisconsin street, when one of the company's electric cars ran into his buggy. The vehicle was overturned and the horse was injured so badly that Mr. Moore has not been able to use him since.

What is said to be the largest contract for stationary engines ever awarded has just been received by the Edward P. Allis company of Milwaukee. The other party to the contract is the Brooklyn Electric Railway company. The contract is for the building of fourteen engines, aggregating 20,000 horse power, and the cost of the work will reach half a million. The contract was awarded on Friday, August 19th, but the fact has been kept quiet until within a few days.

The contract calls for the construction of six 2,000 and eight 1,000 horse power compound engines.

About all of the establishments in the country capable of building such large engines competed for the Brooklyn job. The largest contract of the kind ever made before, it is said, was one for engines of 10,000 horse power, in the aggregate, let by a London corporation, which afterwards bought a plant of 10,000 horse power, making a total of 20,000 horse power in two contracts.

Under a separate contract with the General Electric company, of Boston, which will supply the electrical apparatus for the Brooklyn railway, the Edward P. Allis company will supply the castings for the dynamos. The contract for the engines amounts to $440,000 and the contract for the castings between $80,000 and $90,000, so that the work that the company will do for the Brooklyn railway will amount to something more than $520,000,

Since May, when the annual report was rendered, the condition of the Northern American company, which has invested very heavily in electrical enterprises in Milwaukee, is said to have greatly improved. The result is due to the enhanced market value of the company's securities, and to the rapid development of its enterprises. The Milwaukee street railway lines, which are being pushed to completion, are showing most satisfactory results, although they will not be completed until 1893. The Cincinnati electric lighting and power plant is practically completed, and its business is steadily growing. The first section of Cincinnati's street lighting, under the company's eleven years' contract, will be in operation during the autumn, and the suburban lighting system will be ready in the near future. They will materially increase the company's revenues.

Recently the Wisconsin Telephone company has been greatly bothered by its wires coming in contact with trolley wires. The current from the electric railways, of course, knocks down all of the numbers, and they sometimes remain down fifteen or twenty minutes. Not long ago, eighty drops, costing $2.50 each, burned out at one time in the telephone exchange.

C.

Appleton, Wis.

APPLETON, Aug. 27.—The Edison Electric company has completed the work of relaying its entire track of three and one-half miles with a 38 pound T rail. The road is now in fine condition.

By October 1st the streets of Appleton will be as well illuminated as those of any city in the country. The local company is busily engaged in installing the sixty-five 1,500 candle power arc lights, which, with the forty already in use, will make a total of one hundred and five 1,500 candle power lamps.

Lightning entered into the power-house of the Street Railway company yesterday doing considerable damage to a 100 kilowatt armature. A. W.

Kansas City, Mo.

KANSAS CITY, Aug. 27.—The ordinance to grant the West Side Street Railway company a franchise for an electric railway on Wyandotte street from Second street to Twenty ninth street, on Twenty-ninth street from Wyandotte street to Central street and on Central street from Twenty-ninth street to Thirty-first street, has been referred to the public improvements committee. The road is to be equipped by the Thomson-Houston company if the franchise is granted. It is proposed to connect it at Thirty-first street and Central street with a line to run several miles south through the town of Westport.

The Kansas City Electric Light company has not yet complied with the ordinance passed recently directing it to suspend all the arc lamps furnished the city for street lighting, from 12 foot mast arms.

The Kansas City Elevated Railway company has absorbed the Inter-state Consolidated Rapid Transit Railway company and is equipping the line with electricity. A contract has been made for 6000 pound McGuire trucks for the cars.

The bond given by the contractor superintending the conversion of the "L" road into an electric line contains a clause in which the contractor agrees to have the electric line in readiness for use on or before September 15th. The heaviest work of the transformation has already been completed.

The stock holders of the new company have just elected the following officers: President, Joshua Wilbourn, Providence, R. I., vice president, D. D. Hoag, Kansas City, Kas; treasurer, A. H. Califf, New York.

D. D. Hoag has also been made secretary of the company to serve for the present. The directors chosen are: Joshua Wilbourn, Providence, R. I.; J. C. Ten Eck and A. H. Califf, New York; Frank Semple, Pittsburg, O. H. Dean, Robert Gilham and S. L. Conklin, Kansas City, Mo.; D. E. Cornell, Silas Porter and D. D. Hoag of Kansas City, Kas.

The council of Kansas City has just instructed the city counselor to bring action in the circuit court to revoke the franchise of the East Fifth Street Railway company, on Fifth street from Walnut street to Lydia avenue, Lydia avenue from Fifth street to Guinotte avenue, Guinotte avenue from Lydia avenue to the eastern city limits, a distance of about five miles. The road has not been operated since January 1st.

Thomas Wolfe has submitted a proposition to the council of Kansas City, Kas., to light the streets free of charge for twenty years, if the city will give him an exclusive franchise for an electric light plant. The Fort Wayne Electric company has submitted a proposition also and there is a big fight in the council. The city spends $20,000 a year at present for street lighting. T.

St. Louis, Mo.

ST. LOUIS, August 26.—The Board of Public Improvements has refused permission to the St. Louis Electric Light & Power company and the Bell Telephone company to erect additional pole lines on Olive street, on the ground that the adjacent alleys would answer every purpose.

The Forest Park & Clayton Electric Railway company has begun work on its roadbed, the contract for construction having been placed with the Fruin-Bambrick Construction company of St. Louis, which has agreed to finish the work by Nov. 1. No steam or electric apparatus or construction have yet been provided for.

In its issue of Sunday, 21st inst., the *Globe-Democrat* published a brief but complete resume of the progress of electricity. The article is two columns long, and begins with the discovery of the electrical properties of amber by Thales, 600 B. C, and ends with 1892, at which date it notes the investment of $700,000,000 in electrical industries in this country alone.

W. L. Arnold of the General Electric company has just returned from a trip in Southern Illinois. While away he contracted with the newly organized Pinckneyville Electric Light company, Pinckneyville, Ill., for its complete electrical equipment.

The Wagner Electric company has been reorganized, and the capital stock increased to $100,000. The company has heretofore been manufacturing a line of electrical specialties on Olive street, near Nineteenth. The works have just been removed to 2017 Lucas place, where they occupy a large new building.

H. H. Humphrey, manager of the St. Louis office of the General Electric company, reports an increase in business, both in apparatus and in light and railway supplies. Two incandescent machines, each having a capacity of 540 lights, have been sold for the new "Arlington" hotel at Hot Springs, Ark. Another important order was for 9,000 rubber weather-proof sockets for use on the Fall illumination work, on the many ornamental panoramas to be displayed on the streets.

The Emerson Electrical Manufacturing company has just finished work on the many electrical devices to be used in connection with the Fall illumination. Many new and ingenious pieces of apparatus have been designed and manufactured for this occasion.

Hon F. G. Niedinghaus of St. Louis has made an application to the village board of Madison, Ill., for a franchise to build and operate an electric light and electric railway system, to connect his new town Granite City with Madison, and across the Merchants' Bridge to St. Louis.

W. B. McKinley of the Union Manufacturing company, Champaign, Ill., secretary of the local electric light and power company, and of the Champaign & Urbana Electric Street railway, has interested himself at Springfield, O., in street railways and will change their motive power to electricity.

Alex. E. Abend, civil engineer of East St. Louis, has begun surveys of the motor line and Second street horse-car line at Alton, Ill. These companies have decided to adopt electricity and will put down new rails at once, O. W. Meysenberg & Co. of St. Louis having the contract. Both lines will use the same loop at the central terminus east of the court-house. B.

PERSONAL.

The sympathy of the electrical fraternity is extended to H. P. Lucas of Chicago, who recently suffered the loss of a child.

C. A. Daigh, of the National Electric Manufacturing company, Eau Claire, Wis., was in Chicago for several days last week.

F. A. Pamperin of the Electrical Manufacturing company, Oconto, Wis., and A. A. Forman, manager of the Electric Light company at Iron Mountain, visited Chicago in company last week, and while here each received a telegram on the same day saying that a son and heir had been born to him. Congratulations are in order.

John K. Dunbar, general superintendent of the Southwestern Telegraph & Telephone company, died recently at Buffalo Lythia Springs, Va. He had not been strong physically for many years and his death was indirectly caused by the grip, of which he had several very serious attacks. Mr. Dunbar was born in Clinton, La. He was for a few years in the employ of the Western Union company at San Antonio, Tex. He organized the telephone business in San Antonio and from the management of that exchange was promoted to the general superintendency of the company in 1883. Mr. Dunbar was known by many people in Arkansas and Texas and was universally respected. A typical southern gentlemen, honest, brave and true, his death in the prime of life causes deep sorrow to hundreds of his friends and acquaintances in the southwest. A wife and two daughters survive him.

NEW INCORPORATIONS.

Everett Electric Brick company, Everett, Wash.; capital stock, $20,000; to generate electric light and power; F. O. Coe, Everett, Wash.

Albia Electric Light & Power company, Albia, Ia.; capital stock, $30,000; to purchase, own and operate electric light and power plants; J. C. Marry, Albia, Ia.

Dahl Electric company, Jersey City, N. J.; capital stock $500,000; to manufacture and deal in motors, dynamos and other electrical apparatus; Collins & Corbin, Jersey City, N. J.

Southwest Missouri Electric Railway company, Carterville, Mo.; capital stock, $500,000; to build and operate street and suburban railways in Jasper county; J. M. Maret, Webb City, Mo.

Columbian Electric Perambulator company, Chicago, Ill.; capital stock, $1,000,000; to manufacture, buy and sell electrically propelled vehicles, etc.; Francis W. Parker, 1007 Opera House Building, Chicago, Ill.

Toledo Electric Heating company, Toledo, O.; capital stock, $100,000; manufacturing, selling, and leasing electric heating apparatus and machinery; William Webster, Toledo, O.

Natural Liquid Purifying company, Hamilton, O.; capital stock, $25,000; purifying or improving the quality of spirituous liquors or other liquids by refrigeration, electricity, etc.; Robt. S. Carr, Hamilton, O.

Hopatcong Hotel company, Mount Arlington, N. J.; capital stock, $135,000; to construct, maintain and operate gas works, water and electric light works, etc.; Clark & Culver, 80 Broadway, New York, N. Y.

McKechney Milling company, Deer Lodge, Mont.; capital stock, $300,000; manufacturing, mining, mechanical and chemical business, treating ores, maintaining and operating electric power plants, for supplying electricity

to cities, towns, or private persons to build, maintain and operate telegraph and telephone lines.

Gerard Electrical Supply company (incorporated in W. Va.), Philadelphia, Pa ; capital stock, $250,000; manufacturing and dealing in all kinds of electrical devices; D. M. Lowrey, 5th and Chestnut streets, Philadelphia, Pa.

North Shore Contracting company, Chicago, Ill.; capital stock, $50,000; to build railways, water works, gas works, electric lights, and all kinds of public works, C. E. Simmons, C. & N. W. Ry. Land Depot, Chicago, Ill.

New England Power company, Newark, N. J.; capital stock, $100,000; to produce and furnish compressed air, heat, power and electricity for all domestic and other purposes, etc.; Parrish & Pendleton, 44 Broadway, New York, N. Y.

Heppner Light & Water company, Heppner, Ore.; capital stock, $40,000; to construct and equip, maintain and operate an electric light and water plant in the town and environs of Heppner, Oregon; James D. Hamilton, Heppner, Oregon.

Buffalo General Electric company, Buffalo, N. Y.; capital stock, $1,900,000; consolidation of the Brush Electric Light company of Buffalo and the Thomson-Houston Electric Light & Power company of Buffalo, under the Buffalo General Electric company.

ELECTRIC LIGHTING.

Salina, Kan., is putting in a new electric light plant.

The ferry steamer Oakland at Oakland, Cal., will be illuminated by 180 incandescent lamps.

Chadron, Neb., last week had a public celebration over the opening of the electric lighting station.

The Tacoma, Wash., Light & Water company has agreed to sell its plant to the city for $21,000.

An effort is being made to organize an electric light company in Henniker, N. H., with a capital of $3,500.

The trustees of the village of Greenbush, N, Y., have awarded a five-year contract to the East Albany Gas Light company for 200 25 candle power incandescent lamps for street lighting.

The city council of Youngstown, O., has passed an ordinance requiring the Lake Shore & Michigan Southern Railroad company to place arc lamps at all street crossings of its line within the city limits.

Luverne, Minn., has completed arrangements for electric lights. The contract has been let to the Western Electric company, and the plant is to be completed by September 15th. The cost will be about $6,500.

The stockholders of the Merchants' Electric Light company of Leavenworth, Kas., have elected the following directors: Frank O'Donnell, Henry Ettenson, Herman Burns, R. Sprioge, J. E. H. Weigant, Ed. Crancer and Henry Brenggan.

Ground has been broken for the new electric power house north of the water tower at Pullman. The basement will be equipped with about fifteen Wood dynamos driven by separate engines. The upper floor will be used by the electrical department. It is reported that a large portion of the town will be lighted by the plant.

Sealed proposals will be received at the office of the Board of Public Works up to noon of Friday, September 9th, for the furnishing to the city of Seattle, Wash., an electric light plant for lighting the streets, public buildings and grounds of the city, including engines and other apparatus, together with all labor and cost of construction for the plant installed, complete, with all the latest devices.

The Longmont light plant has been purchased by a new company, composed entirely of Longmont, Colo., citizens. The new company consists of D. C. Donovan, W. B. Wiswall, J. H. Jones, F. H. Stickney and J. W. Turrell; the first three being respectively president, secretary and treasurer. The new company will at once make some needed improvements which will be fully appreciated by its patrons.

Superintendent J. G. Magnier of the Columbus, O., Electric Light company was before the Board of Public Works last week to answer complaints against the service. Many things, he said, were prejudicial to the proper working of the lights. The sparrows were largely responsible, building nests in the globes or above them, between morning and evening; boys throwing stones or shooting at the lights had greatly injured the service.

The people of Santa Cruz are just beginning to realize the value of the water power now wasted in their mountains. They propose to utilize the San Lorenzo river to supply their cities and towns with electricity. The development of industry founded on the combination of water power and electricity is only just beginning in California, but it has a most important future, because it will supply cheap power where manufacturing is now handicapped by the high cost of fuel.

The failure on the part of the Board of Aldermen to pass the Assembly resolution providing an appropriation of $5,000 for the illumination of the streets of St. Paul during the State fair, is being adversely commented upon, according to the local press. President Burwell of the Minnesota Agricultural Society said that thousands of people, attracted by the fair, were in turn attracted to the city by the street illuminations. The jobbers' union had appropriated a considerable sum of money for masquerades, carnivals and various other events of the evenings' amusement of the people, but, without the illuminations, these would have to be dropped. There had never been any objection by citizens to the appropriation of money for illuminating the streets, and, from a business point of view, the failure to have the illumination this year would be suicidal.

The Madison, Wis., Electric company, composed of local capitalists, has disposed of its plant, franchises, etc , to the Four Lakes Light, Power & Heating company for $51,000, and the purchaser will hereafter control the electrical business in Madison. The new company will ask a franchise of the common council at its next meeting, as it thinks the franchise of the old company is not complete in every particular. The company will expend $60,000 in enlarging and improving the plant, introducing new generators and overhauling pole lines, etc. The new concern hopes to furnish considerable current for manufacturing purposes.

ELECTRIC RAILWAYS.

A new electric street railway is to be built at Seattle, Wash.

An electric road is projected from Plainfield, Ind., to Indianapolis.

An extension of the Cairo, Ill., Electric Street railway is under consideration.

Streets are being graded at Ottumwa, Ia., preparatory to building an electric railway.

Harper & Co. have been granted the franchise to build an electric road from Cleveland to Gambier.

The Delta Electric company has petitioned the Cairo, Ill , council for a franchise to operate an electric road.

Work has been commenced on the Marshalltown, Ia., street railway, which is to be operated by electricity.

The Consolidated Street Railway company will extend its road on Elberon avenue, Cincinnati, at an early day.

An electric railway fourteen miles in length and extending between Atlanta, Ga., and Stone Mountain is contemplated.

Martins Ferry, O., will have quite an extensive electric railway system. The local company is planning to extend its lines.

The Youngstown, O., Electric Railway company has been granted permission to extend its Fruit street line, the work to be completed by Oct. 1.

The Decatur, Ill., City Electric Railway company has been granted a twenty year franchise and will construct and operate an electric railway.

F. A Burdick of Aberdeen, S. D., has been organizing a company to build and operate an electric railway between Deadwood, Lead City, Terraville and other points in the Black Hills.

Work has been begun by the Marshalltown Light, Power & Railway company, Marshalltown, Ia., on a three-mile electric railway to take the place of the old mule line. The new company also operates the gas and electric light works, and will at once build a new power house for the light and railway plants with a capacity of 400 horse-power. Wm H. Bryan of St. Louis is engineer in charge of the work.

According to the Cincinnati, O., *Commercial Gazette*, it has been decided to establish a belt electric line in that city extending from the Bellevue house, by way of Elm street, Eastern avenue and intervening thoroughfares, to Columbia, thence to Mt. Lookout and the observatory; from there over Observatory avenue and Erie avenue to the Hyde Park and Madison road line, and so to Walnut Hills, and by the cross-hill route to McMillan, Ohio avenue and the Bellevue house again.

The city council of Oakland, Cal., has under consideration an ordinance providing for the substitution of electric power for horses or mules in running street cars on Park avenue from the crossing of the tracks of the Central Pacific railroad to the southern boundary of the city of Oakland, under a franchise granted to Theodore Meetz by the city of Oakland Dec. 17, 1888. Another measure before the same body is an ordinance substituting electric power for horses or mules in running street cars on Webster street, Water street and Broadway street, under a franchise granted the Alameda, Oakland & Piedmont Rail road company, by the city of Oakland, which was passed over the veto of the mayor Oct. 18, 1886.

The Tiffin & Fostoria Electric Railway company was incorporated last week with a capital stock of $175,000. There are twelve incorporators, including Hon. Charles Foster, Andrew Emerine, R. Crocker and Ira Cadwallader, of Fostoria, and Hon. George E. Seney, John McCauley, J. A. Beatty and R. W. Brown, the promoter, of Tiffin. The road will be built as soon as the franchises are secured. It will be 13½ miles in length, and will cost about $150,000. The cars will stop on signal at any point, and graded fares will be charged. It is the intention of the management to run a car between the cities every hour, beginning at 5 o'clock in the morning and stopping at midnight. The track will be built alongside the public highway, and a series of parks will be established at different points along the route.

William M. Harriman, Nicholas Fish and Oliver Harriman, Jr., composing the firm of Harriman & Co., and Isaac B. Newcombe and Camille Weidenfeld, composing the firm of I. B. Newcombe & Co , all of New York city, filed a petition in the Buchanan county circuit court, St. Joseph, Mo., Aug. 26th, against the People's Street Railway Electric, Light & Power company asking that a receiver be appointed to take charge of the entire electric street car system and illuminating plant of the city. The capital stock of the street car company is $800,000, and its bonded indebtedness is the same. The deficit in operating expenses during the last year was $2,596, and there is no money in the treasury to pay interest accruing on bonds due Oct. 1, 1892. The rolling stock and tracks are in poor condition and will require the expenditure of $100,000 to put them in shape. This amount the eastern stockholders will put up if the management is taken out of the hands of those at present in power and a receiver appointed to their liking.

TELEPHONE.

The Galena, Ill., exchange of the Central Telephone company will be removed to its new quarters about the middle of September. The new exchange will be thoroughly equipped with the most approved apparatus, and other improvements in the service are contemplated.

F. A. Forbes, general superintendent of the Michigan Bell Telephone company, has replied to a communication petitioning for a telephone connecting between Grand Rapids and Cadillac, in which he says the company "would be willing to look the ground over with a view of building a line this fall or early next spring."

An injunction has been granted by Judge Dennis in the circuit court, Baltimore, restraining the Chesapeake and Potomac Telephone company from removing the telephone of one of the company's subscribers. The proceeding is based upon the telephone law passed by the last legislature. The subscriber alleges in his bill that he is desirous of continuing the use of the telephone, and tendered the company one quarter's rent, at the rate of $78 a year, authorized by the telephone law. The company refused to accept the rental offered or to make a contract in accordance with the act of the legislature and has notified the subscriber that his telephone service will be discontinued and his telephone removed. The injunction restrains the company from removing the telephone or in any manner interfering with or obstructing the subscriber's use of the service.

MISCELLANEOUS.

The residents of Oakland avenue who live in the vicinity of the electric light tower, says the Omaha *Bee*, have had a good deal of curiosity aroused by an immense flock of birds that gathers every evening about an hour before sundown on the top of the tower, and stays until the lamps are lighted. When the current is turned on large numbers of them are instantly killed, and the rest immediately fly away to return the next afternoon.

The Edison General Electric company has begun an action against F. J. McCullough, J. P. Van Patten, J. B. Fidlar, Frances W. French, N. Kuhnen, Jr , J. N. Van Patten, Josephine McCullough, O. S. McNeil and W. J. McCullough, stockholders of the Davenport, Ia., Electric Railway, Light & Power company to recover a judgment of $3,579.07 against the company, each defendant being sued for a certain amount alleged to be unpaid for shares held at the time the judgment was rendered.

TRADE NEWS.

The National Electric Manufacturing company of Eau Claire, Wis., has opened an office at room 608 Pullman building, Chicago, with Paul Bossart in charge.

The new official reference book recently issued by the New England Electric club will be found very handy, as it contains a complete list of members and other information of interest.

The "Niagara" motor is one of the latest to enter the field, and a line to the Lovell Manufacturing company, limited, Erie, Pa., will bring a neat little catalogue describing the compact little machine's fine points.

The Electrician Publishing company, 6 Lakeside building, Chicago, has recently issued a most complete catalogue of all books published to date on electrical subjects. This catalogue will be sent free to any address.

The Buckeye Electric company finds it necessary to increase its factory force to keep pace with increasing business. The sales from the Chicago office of this company are increasing rapidly, and the outlook for a heavy western trade is most promising.

The Western Electric company, Chicago, has just issued a handsome catalogue descriptive of its most improved electric arc lighting apparatus. The Western Electric high and low tension systems are referred to as well as the company's incandescent system.

J. C. Knight, of the Electric Construction & Supply company, New York, returned last week from Richmond, Va., bringing with him an order from the Richmond Manchester railroad for fifty street railroad lamps. This company received last week another order for Ward arc lamps for use at the Mechanics' Fair building, in Boston. There are now 218 of these lamps in use in this building.

The Babcock & Wilcox company of New York received last week from the Brooklyn City Railroad company, through President Lewis, a contract to furnish twenty boilers for the eastern district trolley plant. This is said to be the largest contract of the kind ever given out from Brooklyn, the amount being $200,000. It is also stated that this company has purchased about $300,000 worth of engines from the Allis company of Milwaukee.

The New England agent for the Eddy Electric Manufacturing company, E. A. Gilbert, reports large sales of dynamos and motors. Among the many sales may be men-

tioned a 400 light dynamo for use in the Old Provincial gold mines in Nova Scotia; a 750 light dynamo to the Holtzer-Cabot company for a Washington firm; a 30 horse power motor and a 300 light dynamo for the new Lyceum theatre in Boston and a 300 ampere generator for the American Lead company, of Salem, Mass.

The Standard Paint company, of New York, is well to the front in the work at the World's Fair grounds, for the pipes now being laid by the Waukesha Hygeia Mineral Springs company, manufactured by the National Tube company, of McKeesport, Pa., will be coated both inside and out with its No. 1 P. & B. pipe coating compound. The Standard company is also supplying all the insulating paper to be used for protecting the Cold Storage building now being erected by the Hercules Iron works, of Chicago. All of the iron pipes, etc., in this building will be painted with P. & B. paint.

The Carpenter Enamel Rheostat company now has its works at Bridgeport, Conn., in operation. Although the works have only been in operation a short time, orders have already been received from over fifty concerns, one order alone being for one thousand rheostats. The capital stock of the company is $100,000, fully paid. The officers of the company are H. Ward Leonard, president; George H. Finn, vice-president; Charles E. Carpenter, secretary and treasurer. Several New York gentlemen are financially interested. A progressive business policy has been adopted by the concern.

Queen & Co., Philadelphia, have laid in a big stock of, Deprez Carpentier ammeters and voltmeters. These instruments are strictly dead beat so that readings can be taken very quickly, and the scales are graduated from zero up. Being mounted in compact nickel-plated metal cases, they are adapted for portable testing as well as for switchboards. For alternating currents the Cardew voltmeter is recognized as a standard switchboard instrument, while an essential feature is its equal correctness when used on continuous circuits. Queen & Co. are also making these voltmeters in quantity.

The following abstract from a letter from Geo. I Alden, professor of mechanical engineering, Worcester Polytechnic Institute, to the Hine Eliminator company, New York, relating to a recent test of the eliminator will be of interest to steam users: "With different qualities of steam entering the elimioator, we found that the steam after passing through the eliminator was nearly dry, the calorimeter showing from 99.28 to 99.48 per cent. of steam. All our results came between the above figures. Our experience leads us to believe that, with the kind of calorimeter used to determine the quality of the steam when very wet and before entering the eliminator, it is impossible to get accurate results, because the water is not mixed with the steam, but flows along the surface of the steam pipe. For this reason we do not attempt to give the exact amount of moisture in the steam before it entered the eliminator. We know, however, that in some of the trials there was not less than 40 per cent. of water in the entering steam. Our test, therefore, shows fully as high an efficiency for the horizontal as does the Cornell test for the vertical eliminator."

BUSINESS.

Among the many large buildings which have recently, been wired with Okonite wire by the Central Electric company, Chicago, is the St. Charles hotel, which will be furnished with 1,100 lights.

The Columbia Incandescent Lamp company, St. Louis Mo., is determined that office desks as well as street cars shall be equipped with at least one on of its "Columbia special" railway lamps, for the Columbia blotter can now be seen everywhere

The Cedar Rapids, Iowa, Electric Light & Power company is engaged in the construction of about one and one-half miles of protected steam pipe for the purpose of transmitting and selling for heating purposes its large supply of exhaust steam. The work and material for this construction is furnished by the American District Steam company, of Lockport, N. Y. The same company is constructing a smaller exhaust plant for the Grinnell, Iowa, Electric Light & Power company. The increasing prices for anthracite coal under the new Reading combination emphasize the demands for cheaper in the heat for buildings, which many electric companies are able to furnish and at the same time materially increase net revenues.

A four column article in the Bound Brook, N. J., *Chronicle* descriptive of the American Engine company's factory, brings forcibly to mind the fact of this concern's phenomenal growth. It seems but a few months ago that the American company, under the guidance of General Manager Elmer S. Smith, commenced manufacturing the now well known American engine. A glance now at the Bound Brook establishment is all that is necessary to tell the tale of successful business management. Within the two hundred and thirty-five acres owned by the company three railroads run in parallel lines, dividing it into several sections of 250 feet each in depth. About 12,000 lineal feet are reserved for manufacturing purposes, and to other manufacturers who desire to locate at Bound Brook land will be supplied on the most liberal terms. In connection with the American Engine company's works there has been made an expenditure of nearly $400,000. This gives the place an impetus and the stability of the enterprise is assured by the fact that there is no question of the amount of capital back of it.

Among the sales made by the National Electric Manufacturing company, Eau Claire, Wis., during the month of August, are the following: Cicero Water, Gas & Electric Light company, Oak Park, Ill., one 2,000 light machine; Cook County hospital, Chicago, four 800 light machines; Electric Light & Power company, Livingstone, Mont., one 2,000 light machine; Electric Light company, Bloomington, Ind., one 2,000 light alternator; Hyde Park Electric Light & Power company, Chicago, one 1,000 light machine; Steam Shovel & Dredge company, Bucyrus, O., two 120 kilowatt machines for a power transmission plant with three motors of 16 horse power and eight of 5 horse power capacity each; Cudahy Packing company, South Omaha, Neb., two 600 light machines; Electric Light & Power company, Sheboygan, Wis., two 1,000 light machines; Delta Electric company, Cairo, Ill., one 150 horse power generator and one 1,000 light alternator; and Orville Carpenter, Pawtucket, R. I., one 300 light alternator for special purposes. The National company, under the new management, is securing a large amount of business, and the outlook for the coming year appears to be particularly bright.

The International Okonite company, limited, of New York, has made for itself a record and established a name that speaks for itself. Starting business under the firm name of Smith & Gelpcke in a small town on Long Island and operating on a very small scale, this concern grew until the present Okonite company was organized in March of 1884, with Capt. Willard L. Candee and Commodore C. A. Cheever as its principal promoters. To these two gentlemen is due the credit for the success of the present company. The International Okonite company, limited, was formed by a strong syndicate of American and foreign capitalists in 1890, and a branch office was established and a factory erected in London, England. The company's principal factory is situated on the banks of the Passaic river at Passaic, N. J., and is directly on the lines of the New York, Lake Erie & Western, and Susquehanna & Western railroads. Excellent facilities for shipping and receiving purposes are thus secured. The plant consists of a main building, three L buildings and other separate structures, the whole covering a space of about 125,000 square feet. In securing popularity and a firm foothold for Okonite wires, the management of the company has always displayed excellant business sagacity and today it may be truthfully stated that the superior merits of the Okonite goods are as universally recognized as its name and trade mark is well known. At one time 450 workmen were employed to handle the business but owing to improved machinery this number has been reduced to 300 which are now employed steadily. The company's capacity is about 100 miles of wire per day.

In the *American Machinist* of July 28th there was presented an interesting article by T. T. Parker regarding pitting in boilers. In the course of the article Mr. Parker says: "A boiler of the porcupine persuasion pitting was found in the mud drum. Acting under advice. the drum was cleaned and scraped, after which it was painted with graphite mixed with cylinder oil. Measurements of the depths of the pits were taken, and six months after they were found no deeper, and no new ones had shown up. Other parties have since tried this experiment in mud drums, but it is too early as yet to give the result. However, knowing the character of plumbago, if the interior of a boiler could be painted with it in such a way that it would stay, it may be this would prove a remedy. I am satisfied also that the person doing so would kill two birds with one stone, as the scale could be easily detached. In a pair of cylindrical boilers 42 by 28 occasional applications of cylinder oil (mineral) and plumbago have kept back corrosion on a trial of six months. Boilers were new when plumbago was used. The boilers which the new ones replaced were thrown out rotten from corrosion. The feed was mine water, as nothing else could be had." Harig, Koop & Co., Louisville, Ky., also, after experiencing more or less trouble from rust and scale in the mud drums of their boilers, applied with great success graphited oil, purchased from the Joseph Dixon Crucible company, Jersey City. The mud drums were cleaned out and the graphited oil applied with swab, brush or anything handy to the joints and parts where the water enters the drums. Every four or six weeks this process is repeated with the most gratifying results.

ELECTRICAL PATENTS.

Issued August 23, 1892.

481,204. Plug Spring Jack. Christopher A. Shea, Boston, Mass.

The device comprises a plug and conductor and a circuit breaker between them and a support for a supplemental testing plug.

481,220. Electric Motor and Generator. Charles S. Bradley, Avon, N. Y., and James J. Wood, Fort Wayne, Ind.

The magnet comprises a laminated core. The side plates of the core having their polar projections bent over the end of the magnetizing coils to retain them in position.

481,223. Ships Telegraph. Albert B. W. H. Cords, Hamburg, Germany.

481,246. Thermal Cut-out. Albert P. Seymour, Syracuse, N. Y.

A fixture cut-out is composed of a curved block of insulating material formed so that it may be molded by a single operation.

481,247. Telegraphy. James G. Smith, New York, N. Y.

A system of telegraphy comprising means whereby at small expense, persons in one city or district may establish communication with persons at a distance by the use of private lines without requiring any hand manipulation except on the part of the person calling and the one called, the rest being accomplished automatically.

481,281. Circuit Changing Apparatus. Almon D. Page, Newark, N. J.

Contact devices carried by adjustable disks, by means of which the distance between the contact devices may be varied, are adapted to bear against a body having conducting sections and moving beneath the contact devices.

481,284. Telephone. Adolf Rettig, Saabrücken, Germany.

A wooden case with the grain of the wood running across the back is combined with a plurality of diaphragms of different area and the latter and the wooden case are connected by spring devices.

481,285. Shade for Incandescent Electric Lamps. Charles J. Salick and Edward Sipp, Watertown, Wis.

481,288. Reflecting Shade for Incandescent Electric Lamps. Lucius T. Stanley, Brooklyn, N. Y.

The shade comprises a parabolic reflector having at its lower end a flange to which is attached an annular reflecting apron, and a diffusion glass closing the lower opening of the shade.

481,291. Electric Water Heater. Thomas Ahearn, Ottawa, Canada.

481,293. Arm Rest For Telephones. Joseph R. Bailey and Levi C. Lincoln, Woonsocket, R. I.

A vertically movable bracket is journalled upon a shouldered rod, and a ratchet lever carried upon the bracket is adapted to engage with the shoulders upon the rod.

481,297. Electric Switch. John H. Clark, Boston, Mass.

A freely suspended weight is connected with the movable member of a switch device by a flexible connection passed about a movable pulling point intermediate between the weight and the movable switch member.

481,364. Train Indicator. Herbert L. Manton, Melbourne, Victoria.

The indicator comprises a dial having a series of holes at different distances from its axis and a series of spring-retracted press button plugs having reduced ends forming shoulders to limit the entry of the plugs into the holes.

481,378. Reflecting Shade for Incandescent Lamps. Lucius T. Stanley, Brooklyn, N. Y.

A reflector encloses the lamp and spiral springs are attached thereto by one of their ends, the other end of each engaging with a glass plate over the opening of the reflector.

481,381. Mast Arm. Augustus Wright, Providence, R. I.

The lamp support is adapted to move along a trolley rail or wire and mechanism is adapted automatically to cut the lamp into and out of circuit, and to close the circuit when the lamp is cut out,

481,386. Electric Elevator. William Baxter, Jr., Baltimore County, Md. Filed July 19, 1888. Renewed Oct. 31, 1890. Serial No. 369,873.

A reversing switch is carried upon the elevator car and is connected with the motor armature and the feeding mains by a flexible cable attached to the car whereby the motion of the car may be controled by changing the direction of the current through the armature of the motor.

481,401. Trolley for Electric Railways. Wilton F. Jenkins, Richmond, Va.

Forward and rearward bearing surfaces for the trolley connection are carried upon the car body, a trolley carriage runs upon conductors and a jointed arm is connected with the trolley carriage and arranged to move transversely to the car into or out of the space between the bearing surfaces.

481,402. Trolley for Electric Railway Conduits. Wilton F. Jenkins, Richmond, Va.

The invention embodies a drag connection for the trolley which may be reversed without disconnection from the car and means are provided for taking up vertical and lateral vibration between the car and trolley.

481,403. Conduit for Eelectric Railways. Wilton F. Jenkins, Richmond, Va.

The conductor support has a collar or shoulder and a screw-nut and insulated clamping jaws arranged between them to clutch and hold the conductor.

481,407. Production of Caustic Alkalies and Chlorine. Farnham M. Lyte, London, England.

481,430. Pneumatic Electric Circuit Controlling and Interlocking Apparatus. William W. Slater and Harry C. Barnes, Oakland, Cal.

A lever acting upon a diaphragm which fits within a chamber is acted upon by the wheels of a passing train so as to depress the diaphragm as each wheel passes to produce a pulsation of the air through a pipe to a point where the electro-pneumatic mechanism is to be actuated.

481,457. Insulator. Arthur J. Wylie, Rome, N. Y.

An insulator is provided with a longitudinal hole to receive the wire and a longitudinal slot is provided to admit of expansion of the insulator.

481,474. Magnetic Separator. Gurdon Conkling, Glens Falls, N. Y.

Ore is fed upon a belt moving obliquely to the vertical and the pole piece of a series of magnets placed beneath the belt to attract the magnetic particles to the belt.

481,483. Telephone System. Richard N. Dyer, East Orange, N. J.

Current reducing coils are located in a branch of a current supplying circuit and secondary coils are provided upon the magnet and connected with the line through the bell circuit; a key closes the branch through the magnet coils and not through the transmitter.

481,503. Trolley Switch. Jacob S. Merkins, Highlands, Colo.

481,517. Trolley Protector. John Walsh, Cleveland, Ohio.

481,529 Telephony. John W. Gibboney, Lynn, Mass.

The method of transmitting speech consists in putting upon the line alternating or pulsating waves of current inaudible or nearly so in receivers, and inductively superposing waves of current corresponding to the vocal waves received by a transmitter.

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Clark Joint Gum should be used for making waterproof joints. This is put up in half-pound boxes, in strips about one foot long and five-eighths inch wide, and when wrapped about a joint and pressed firmly it makes a solid mass. **FOR RAILWAY** and **MOTOR** use, we make all sizes of stranded and flexible with Clark insulation.

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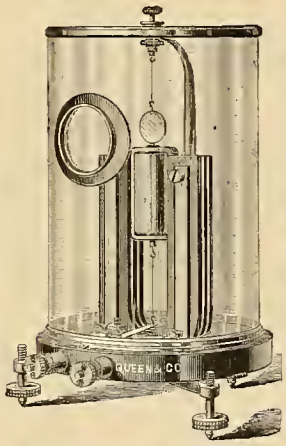

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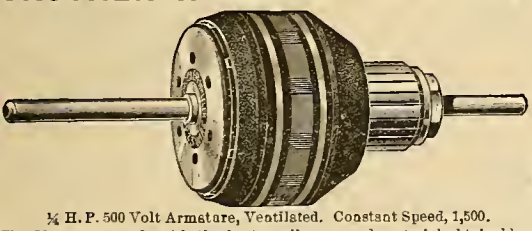

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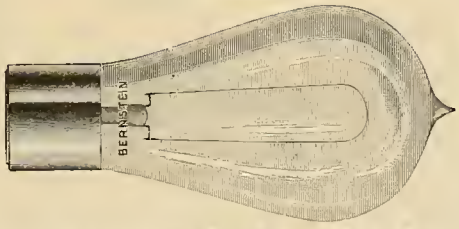

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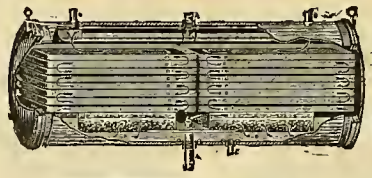

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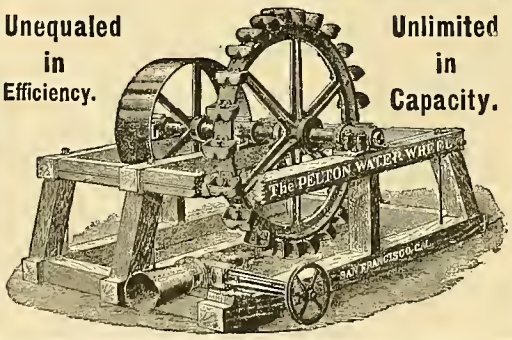

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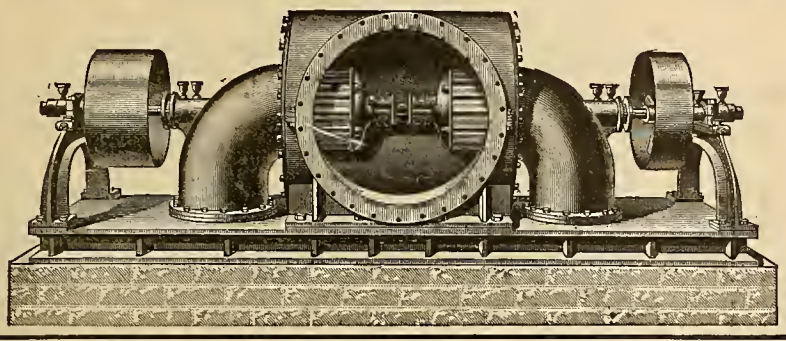

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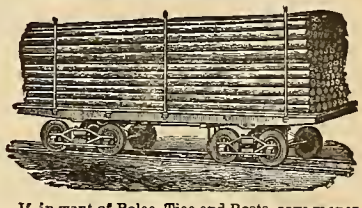

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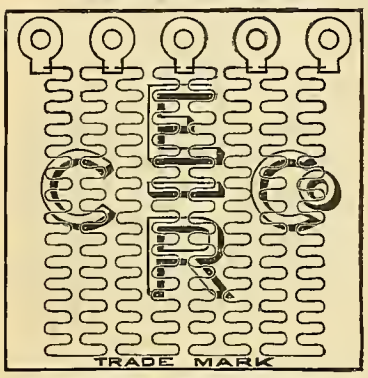

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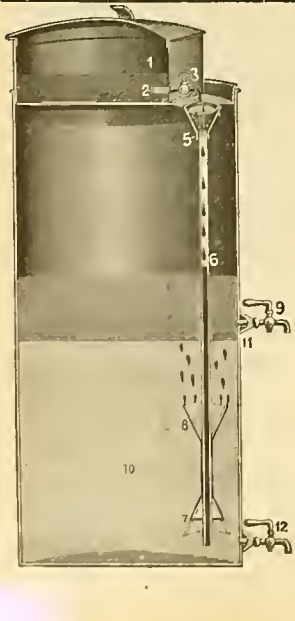

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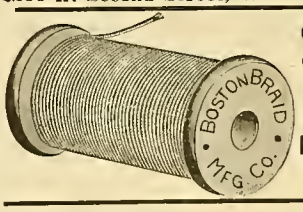

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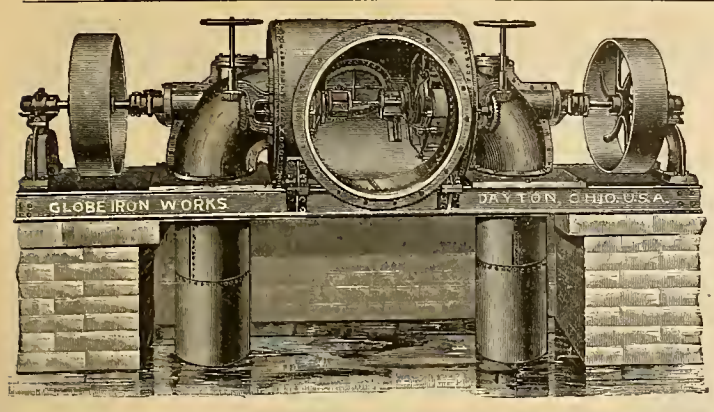

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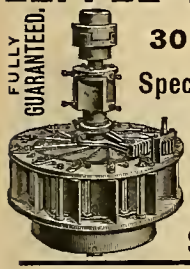

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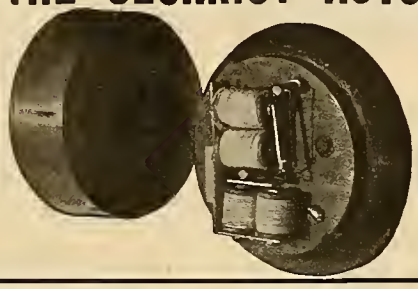

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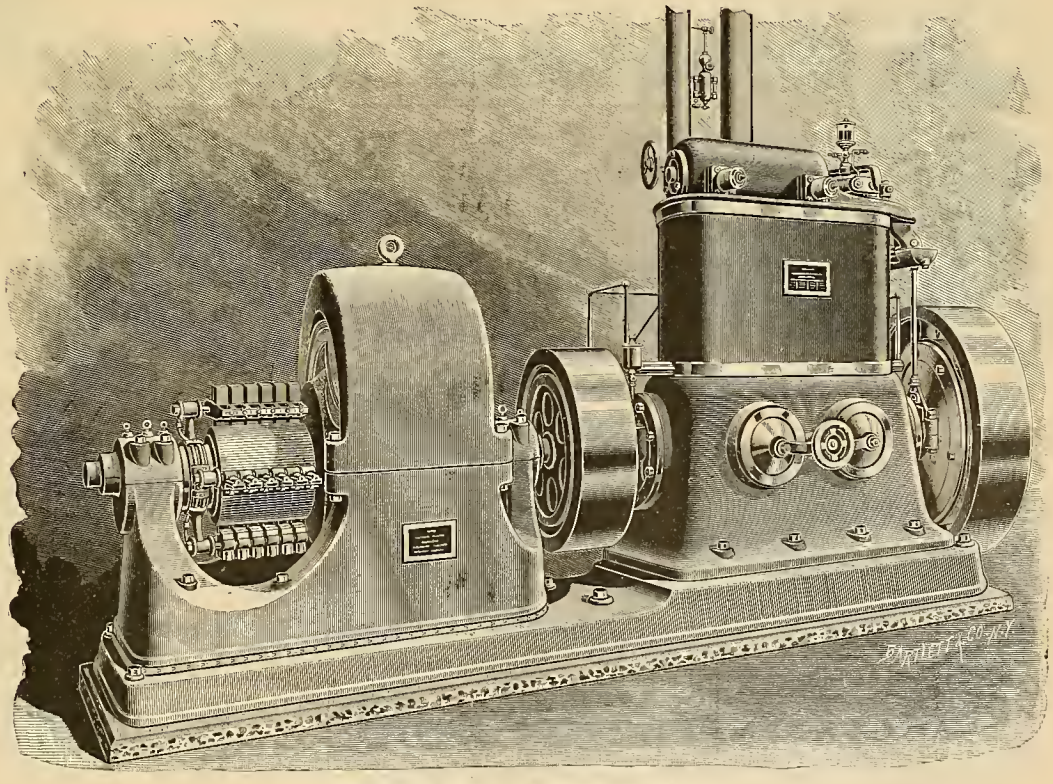

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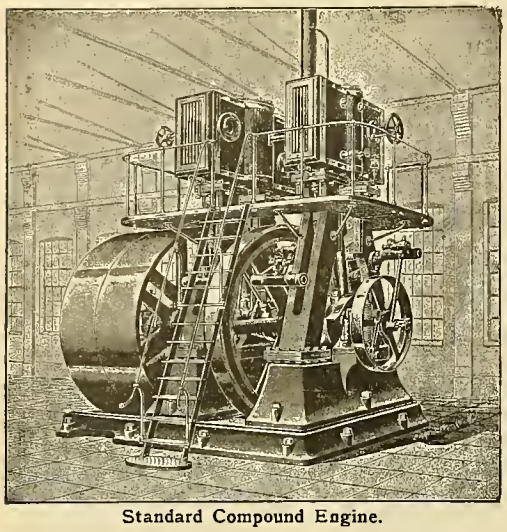

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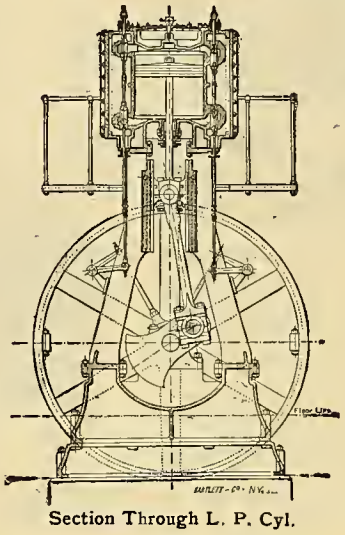

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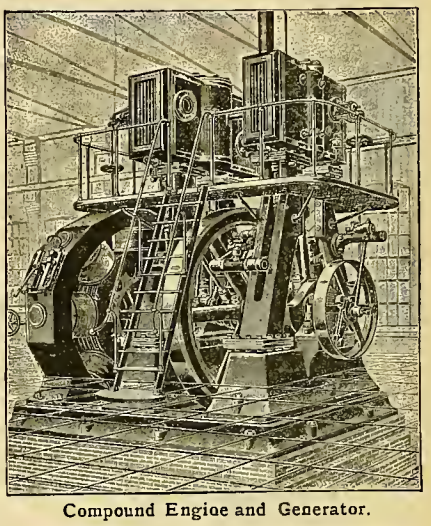

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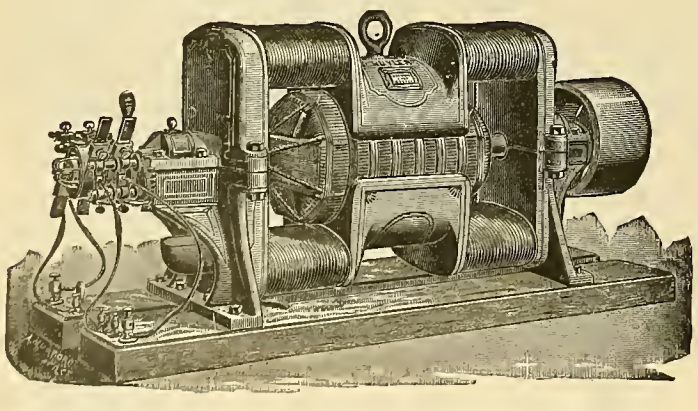

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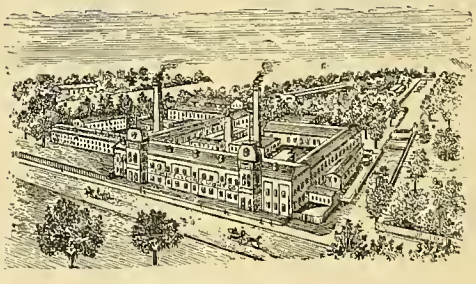

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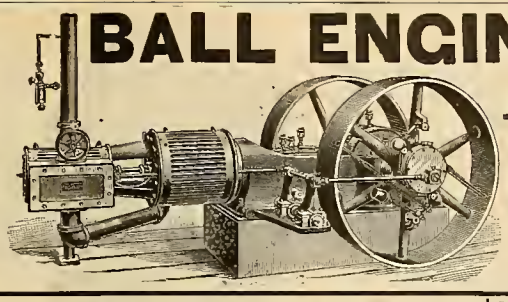

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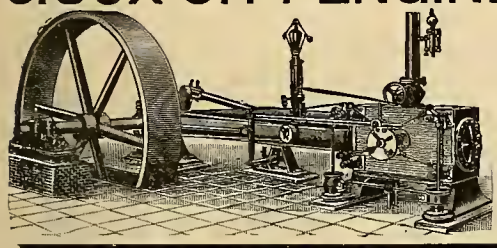

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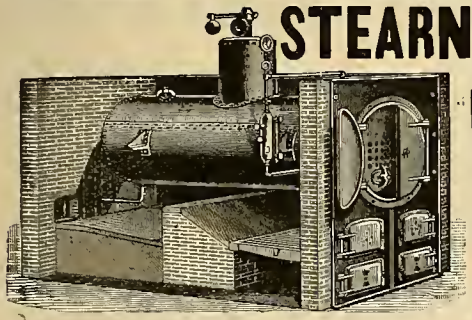

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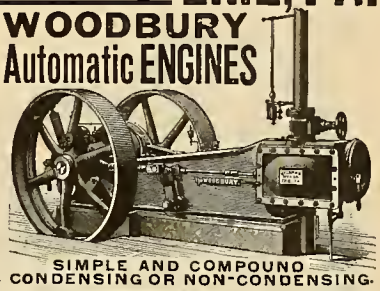

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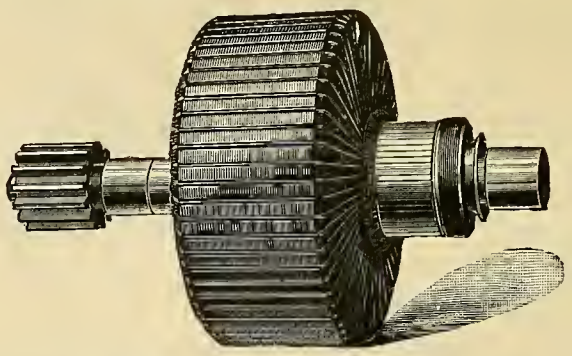

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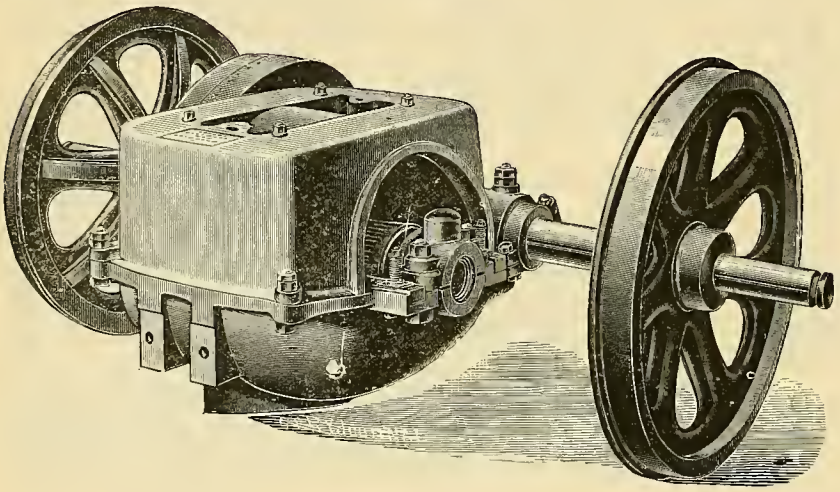

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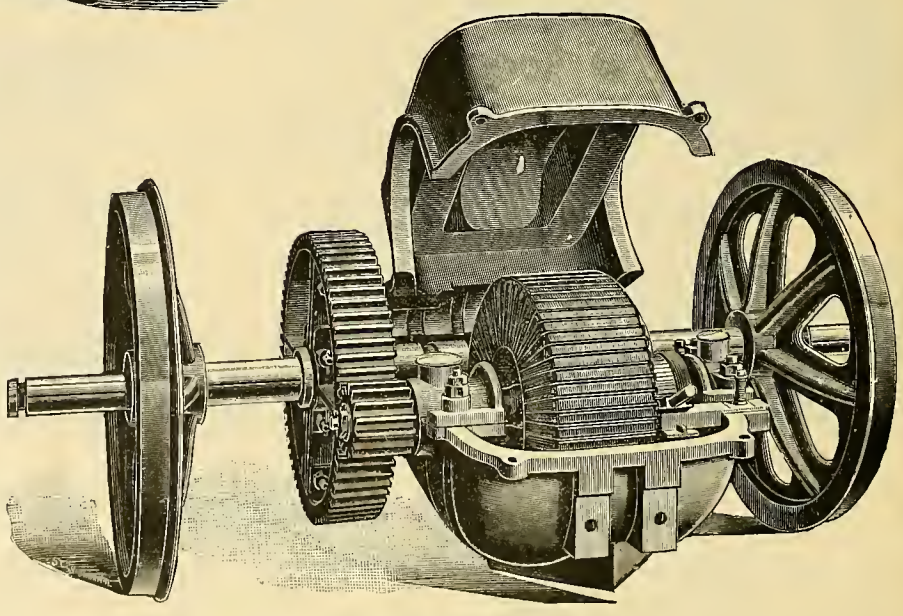

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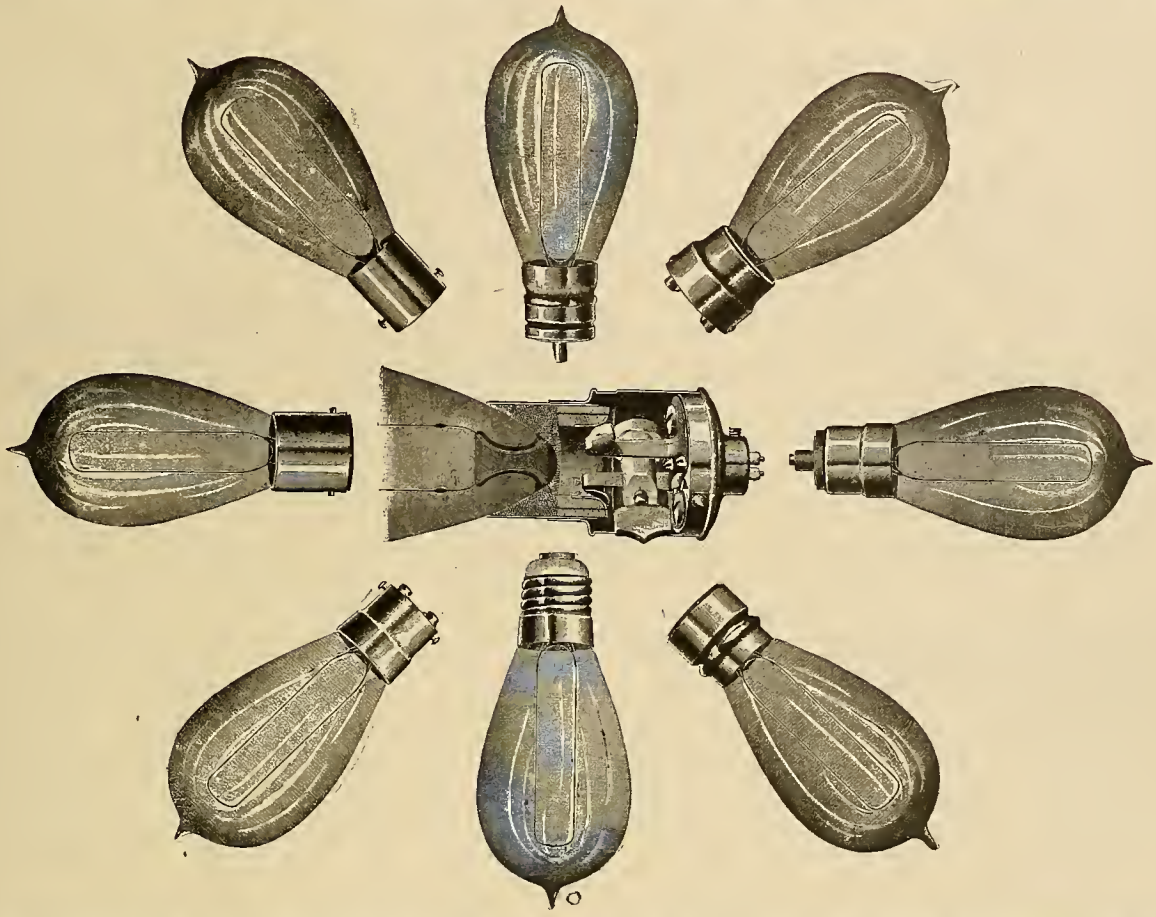

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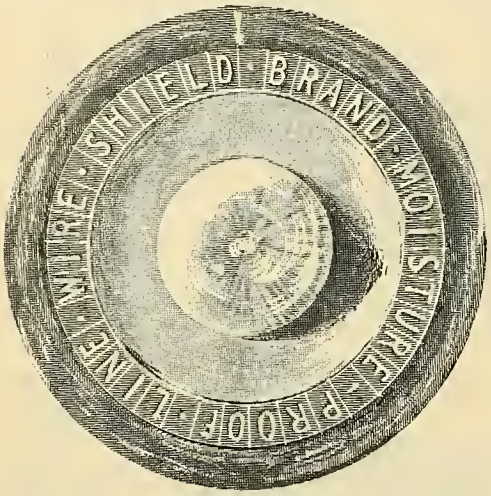

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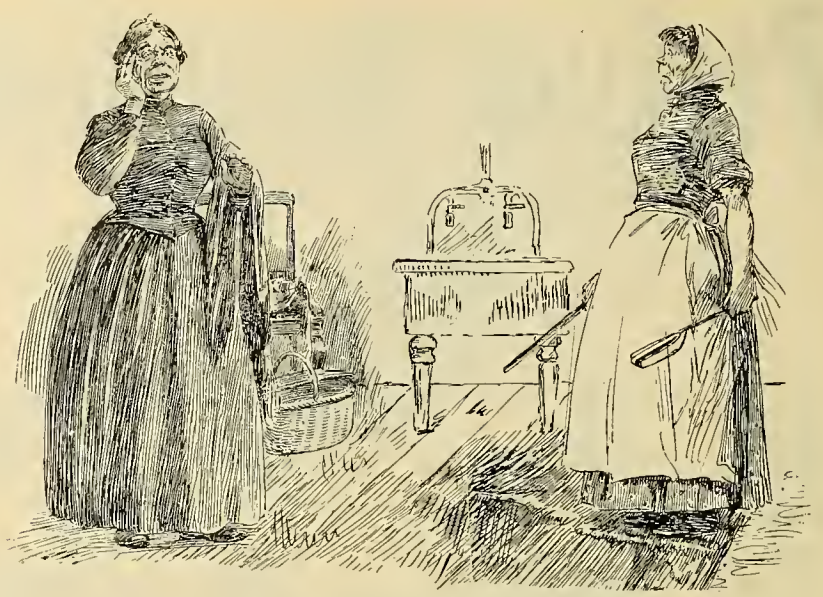

"Sure an' it's good natured they be wantin' us cooks to be," said Bridget O'Shaunnessy, who had dropped into Nora's kitchen to rest a bit, on the way home from market. Her remarks were addressed to Nora McGoogan who cooks for the family living next door. "I'd loike moighty well fer the foine people to tell us how cooks are to be good natured."

"I would that same," said Nora, who had just been punching the fire, "fer it's a scrappin' toime we have of it."

"Right ye are," added Bridget. "I've just been gouging the eyes out of the petaties, an' now I've got to haste the mate."

"An' I've just split the head o' the cabbage an' whipped the cream an' pounded the steak," said Nora.

"An' I've got to bate the eggs," said Bridget, "an' this afternoon I'll wipe up the floor with the mop an' then I'm goin' to make the currant jell an' jam the grapes."

"I'm goin' to be busy, too," said Nora. "I've got to hang the wash an' then pitch in an' do up the preserves."

And they both went at their work wondering how in the world a person with a kindly disposition could serve as cook.

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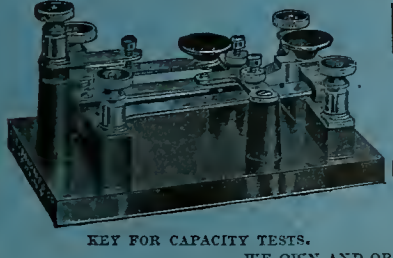

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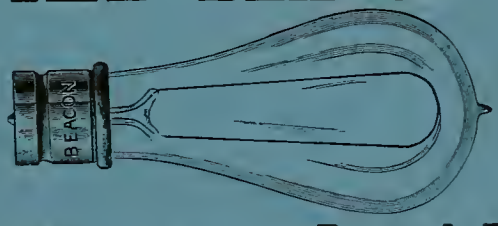

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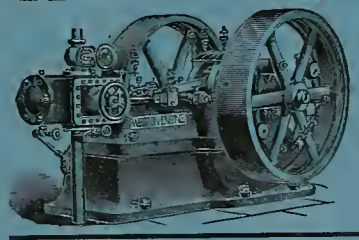

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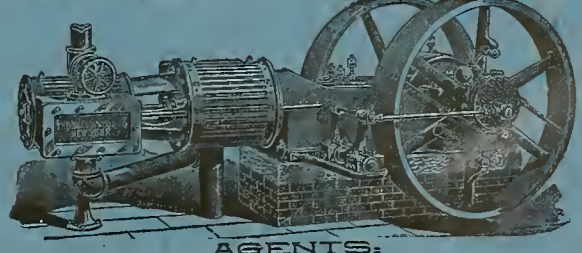

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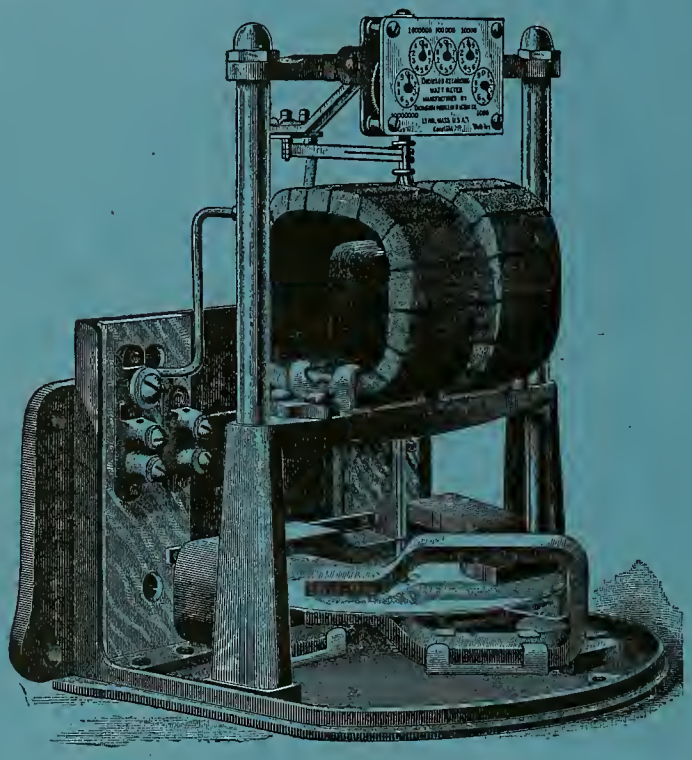

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Yours truly,

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(Signed) E. F. Cooley, Supt.

Thomson-Houston Electric Co.,

PRINCIPAL OFFICE,
620 Atlantic Ave., Boston, Mass.

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173 Adams Street, Chicago, Ill.

INDEX AND CLASSIFICATION OF ADVERTISEMENTS.

ALPHABETICAL LIST.

American Battery Co..... ix
American Desk & Seating Co.. xiv
American District Steam Co.... x
American Electrical Mfg. Co.. iv
American Engine Co..... xii
Andrae, Julius..... —
Andrews & Co., A. H..... —
Babcock & Wilcox Co., The.... i
Baggot, E..... xiv
Ball Electric Light Co..... xvi
Ball Engine Co..... xxi
Ball & Wood Co., The i
Beacon Vacuum Pump & Elec. Co. i
Becker Mfg. Co., John..... xiii
Beggs, J. E., Mch. & Supply Co. x
Beinstein Electric Co..... xii
Boston Braid Mfg. Co..... xviii
Bowers Bros..... xvi
Bridgeport Mach. Tool Wks.. —
Brookfield, Wm..... xii
Brush Electric Co viii
Bryan, W. H.. xiv
Bryant Electric Co..... xii
Buckeye Electric Co., The..... ix
Carpenter Enamel Rheostat Co. xvi
Central Electric Co..... v
Chicago Rawhide Mfg. Co..... —
Crescent Ins. Wire & Cable Co. xiii
Crocker-Wheeler Electric Co.. xiii
Cushing, F. W..... vii
Cutter, Geo i
Cutter Electrical & Mfg. Co... —
Dayton Globe Iron Works Co.. xix
Densmore Typewriter Co..... xii
Detroit Electrical Works..... xxvi
Diamond Electric Mfg. Co.... xii
Dixon Crucible Co., Jos..... xix
Dudley & Co., W. W..... xvi
Duplex Electric Co., Ltd..... —
Eastern Electric Cable Co..... xiii
Easton Electric Co..... x
Eastman Kodak Co..... xiv
Edison General Electric Co..... viii
Electric Cons. & Supply Co... vi
Electric Engr'g & Supply Co.. ix
Electrical Mfg. Co., The..... vi
Electric Secret Service Co..... xxi
Electrician Pub. Co..... ..... xv, xvii, xviii, xix
Electrical Construction Co. The. xii
Electrical Eng. & Supply Co. The—
Electrical Supply Co., The... xxiv
Elektron Mfg. Co..... xvi
Empire China Works..... x
Enterprise Electric Co..... xv
Falls Rivet & Machine Co..... ix
Ferracute Machine Co..... xix
For Sale Advertisements. x, xii, xiii
Fort Wayne Electric Co..... xxvi
General Electric Co..... iv
Gravity Purifier Co..... —
Great Western Elec. Supply Co—
Greeley & Co., The E. S..... i
Hart & Hegeman Mfg. Co..... xvi
Heisler Electric Co..... —
Hill Clutch Works..... xxi
Hine Eliminator Co..... —
Holmes, Booth & Haydena.... xiv
Hood & Co., Wm..... vi
Hughes Bros. Mfg Co..... xiv
Illinois Electric Lamp Co..... xviii
India Rubber & G. P. Ins. Co. xxv
Institute of Technology..... xiv
Interior Conduit & Insulation Co. x
International Okonite Co..... i
Jewell Belting Co..... i
Johns Mfg. Co., H. W..... xvi
Kartavert Mfg. Co..... xvi
Kelly Brothers ..... —
Klipstein, A..... xii
Knapp Electrical Works..... xxiii
Lake, J. H. & D., Co xviii
Lake Erie Engineering Works. xx
Lane & Bodley Co..... —
La Roche Electric Works..... xix
Leclanche Battery Co., The .. xix
Lefmann, Julius xix
Leffel, & Co., Jas xix
Leonard & Co., H. W..... xix
Link Belt Machinery Co..... xv
Loud, H. M. & Sons Lumber Co. xiv
Lovell Mfg. Co., Ltd..... xiii
Mather Electric Co..... iv
Midling Electric Wks..... xii
Moore, Alfred F..... i
Morse & Co., A. M..... .. xv
Munsell & Co., Eugene..... xii
National Carbon Co..... xiv
National Electric Mfg. Co..... —
National India Rubber Co..... —
New York Insulated Wire Co. xv
N. Y. Safety Steam Power Co. x
New York & Ohio Co..... i
Ostrander & Co., W. R..... xxi
Page Belting Co..... xviii
Partrick & Carter Co..... xviii
Pearson & Co., W. B..... xx
Pelton Water Wheel Co xiv
Perkins Elec. Switch Mfg. Co. ix
Phoenix Glass Co..... xxi
Pioneer Armature Co..... xiii
Porter-Leavitt Elec. Motor Co. xiii
Queen & Co..... xiii
Racine Hardware Mfg. Co..... —
Railway Equipment Co..... ix
Redding Electric Co..... x
Ries Electric Specialty Co..... x
Roebling's Sons Co., J. A .... —
Rose Elec. Light Supply Co... xii
Royal Electric Co..... —
Samson Cordage Works. xii
Sawyer-Man Electric Co..... xi
Schuyler Electric Co..... iv
Sechrist, Albert..... xix
Shultz Belting Co..... xviii
Siebert, G..... xiii
Siemens & Halske Electric Co. xiii
Sioux City Elec. Supply Co., —
Sioux City Engine Works.... xxi
Smith, A. T..... —
Smith, Thos. G. Jr..... —
Somoff, J. L..... —
Sperry Elec. Mining Mach. Co. xvi
Standard Electric Co..... vi
Standard Paint Co x
Stanley Electric Mfg. Co..... v
Star Electrix Co... xv
Stearns Mfg. Co..... xxi
Sterling, W. C..... xv
Stilwell & Bierce Mfg. Co. xiv, xv
Sunbeam Incand. Lamp Co... xxv
Taylor Engine Co..... —
Thomson-Houston Elec. Co.. ii, xxii
Union Hardware Co..... xii
Utica Elec. Mfg. & Supply Co. x
Van Nuis C. S..... i
Vulcanized Fibre Co..... xv
Waddell-Entz Company..... xii
Wannopee Pottery Co..... xxi
Want Advertisements... xii, xiii
Washburn & Moen Mfg. Co..... iv
Western Electric Co..... xiv
Westinghouse, Church, Kerr & Co..... xx
Westinghouse Elec. and Mfg Co. xi
Weston Engine Co..... i
Woodhouse & Rawson, Ltd.... —
Worthington, Henry R..... xii

CLASSIFIED LIST.

Annunciators.
Central Electric Co.
Detroit Electrical Works.
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Lefmann, Julius.
Leonard & Co., H. W.
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N. Y. Safety Steam Power Co.
Pearson & Co., W. B.
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Detroit Electrical Works.
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Electrical Supply Co., The.
Enterprise Electric Co.
Holmes, Booth & Haydens.
International Okonite Co., The.
Knapp Electrical Works.
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Bryant Electric Co.
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Racine Hardware Mfg. Co.
Smith, Thos. G. Jr.
Sioux City Engine Works.
Stearns Mfg. Co.
Taylor Engine Co.
Westinghouse, Church, Kerr & Co.
Weston Engine Co.

Fan Outfits.
Stanley Electric Mfg. Co.

Fibre.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

Fire Alarms.
Electrical Supply Co., The.
Knapp Electrical Works.
Partrick & Carter Co.
Western Electric Co.

Furnace Grate Bars.
Kelly Bros.

Fuse Wire.
Electrical Supply Co.
Knapp Electrical Works.
Sperry Elec. Mining Machine Co.

Gas Lighting, Electric.
Detroit Electrical Works.
Knapp Electrical Works.
Partrick & Carter Co.

General Electrical Supplies.
American Electrical Mfg. Co.
Andrae, Julius.
Beacon Vacuum Pump & Elec. Co.
Bryant Electric Co.
Central Electric Co.
Cutter, Geo.
Cutter Electrical & Mfg. Co.
Detroit Electrical Works.
Edison General Electric Co.
Electric Cons. & Supply Co.
Electric Eng. & Supply Co.
Electrical Eng. & Supply Co., The.
Electrical Manufacturing Co., The.
Electrical Supply Co., The.
Enterprise Electric Co.
General Electric Co.
Great Western Electric Supply Co.
Greeley & Co., The E. S.
Hart & Hegeman Mfg. Co.
Hood & Co., Wm.
Klipstein, A.
Knapp Electrical Works.
Queen & Co.
Redding Electric Co.
Sioux City Elec. Supply Co.
Utica Elec. Mfg. & Supply Co.
Western Electric Co.

Globes and Electrical Glassware.
Brookfield, Wm.
Phœnix Glass Co.

Graphite Specialties.
Dixon Crucible Co., Jos.

Insulators and Insulating Materials.
American Electrical Mfg. Co.
Andrae, Julius.
Brookfield, Wm.
Bryant Electric Co.
Cushing, F. W.
Edison General Electric Co.
Electric Engineering & Supply Co.
Electrical Supply Co., The.
Empire China Works.
Enterprise Electric Co.
Hart & Hegeman Mfg. Co.
Interior Conduit & Insulation Co.
International Okonite Co., The.
Johns Mfg. Co., H. W.
Kartavert Mfg. Co.
Lefmann, Julius.
Moore, Alfred F.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Standard Paint Co.
Utica Elec. Mfg. & Supply Co.
Vulcanized Fibre Co.
Wannopee Pottery Co.
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Magnet Wire.
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Central Electric Co.
Crescent Ins. Wire & Cable Co.
Cushing, F. W.
Cutter, Geo.
Detroit Electrical Works.
Eastern Electric Cable Co.
Edison General Electric Co.
Electrical Supply Co., The.
Enterprise Electric Co.
Great Western Electric Supply Co.
Holmes, Booth & Haydens.
International Okonite Co., The.
India Rubber & Gutta Percha Insulating Co.
Knapp Electrical Works.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Roebling's Sons Co., J. A.
Sperry Elec. Mining Machine Co.
Waddell-Entz Company.
Washburn & Moen Mfg. Co.
Western Electric Co.

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American Electrical Mfg. Co.
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Bernstein Electric Co.
Buckeye Electric Co.
Central Electric Co.
Cutter Electrical & Mfg. Co.
Edison General Electric Co.
Electrical Eng. & Supply Co., The.
Electrical Manufacturing Co., The.
Electrical Supply Co., The.
Hood & Co., Wm.
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Knapp Electrical Works.
New York and Ohio Co.
Redding Electric Co.
Sawyer-Man Electric Co.
Somoff, J. L.
Sunbeam Incandescent Lamp Co.
Thomson-Houston Electric Co.

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Bridgeport Machine Tool Works.

Lightning Arresters.
Van Nuis, C. S.

Magnet Wire.
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Detroit Electrical Works.
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Edison General Electric Co.
Thomson-Houston Electric Co.
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Westinghouse Electric & Mfg. Co.

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Midland Electric Wks.

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Crocker-Wheeler Electric Co.
Detroit Electrical Works.
Easton Electric Co.
Edison General Electric Co.
Electrical Eng. & Supply Co., The.
General Electric Co.
Great Western Electric Supply Co.
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Lovell Mfg. Co., Ltd.
Mather Electric Co.
Porter-Leavitt Electric Motor Co.
Royal Electric Co.
Siemens & Halske Electric Co.
Thomson-Houston Electric Co.
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Siebert, G.

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Electrical Supply Co., The.
Lefmann, Julius.
Loud, H. M. & Sons' Lumber Co.
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Empire China Works.
Wannopee Pottery Co.

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Electrician Publishing Co.

Push Buttons.
Detroit Electrical Works.
Central Electric Co.
Electrical Supply Co., The.
Knapp Electrical Works.
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Worthington, Henry R.

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Detroit Electrical Works.
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Central Electric Co.
Cushing, F. W.
Crescent Ins. Wire & Cable Co.
Eastern Electric Cable Co.
Edison General Electric Co.
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India Rubber & Gutta Percha Insulating Co.
International Okonite Co., The.
New York Insulated Wire Co.
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Greeley & Co., The E. S.
Knapp Electrical Works.
Western Electric Co.

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Detroit Electrical Works.
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Central Electric Co.
Electrical Supply Co., The.
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Knapp Electrical Works.
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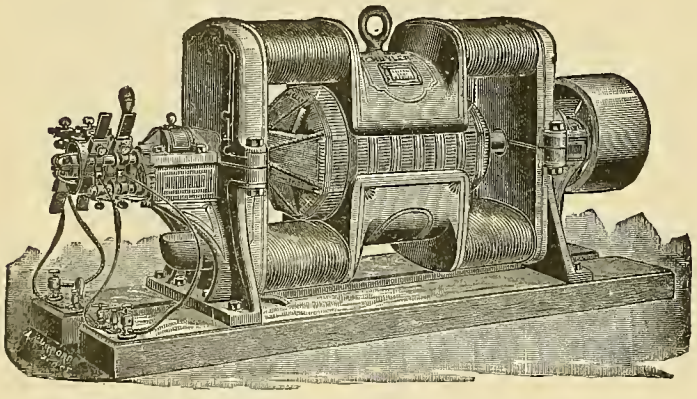
CONTAINS THE FOLLOWING IMPORTANT FEATURES:



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A Pure White Steady Light.

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For Long Life, High Efficiency, Full Candle Power and Freedom from Discoloring.

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INCANDESCENT LAMPS

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OUR SPECIAL RAILWAY LAMPS ARE UNEQUALED.

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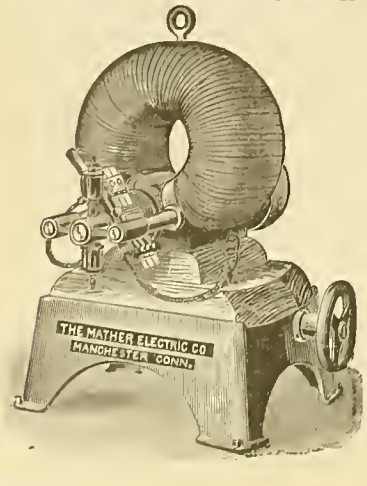

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15	"	" 750	"	125	"	" 6,750	"
20	"	" 1,000	"	175	"	" 8,750	"
30	"	" 1,500	"	250	"	" 12,500	"
40	"	" 2,000	"	350	"	" 17,500	"
50	"	" 2,500	"	500	"	" 25,000	"
75	"	" 3,750	"				

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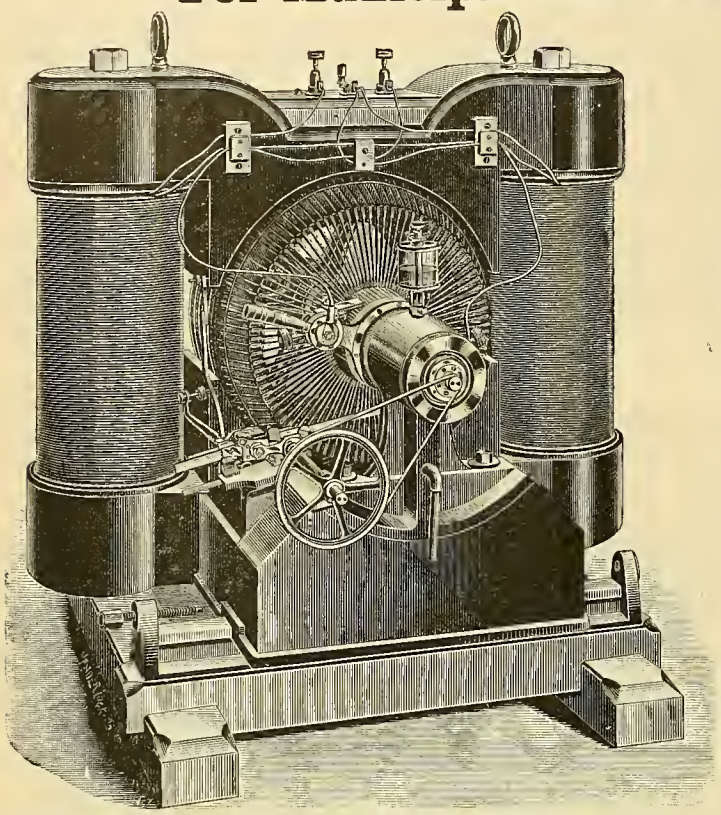
For Municipal and Commercial Arc Lighting

THAN ANY DYNAMO EVER OFFERED.



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Is the only high-grade independent feed lamp which will, with **one feeding mechanism, one carbon rod** and **one pair of carbons,** give a constant unchanging light from

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Lamps for all Systems. **Any Voltage or Candle Power.**

DIRECT CURRENT LAMPS.
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RAILWAY CIRCUIT LAMPS.

FILAMENTS WITH OR WITHOUT HOOKS.
MINIMUM CURRENT CONSUMPTION, with MAXIMUM CANDLE POWER AND LIFE.

Before purchasing elsewhere send in a trial order for Brilliants. Lamps furnished to consumers in quantities at factory prices.

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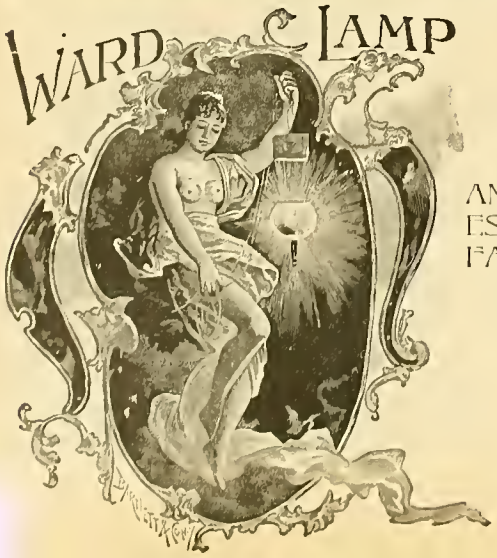

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FOR INCANDESCENT AND STREET RAILWAY CIRCUITS.

AN ESTABLISHED FACT: THE ONLY ARC LAMP THAT WORKS SATISFACTORILY ON AN INCANDESCENT CIRCUIT.

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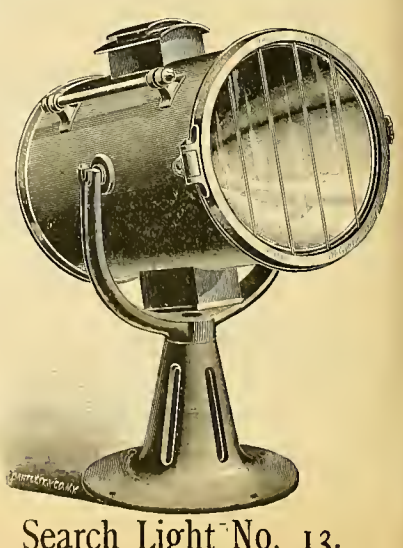

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12,672,000 Feet.

The largest order ever given in this country for high grade insulated wire. The New York Central Railroad has just ordered

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THIS MEANS SOMETHING.

THE BEST INSULATION
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The Old Reliable.

THE MOST ACID-PROOF INSULATION
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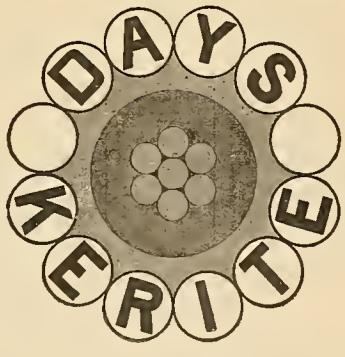

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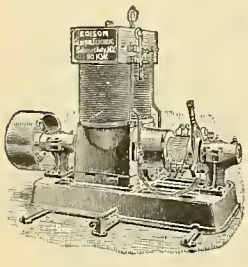
THE ONLY SATISFACTORY SYSTEM, GIVING GREATEST RESULTS FOR LEAST OUTLAY



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MILLIONS SOLD AND MILLIONS SELLING.

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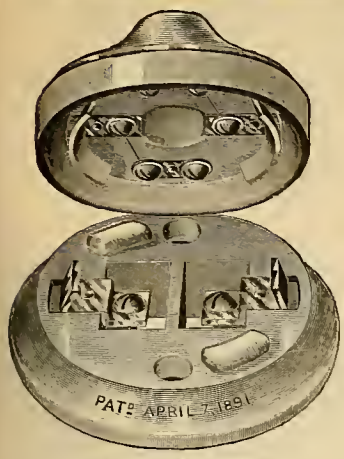

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Durable and Effective Contact.
Plenty of Room for Knot in the Cord.
Strong on Fixtures; the Cap, With Bayonet Lock, Projecting over the shell.

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No screw driver used in adjusting cap.

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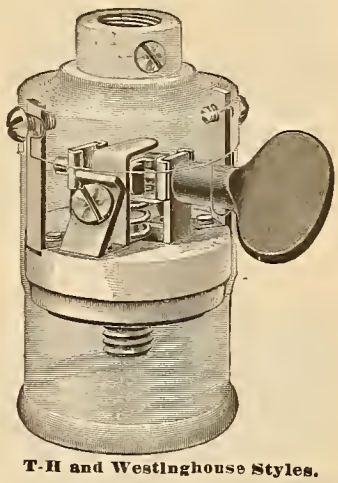
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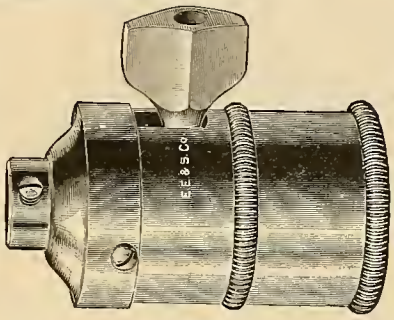

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For all Standard Systems.

Porcelain or Rubber Key.

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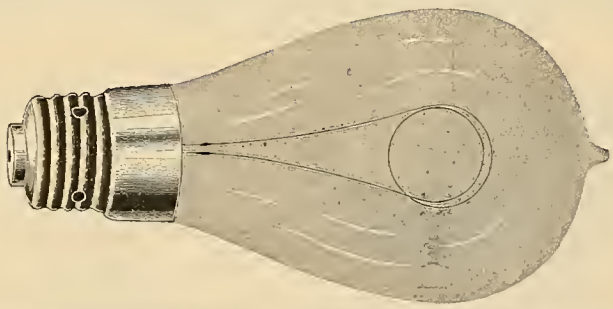

One of our customers writes us that the "last lot of lamps he had discolored so that they looked like regular old BLACK MARIAS." We sent him a lot of *Coiled* filament

"BUCKEYE" Lamps, regular

"keep sweet and move on" kind; they gave him a **pure WHITE** light for about 1,000 hours with such constancy—well, he will hereafter use our lamp.

Get our prices and selling conditions **before** you make another purchase.

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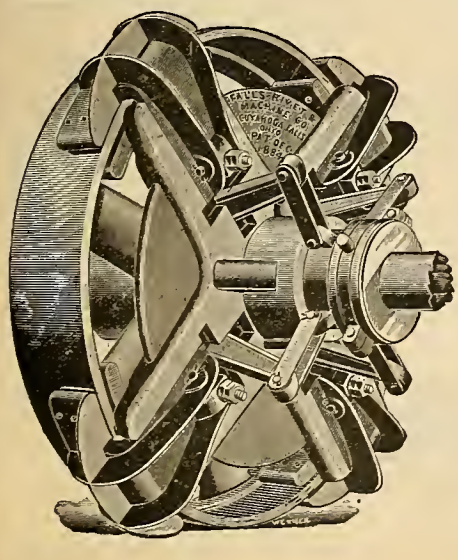

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Special attention given to the Complete Equipment of Electric Plants.

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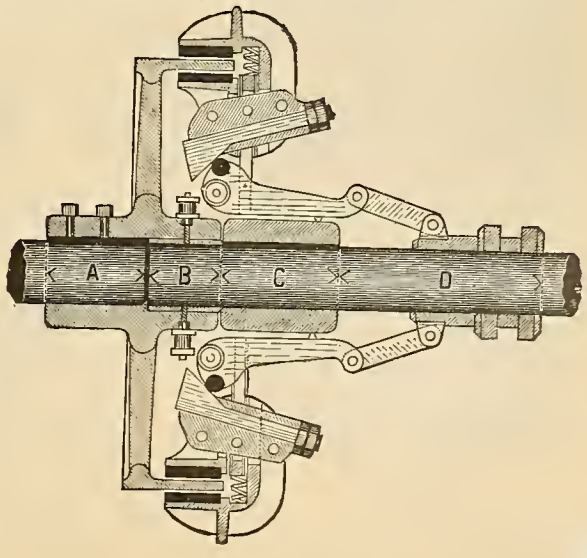

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FOR ALTERNATING CURRENT INCANDESCENT LAMPS, IS BEING UNIVERSALLY ADOPTED.

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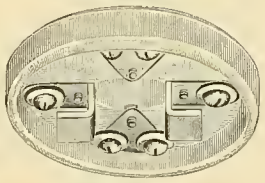

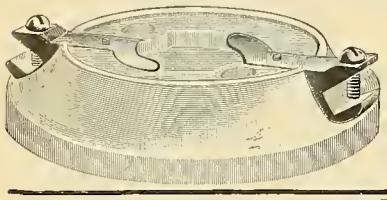

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Have You Ever Used a Cut-Out That Exactly Suited You?

HAVE YOU TRIED THE "IONA"?

No Screw—Positive Connections. Reasonable Prices.

Ask Your Dealer for Them or Write us.

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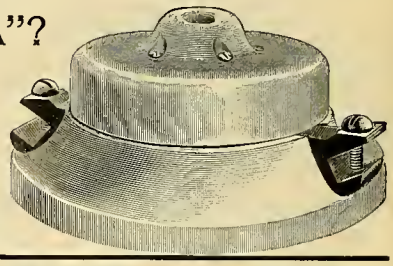

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Non-Conductive Blocks, Rosettes and Bases for Cut-Outs and Switches.

Also Insulators, Cleats, Lamp Trimmings and other Electrical Supplies.

Our production is a dense body. The glazing and body of our ware are of same composition, and are baked alike, which are the features of

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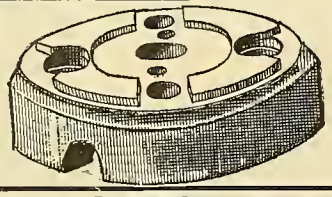

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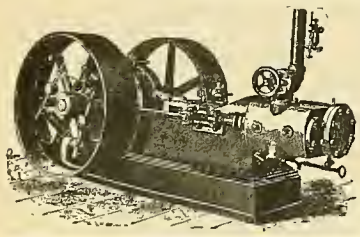

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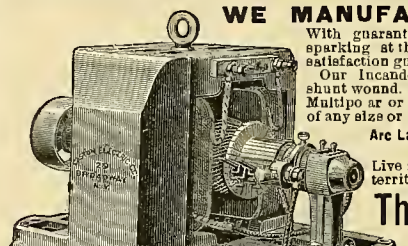

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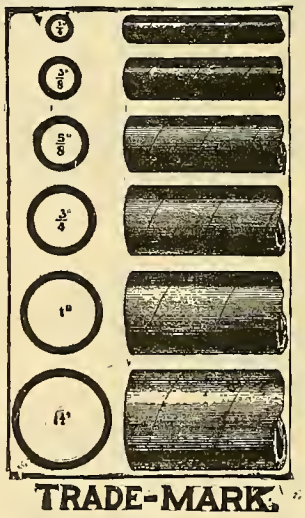

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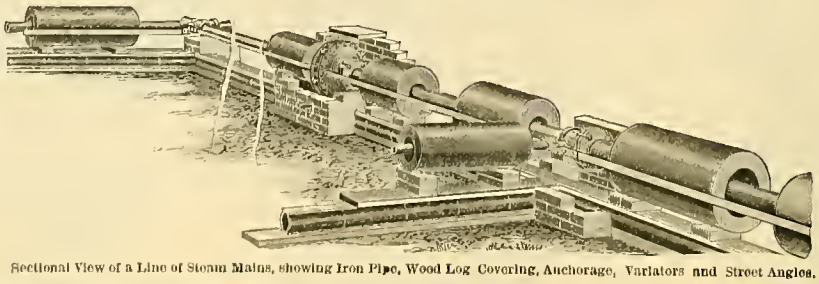

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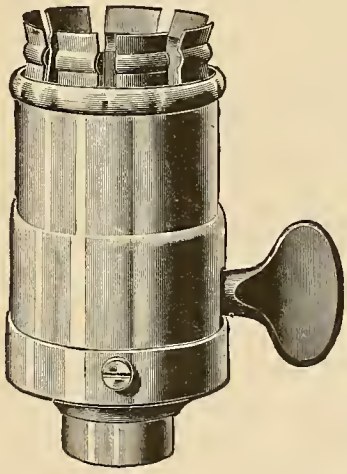

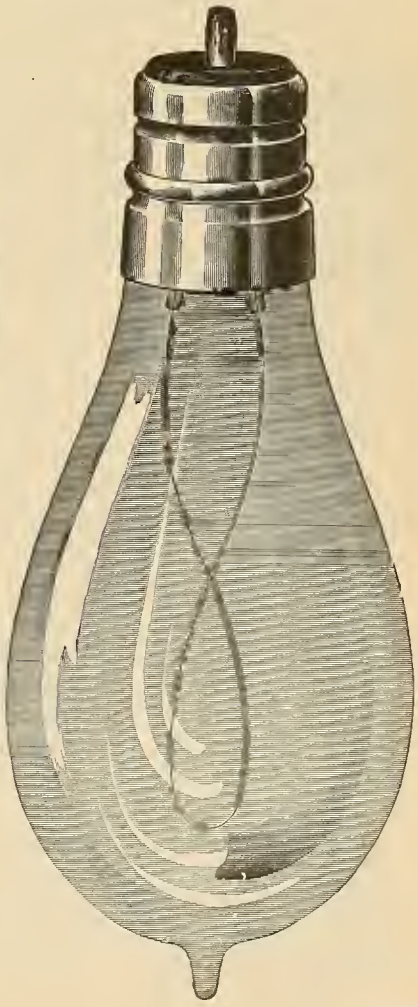

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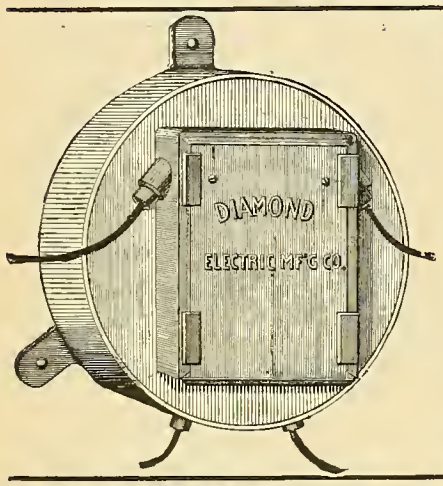

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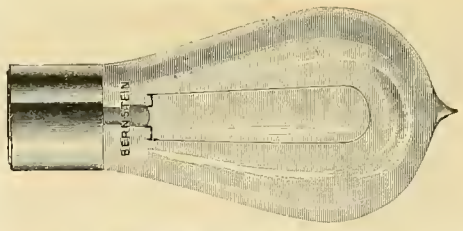

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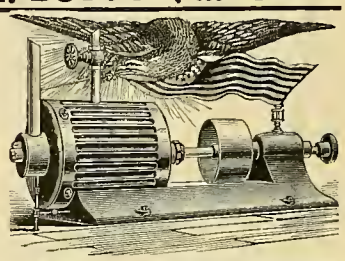

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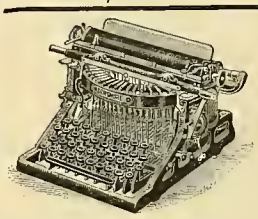

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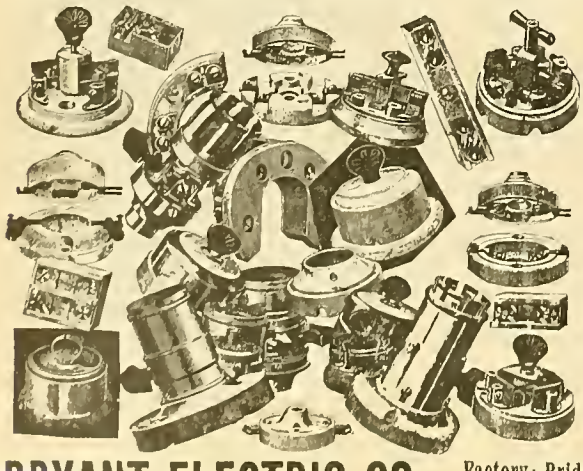

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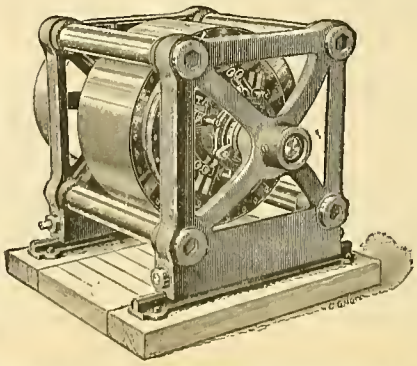

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Western Electrician.

EVERY SATURDAY.

Vol. XI. CHICAGO, SEPTEMBER 10, 1892. No. 11

Electric Railways on the Pacific Coast.

In the face of determined and well organized opposition from the powerful cable companies that are operating in San Francisco, the electric railway has at last gained a foot-hold in the cities of the Pacific coast, and rapid progress in the development of this branch may be looked for. The "deadly trolley," about which so much was said by the newspapers under the baneful influence of the cable clique, has lost its terrors. It has been conclusively shown that, with proper construction and under careful management, the overhead electric system is not only much more economical than the cable system, but that it is comparatively harmless and noiseless, and that vastly superior service can be given. All of these facts have been demonstrated in the construction and operation of the Oakland, San Leandro & Haywards Electric railway, and the San Francisco & San Mateo Electric railway, illustrated in the accompanying cuts. Fig. 1 gives interior and exterior views of the car house and power station of the Oakland, San Leandro & Haywards company. Fig. 2 shows the engine room of the San Francisco & San Mateo Electric railway, and Figs. 3, 4 and 5 are views showing characteristic features of the latter road. This road is operated by the Metropolitan Railway company of San Francisco and is noteworthy as being the first electric railway in San Francisco. The line is ten miles long, and is pronounced a model of fine construction. It is not designed to cover a heavy business district, although it passes through a territory somewhat devoted to retail trade. For the most part it passes through a residence district. The company wishes to open a section for residences that has every advantage except rapid transit. Already there is an appreciable advance in the real estate along the line of the electric road. The electric road parallels a cable line for a short distance, and on this account considerable rivalry was encountered. Its route is picturesque. Leaving the level stretches of sandy street, it surmounts an eminence that affords a beautiful view in every direction, and then it gradually descends to terminate at the shore of the bay. One of the views, Fig. 3, shows a car on a trestle on the San Mateo line, and Fig. 4 shows a car mounting an 11 per cent grade. Fig. 5 illustrates a cooling pond where the water used in condensing is sprayed from fountains. This pond is 30 feet in diameter.

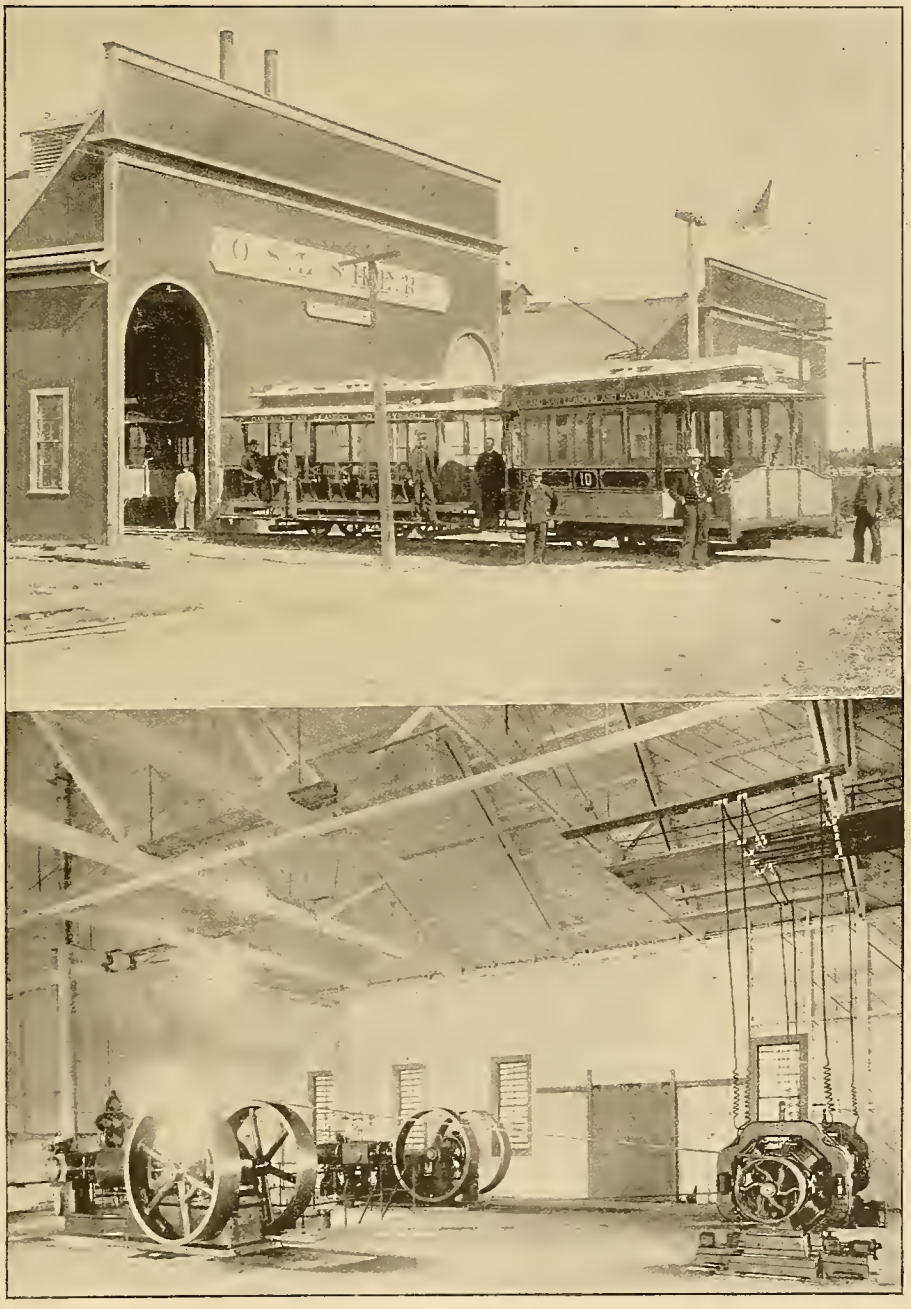


FIG. 1. ELECTRIC RAILWAYS ON THE PACIFIC COAST.

The electrical equipment consists of eight Thomson-Houston generators of 80 kilowatts capacity each. The motor cars are equipped with Thomson-Houston motors. These cars are of the combination type, partially enclosed. No trailers are drawn on this line, owing to the numerous steep grades.

The Oakland line is also equipped with Thomson-Houston apparatus and is operating satisfactorily. In fact, the excellent service which this road is giving has led to the introduction of several ordinances in the Oakland city council for the substitution of electricity on old horse lines, and the building of new electric lines. It will be seen that the field for the electric railway on the coast is excellent, now that the people have had an opportunity to experience some of the advantages to be derived from this method of propulsion.

An ordinance is pending in the Cincinnati, O., board of aldermen, providing that all wires and conductors, except trolley wires, shall be put under ground in subways, the subways not to interfere with any local improvements that may be made along the street.

Electricity at the World's Fair.

If the happenings of the last week in World's Fair circles are to be taken as a sample of what is to follow as the great work advances toward completion, the task of the news gatherer stands a fair chance of becoming one in which a vivid imagination might be made to play a serviceable part. Lemuel Bannister, vice-president and general manager of the Westinghouse company, was in Chicago last week on private business, but he was unable to arrange his affairs so as to find time to visit the grounds and inspect the work of his engineers.

Superintendent Keller has decided to move his office from the east to the west end of the gallery in the Horticultural building. The quarters of the Westinghouse company and the New York Insulated Wire company have heretofore been, as it were, in one apartment in the east end of the gallery.

Among the numerous improved fixtures that the Westinghouse company will introduce in its World's Fair work will very likely be an all glass incandescent lamp. The fact that lamps with metal and cement butts often give trouble when exposed for any length of time to the weather led Mr. Keller to devise the improvement. The lamp as yet has not been fully developed, but there is a fair prospect that it will be perfected in a short time. The socket for outside service with the glass lamp will be either porcelain or glass.

As an instance of the advanced ideas—to say nothing of good taste—of the Westinghouse engineering corps at the World's Fair grounds, it should be stated that many of the handsomest drawings made in the east end of the Horticultural building come from the pen of a lady. This young woman has her own board and does her work like any other delineator, and it is said the knights of the "T" square and triangle at the grounds have to "hustle" to keep even.

There has been some talk to the effect that the World's Fair launch contract was to be divided. It will be remembered that the ways and means committee of the exposition company, acting on the advice of its chairman, H. N. Higinbotham, who had the matter in charge, set aside the recommendation of the construction department and decided in favor of the Electric Launch and Navigation company, of New York. The rumor last week was that the contract would be divided. Secretary Crawford of the ways and means committee pronounced this rumor false.

The department of electricity has been offered a 1,600 horse-power combined engine and dynamo by the Helios company, of Cologne, Germany, through Prof. Max Luhn. Prof. Luhn is here to arrange for his company's exhibit. His

wish was to obtain a lighting contract, but this was out of the question, as his company could not guarantee to furnish the machinery until after July, 1893.

It has been decided to add to the names on the friezes of the electricity building that of Cyrus W. Field. A letter has been received by General Eckert, of the Western Union Telegraph company, in which it is stated that the Rev. Stephen Field has promised to send on to the fair Cyrus W. Field's interesting collection of cable-laying relics. These relics will be exhibited in connection with the Western Union display. The department has also been offered all of Prof. Henry's experimental apparatus which is now at Princeton College. Secretary Hornsby will go to Princeton shortly, to arrange for the proposed exhibit.

The department is assured by England and France of magnificent displays. Charles Mascart, engineer of bridges and highways and director of installation of the French commission, has been in Chicago for several days. France will light the French space in the electricity building, and Germany will light its space.

New Isolated Electric Lighting Plants in Chicago.

The approach of the World's Fair has greatly stimulated building operations in Chicago and naturally tended toward improvement in the electrical business of the World's fair city. The sky-scrapers that have been erected in the down town districts are all equipped with electric lighting plants or connected with central stations. Many new hotels have been constructed with the view of accommodating the throngs that will be attracted to Chicago by the

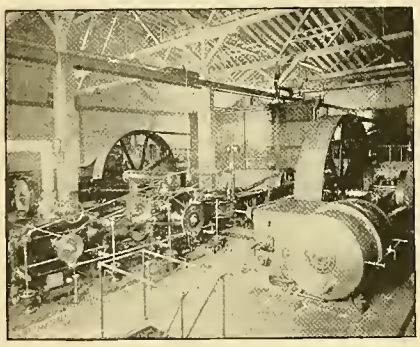


FIG. 2. ELECTRIC RAILWAYS ON THE PACIFIC COAST.

big exposition, and many of these have been fitted up with every luxury known to modern art and ingenuity. As a matter, of course, these hotels and big commercial buildings will be lighted by electricity, and in many of them there will be isolated plants large enough to supply a small town. In the Lakota, for instance, there will be five 190,000 watt machines. This hotel which promises to be one of the finest in the country, will be eleven stories high, and will be wired for 3 000 incandescent lamps. There will be several elevators—for passengers and freight—all operated by electricity. The St. Charles Hotel—another south side caravansary, will have two 25 kilowatts machines and will be wired for 1,100 incandescent lamps. The Wellington Hotel, now supplied with current from the Chicago Edison company's central station, is installing two machines—one 60 kilowatts and one 25 kilowatts.

Among the latest commercial buildings is that of the Produce Cold Storage Exchange, a ten story structure on Lake street. The electrical equipment will consist of one 45, one 60 and one 50 kilowatts machines, 35 Ward arc lamps and 1,500 incandescent lamps. There will also be two Hale electric elevators The e plants are all being installed by the Chicago Edison company. The same company is putting in a plant at the Pullman Works, consisting of a complete arc light plant of 600 lamps, 10 dynamos of the wood type, 1,000 incandescent lamps and one Edison machine.

The Mohawk Valley Electric Light & Power company has been incorporated with a capital of $40,000. Its principal office will be at Canajoharie, N. Y., and it will furnish electricity for producing light, heat and power, and in lighting streets and buildings in the towns of Palatine, Canajoharie, Minden and St. Johnsville, and in the villages of Fort Plain, St. Johnsville, Nelliston, Palatine Bridge and Canajoharie. The directors for the first year are: George H Smith, of Canajoharie; David Zieley, Jr., of Brooklyn; Edwin N Sanderson, Fort Edward; Irving Miller, Palatine; and Octavio A. Zazos, of Dobbs Ferry. The company has already advertised for bids for the construction of a dam across the Garoga creek, near Palatine Church. The size of the dam will be 200 feet from bank to bank, and will be 30 feet in height with power producing capacity of nearly 500 horse power.

Underground Wires for Rochester, N. Y.

The Consolidated electric companies of Rochester, N. Y., and the city officials have been engaged for several weeks in an effort to devise a scheme for placing all electric wires underground in the business portion of the town. The city has submitted a proposition to the company providing that the company builds a conduit on Main street, from Plymouth avenue to University avenue; on Exchange and State streets, from the Erie canal to Allen street, and on North and South St. Paul streets, from Court street to Andrews street, sufficient to accommodate all the wires of the company, and, in addition, not

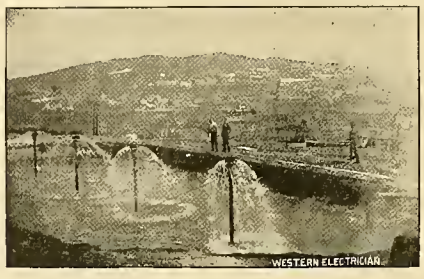


FIG. 5. ELECTRIC RAILWAYS ON THE PACIFIC COAST.

to exceed twenty ducts, for the use of the city, or other corporations or individuals, one-half of such additional ducts to be on each side of the street; the Edison system, however, to be laid on top of this conduit, in its latest and most improved conduit; the kind, capacity, method of construction and occupation of said conduit to be under the direction of the common council, executive board and city electrician. The common council shall also have the right to direct the rental of any or all of the additional ducts. In the contract shall also be a provision for the purchase of such conduit, and the terms thereof, under the direction of the common council.

It is probable that a contract embodying these provisions will be executed as both the company and the city is desirous of effecting a settlement of the question at once.

Elihu Thomson's Telephone System.

New systems of telephony are numerous nowadays, but telephone men will be interested in Prof. Elihu Thomson's latest effort in this line.

In his system Prof. Thomson utilizes upon the line in place of a continuous battery or dynamo current, an alternating current of such a low rate of alternation as not seriously to interfere with speech. The preferred rate of alternations is as low as thirty-two vibrations per second, or even below sixteen vibrations per second. These rates

FIG. 4. ELECTRIC RAILWAYS ON THE PACIFIC COAST.

of vibration are so low that although the instruments are subjected to them they do not seriously interfere with speech, as the tone they produce is almost inaudible on account of the small volume of air set in motion by the diaphragms of the instruments.

In the Thomson system all local batteries are dispensed with at the subscribers' end of the line, and the system is, as it were, a closed circuit possessing great flexibility. The system also permits the working of the annunciators at the exchange by the subscriber momentarily opening the line by a switch, or better, by the simple act of lifting the telephone from the hook, while the replacing of the telephone on the hook again signals the exchange that the use of the line is discontinued. The system also provides circuits, if found desirable, so that there shall not be any circuits actually grounded, as connections to earth through condensers may be made instead of returning through a continuous conductor or a metallic circuit connected to earth, such as is ordinarily employed.

The system will be better understood by reference to the accompanying diagrams.

Fig. 1 illustrates the invention as applied to the exchange of a telephone system. Fig. 2 shows the preferred character of current used in operating the system. Figs. 3 and 4 are diagrams showing the arrangement at the subscriber's end of the system. Fig. 5 is a modified type of transmitter, which may be employed in some cases.

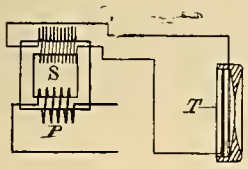
In Fig 1, at G, is indicated a generator of alternating currents, which may consist simply of a coil of wire wound upon a laminated iron core and which is driven by suitable power, or, preferably, around which is driven a set of magnets N S. The generator A has a coil in which alternating currents are generated, and the preferred form of wave is indicated in Fig. 2—something like a saw-tooth or pointed wave. The construction of the field and armature will have to be modified to approximate this form of wave. These are principles now well understood in the art and the result may be achieved in a number of different ways. Connections are led from the coil A, in which the alternating currents are generated, to a set of secondary coils or transformers, indicated at B^1 B^2 B^3 B^4, as many as there are subscribers' lines entering the exchange. These transformers may be connected in multiple or series or in any other arrangement, but are shown connected in multiple from the terminals leading from coil A. The primary coils, therefore, receive the same alternating current impulses or pulsating impulses, as are generated in the coil A. These primary coils work inductively on secondary coils wound upon the same core or in inductive relation to the primary coils, and the secondary coils are in the subscribers' lines or arranged to be in the subscribers' lines when com-

FIG. 3, ELECTRIC RAILWAYS ON THE PACIFIC COAST.

munication is desired to be had. The subscribers' lines leading from these secondaries are shown as four in number a b c d and may, as usual, be led off to considerable distances. The terminals of the secondary coils not connected to the lines a b c d are arranged to be connected to earth at E' through a condenser K or directly to earth, as desired, and in the lines a b c d, as at e f g h, are arranged annunciators, which, so long as current flows in the lines, retain their drops in position, but on a momentary interruption of current occurring, allow their drops to fall and indicate that the subscriber desires to use the line or call the exchange. Arrangements should exist, but they are not shown in the figure, for plugging into the subscribers' lines, as usual, the exchange-instruments, whereby the operator can communicate with the subscriber. The transmitter and receiver used in the exchange will be similar in pattern to that which the subscriber uses. On a call being indicated by the droppings of an annunciator, say at e, the operator plugs or switches line b in the ordinary way to the other subscriber's line, and at the same time disconnects the earth at E'. This may be done by the insertion of plug switches or by the ordinary exchange switch boards. Assuming then that the lines a b c d have been connected through the exchange in response to a call from either b or c, communication can now be had between the subscribers on those lines.

In Figs. 3 and 4 is shown the subscribers' equipment, which consists of a call bell H, consisting of an electromagnetic arrangement responsive to an alternating current of low frequency and considerable intensity. It also consists of the transmitter transformer I, a coil of which, as P, is connected into the line when in use, while the secondary S is connected locally through the transmitter T, whereby variations of the amount of closure of the circuit through the coil S may be obtained, and the secondary S may have a current of very low potential when metallic electrodes are used in the transmitter or when the variations of resistance in that circuit are obtained by a diaphragm acting on a mercury globule. It would be of higher resistance, but still of comparatively coarse wire if a carbon transmitter were used, and in the case of a static transmitter, such as is

shown in Fig. 5, consisting of a condenser whose plates are brought near together and capable of being moved by the waves of sound of the voice it would be a very high resistance coil of very many turns. R represents the receiver, introduced into the line in series with the coil P, and they may be connected through a transformer, as is the transmitter, and wound accordingly. The receiver is of the ordinary type, such as is used in common telephone practice. An earth connection should be made, as at E^2. This earth connection may, however, not be a complete conducting connection, but may be made through a condenser of suitable capacity, so that the line remains insulated while still capable of transmitting the waves of current. At R' is shown in dotted lines the position of the telephone receiver when hung upon its supporting hook or rather its position in the act of being hung upon its hook. When unhung, contact i is closed and would form, if it is desired to use the connection, a shunt to the bell magnet H. As, however, the bell magnet does not respond to the normal impulses during speech, it is not necessary to so connect it except to avoid the self induction or resistance. At j k are contacts, which are operated as follows: When the telephone receiver R is unhung, the circuit is closed at K by the movable lever on which the telephone is supported, (indicated at l,) always tending upward and depressed during the hanging of the telephone receiver. This completes the line through to the transmitting instruments. When the receiver R is hung on the level l, contact is closed at j and the connection is made which cuts out the transmitter and receiver and keeps only the bell H in the subscriber's line b. This set of switching actions is not essential to the operation of the system, but it is quite useful in the following particular: In taking the receiver R from the hook, contact at j is opened before contact k is



FIGS. 2 AND 5. ELIHU THOMSON'S TELEPHONE SYSTEM.

closed, or, in other words, there is a momentary opening of the line. This momentary opening of the line may be the means of signaling to the exchange or dropping the exchange annunciator, the system operating like a closed-circuit system. When the annunciator drop is lifted, it is held in its lifted position so long as the line from earth plate E' to earth E^2 is intact, whether the condensers are used in the line or not. During this time the secondary B' is sending impulses at a low rate—say sixteen or twenty vibrations per second—but not of sufficient force or potential to ring the bell H. The lifting of the receiver R and lever l opens contact j a slight time before closing it at k, and the annunciator e drops, indicating that the subscriber has lifted the telephone from the hook and desires to communicate. The exchange now answers the call by plugging in the telephone at the exchange, using a telephone set similar to that which the subscriber has. The subscriber speaking into the transmitter T varies in any suitable manner the resistance of the circuit S, which is in inductive relation to the coil P in the line. The circuit of the transmitter S forms a closed circuit secondary to the primary coil P in the line through which alternating currents are constantly flowing when such coil is in circuit. The variations of resistance of this closed secondary circuit set up variations of counter electro-motive force in the coil P, which react throughout the connected lines and at a rate corresponding with speech vibrations, and these smaller superposed waves on the low-rate alternating current or pulsating current impulses are carried to the other subscriber on the line at c, where they may be heard in a receiver R^2 if lifted from the hook, as at l^2, whereby contact k^2 is closed. The subscriber on the line c has a similar set of instruments to those just described, and the connections are substantially the same. It may be mentioned that the back contact of the lever l, (indicated at j^2,) may either be connected to earth directly, or it may be connected by a wire to earth, as shown in dotted lines w, instead of the earth connection to the line leading through the instruments. In this case the earth plate to the left in the figure will be dispensed with and the earth plate to the right will be connected by the wire w through the instruments to the left-hand contact at j.

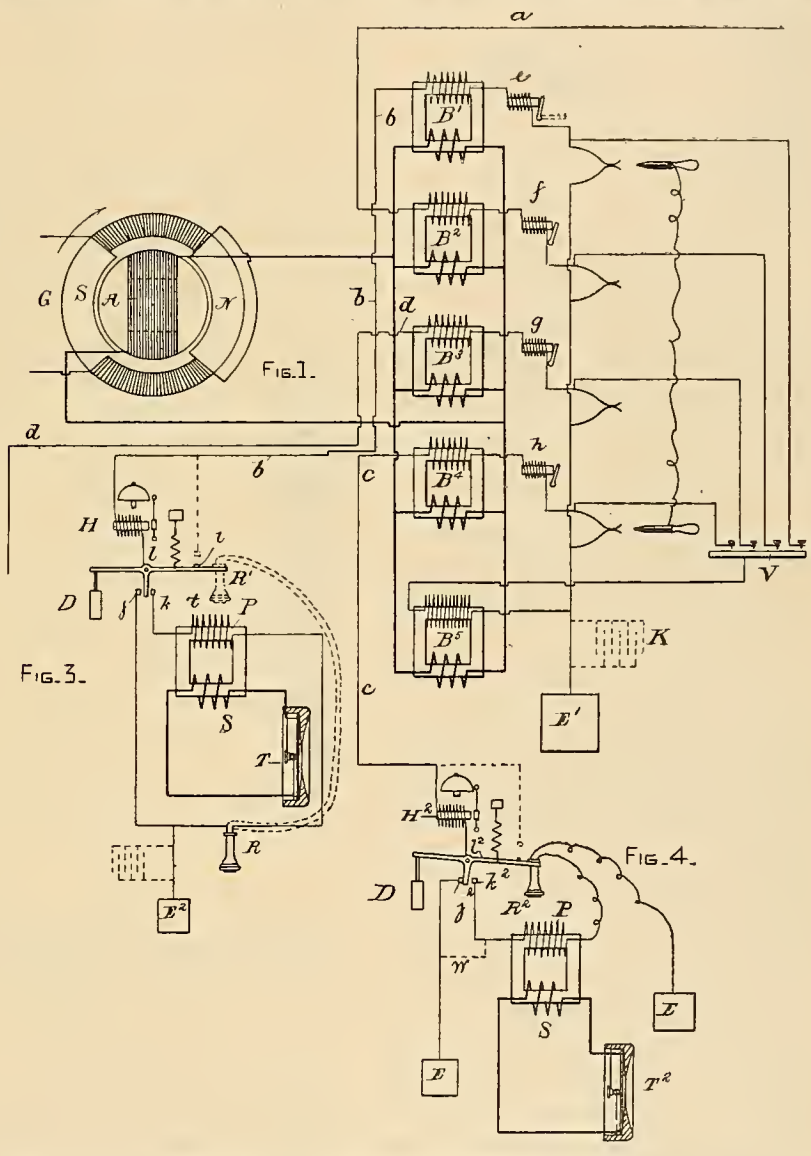
Since alternating currents or impulses flow equally in both lines b and c when connected, speech may be had back and forth from one end to the other by the use of the transmitters and receivers provided, and although there is an alternating current traversing the line simultaneously, it is a low-period current which hardly produces any effect in the receiver on account of its low rate, and, in fact, in any case could only produce a very low hum upon which the waves of the voice are superimposed.

With the form of wave shown in Fig. 2, in which there is a quick change of the current at all times, there are no dead-points of communication which would stop the action of the transmitter except at the tops of the waves; but with the normal strength and rate it is an indication that the line is complete.

In this system the subscribers' apparatus becomes practically a fixed apparatus not requiring attention such as is demanded in the keeping up of a battery, and the electrical energy which is at the command of the subscriber is as unlimited as the resources of the exchange permit. If it is desired, no part of the system need be grounded.

Fig. 5 shows a transmitter in which the secondary S is of very fine wire and connected to two parallel plates which form a transmitter condenser, the movements to and fro of the plates during speech varying the condensing capacity, and therefore the amount of flow of current in S and inductively the action of the coil P. This arrangement to be effective should have as much condenser surface as possible, or a higher rate of alternations be used than with the other type of transmitter.

In order to insure that the circuit of each subscriber's line shall be opened for a moment during the removal of



FIGS. 1, 3 AND 4. ELIHU THOMSON'S TELEPHONE SYSTEM.

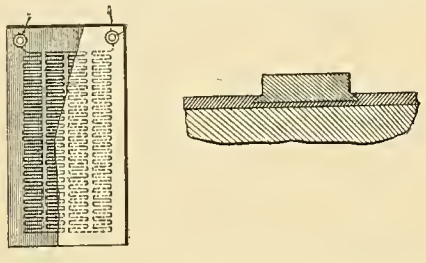
these are so small a portion of the general wave that they do not affect the speech transmission perceptibly.

It remains to describe the arrangement by which the exchange calls the subscriber. For this purpose a transformer, as at B^5, may be provided, which is capable of being connected into the subscribers' lines by proper switch appliances, as at V, and which transformer B^5 may be made to produce currents of great vigor which add themselves to the currents already found upon the lines and due to the transformers B', B^2, B^3, and B^4. With this added current the bell-magnets H may easily be made to respond to the alternations, their adjustment being such that during the transmission of speech alternations they are incapable of operating the bell and require the added current to actuate them. The rate of alternations impressed upon the lines may be just rapid enough to produce a low hum and may serve, therefore, as an indication of the condition of the line. If the subscriber in listening at his receiver does not detect the low hum, he will know at once that the line is interrupted. If, however, it be heard the receiver and the replacing of the same, it is advisable to provide the sustaining hooks with dash-pots or other retarding mechanism, whereby an appreciable interval elapses in the change of position of the lever from its upward to its downward position or the reverse. Such devices are indicated at D D as dash-pots filled with fluid for checking the motion. Of course it is not essential in signaling from the exchange outward to the lines that the same frequency of alternations be used, or that alternating currents be employed at all, as by making the subscriber's bell sensitive to interrupted currents, or by making them sensitive to particular periods of currents the signals may be effected by different currents from those which are used normally upon the line. The signal arrangements do not form an essential feature of the invention, and may be replaced by the ordinary magneto and a proper signaling system used in connection therewith; but it is preferred to combine the features which have been described in the complete system of this character, as it gives economy of operation and economy in the plant.

The Carpenter Enameled Rheostat.

The accompanying cuts will enable the reader to obtain a clear idea of the general construction of the rheostat manufactured by the Carpenter Enamel Rheostat company, of Bridgeport, Conn.

In the device there is employed a base plate of metal for receiving a coating of enamel or similar vitreous material, which is adhesive and a non-conductor of electricity. Many such materials, suitable for the purpose, are now manufactured and applied to many kinds of utensils, generally in a plastic condition and fused for the purpose of attaching to the article, and sometimes are applied in a liquid or powdered state. In this coating is embedded a resistance, consisting of fine wire reflexed, covering practically the entire surface of the base plate, the sections of which are by the coating of enamel or equivalent material secured firmly in position upon, but



FIGS. 1 AND 3. CARPENTER ENAMELED RHEOSTAT.

insulated from the base plate and correspond with the usual coils of a rheostat.

In some kinds of work—such as electrically operated street cars and in some electric light systems—the rheostat employed may have a fixed and unchanging resistance, and therefore no means need be provided for altering or varying its resistance. When such is the case, the instrument may be constructed as shown in Fig. 1, with any desired number of sections of the resistance. In cases, however, where it is desirable to have the rheostat so constructed as to be adjustable for varying resistances, as usual in this class of devices, it will have the general character illustrated in Fig. 2. In this type of rheostat there is also embedded in the coating of enamel the connector-wire leading from the pivot of the switch lever to the binding posts, as shown by dotted lines, and also a series of contact blocks.

In the practical manufacture of these devices, it has been found most advantageous to first coat the base plate uniformly over its entire surface, then set the various resistance coils or sections, wires and contact blocks in position, afterwards applying one or more coatings of the enamel or equivalent material, covering the wires, but leaving the upper faces of the contact blocks exposed; the blocks, for the greater security against displacement, being provided with a lateral flange, Fig. 3, around their base, which is covered by the enamel.

To prevent any undue heating of the base plate when heavy currents are passed through the resistance, the back is ribbed, corrugated, or provided with a series of projections, as shown, which permits a free circulation of air around the back of the plate, and at the same time exposes a large surface for the radiation of the heat.

It is claimed that in this rheostat the cost of construction is reduced to a minimum, while simplicity, compactness, and durability are promoted to the maximum, the enamel or equivalent material serving to retain the resistance coils in position against displacement, protecting them from external injury, preventing the danger of fusion of the resistance, and perfectly insulating the coils from their support and from each other.

Electric Cigar Lighter.

This little device, shown in the cut presented herewith, was designed for use on the counters of cigar stores, to afford a light only as required, thereby saving the expense of a constantly burning flame.

With this lighter the flame is produced by the act of moving the torch from its sheath or holder, and the flame is extinguished by the act of returning the torch to its sheath.

The torch or lamp has a tube corresponding in cross-section with the interior of its sheath, as shown. This torch has one end permanently closed and the other provided with a removable stopper. This stopper is provided with a ring, which affords a convenient handle for using the torch. A wick tube leads out of the tube and the latter is filled with wicking or other absorbent matter to hold the alcohol, part of the wicking being exposed through the wick tube. One end of the wick tube is curved inwardly toward the wick and is made with a projecting lip.

A plate is fastened to the base, and to this plate is secured an arm of conducting material, which extends up over the sheath and has applied to it a contact spring. This spring is in the line of travel of the wick tube. Connections are made between the arm and sheath, and a battery, as indicated, the circuit being normally open. If now it be desired to obtain a flame, the torch is pulled out of the sheath, the wick tube traveling in the slot. As the wick tube's projection comes against the contact spring, the electric circuit is closed, and when the projection passes or is released from contact with the spring, the circuit is broken with a spark, which ignites the wick. After the light has been used, the torch is returned to its sheath, the curved ends of the passage way co-operating with the wick tube to guide it, and the wick tube is shoved home beneath the lip, thereby extinguishing the flame. As the lip is springy it may be made to fit the wick tube so closely as to prevent undue evaporation of the inflammable fluid with which the wick is charged. The parts are inclined so as to facilitate replacing the torch. This lighter was devised by W. J. Eastman, Waterville, N. Y.

The Fall Festivities Illumination at St. Louis.

Electricity plays a prominent, if not the leading part, in the magnificent street illuminations now in progress in St. Louis, under the direction of the Autumnal Festivities association. These street illuminations were begun in a quiet way thirteen years ago, and have been continued and improved each year until the present, when they are

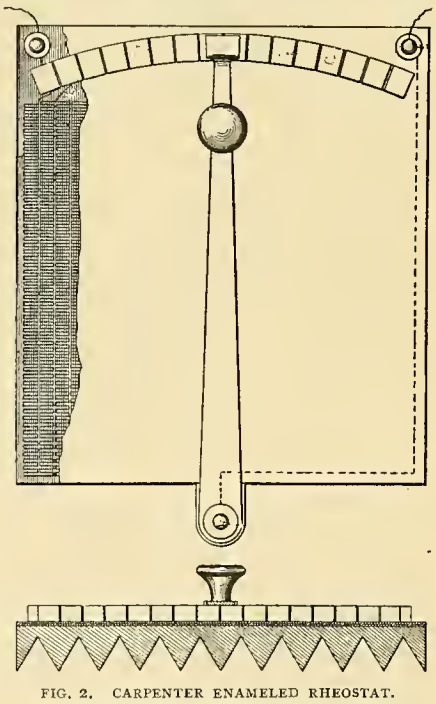


FIG. 2. CARPENTER ENAMELED RHEOSTAT.

on a scale of gorgeous magnificence and unprecedented extent.

J. C. Wilkinson, who has been chairman of the committee for three years, has made a thorough study at home and abroad of the possibilities in street illumination by means of gas and electricity, and is to be congratulated upon the results secured.

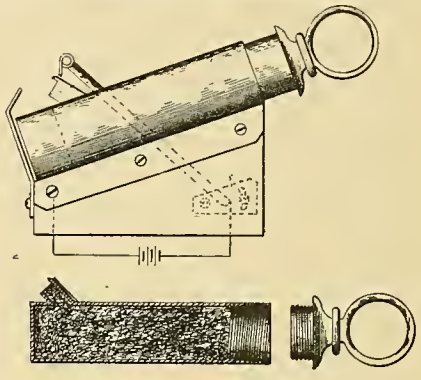
The expense of this year's display is placed at nearly $300,000. The grand total of lights is made up approximately as follows:

16 candle power incandescent electric lights,			14,000.
2,000	"	arc " "	50.
16	"	gas jets	60,000.

The dates set for these public illuminations include August 25, September 1, 3, 5, 15, 22, 29; October 1, 4, 6, 13 and 20. The lighting commences at 7 p. m. and continues until 8:30 except on special occasions, when it is not turned off until later.

Those exhibitions which have already taken place have been complete successes, and St. Louis now claims the distinction of being the carnival city of America.

To be more specific as to the nature of the display, it may be said that over six miles of streets are illuminated. The most brilliantly lighted are Twelfth, Olive, Broadway, Washington, Franklin and Fourth. On Twelfth street the displays made up a panorama in celebration of the quadro-centennial of the discovery of America. Starting south from Washington avenue, the first design is a huge representation of the Western hemisphere, 100 feet in circumference, situated on a pedestal whose total height is 120 feet. Two thousand incandescent lights are used on this piece, which depicts the discovery of America and its advancement in civilization. An electric motor automatically operates a series of switches, by which lights are turned on and off, and certain sequences and combinations are obtained, giving the effect of vanishing and motion. First, a very bright light appears, indicating San Salvador; simultaneously appears the date "1492" in mammoth figures, 25 feet above the hemisphere. At the same time the effect is given of a vast expanse of waters by means of intermittent lights. Then



ELECTRIC CIGAR LIGHTER.

follow the illumination of certain other regions indicating the discovery and settling of the Florida coast, British North America, New England, and finally the western portions of North America, with deep shadows indicating the mountain ranges. The series is repeated continuously, and occupies two minutes in each presentation. The electrical mechanism required to bring about these results is very intricate, and this piece is considered one of the masterpieces of the display. High above the figures "1892" appears, as though suspended in the air, a star with the name "St. Louis,' both indicated by many incandescent lights. When the whole design was illuminated the effect was perfect.

The next figure met with on going south on Twelfth street is the Grant statue, above which are crossed the flag of the United States and the original personal flag of Columbus, presented to him by Queen Isabella, and known as the Castile and Leon. This flag was carried by the flagship of Columbus' fleet, the "Santa Maria." Two thousand five hundred incandescent lamps are used on the design, and 500 more on the statue itself. A motor arranged similar to that described above turns lights on and off, giving the flags the appearance of being waved about in the darkness. In effectiveness this piece is surpassed only by the one just described.

Another piece, situated at the intersection of Pine with Twelfth street, is an exact reproduction of Bartholdi's statue of Liberty Enlightening the World, reduced somewhat in size. It is 55 feet high to the point of the arm holding the torch, from which a huge gas flame five feet long projects. In the diadem of the Grecian cap she wears a 16 candle power incandescent lamp in each spear, and her girdle and shield are lighted by incandescent lamps.

The fourth piece, which is the first seen by visitors coming north on Twelfth street from the Union depot, is a representation of the ship of discovery, the "Santa Maria," in exact imitation of that noted vessel. The effects obtained by turning lights on or off are also wonderfully shown in this piece, the lights representing the waves being very effective, giving the ship the appearance of being rocked in the waves. On one side is a towering column marked "Spain," and the good ship journeys toward the other side, where there is a similar column inscribed "America." Nearly 3,000 incandescent lights are required for this piece.

Twelfth street, which is a plaza 150 feet wide, is bordered on both sides with series of arches supporting gas jets. Each arch is 27 feet high, and holds 50 gas jets. There are on Twelfth street 80 of such arches.

On Olive street the illumination extends from Seventeenth street to Fourth. On Seventeenth street, which is the summit of the hill, visible for many miles each way, there is a column 125 feet high provided with vanishing serpentine lights. The piece used 1,500 incandescent lamps. Along Olive there is a continuous line of side walk arches, and a large number of arches spanning the streets, all illuminated by gas. At Fourteenth and Olive is a large painting of Washington, and at Thirteenth one of Columbus,

both lighted by arc lamps. From the latter a number of incandescent lamps radiate to give the effect of the rising sun.

Perhaps the most impressive spectacle of all is the mammoth globe suspended in mid-air at Broadway and Olive streets, the busiest corner in St. Louis. It is twenty-five feet in diameter and weighs 10,000 pounds. Two sets of electric motors are provided—one to revolve the globe on its axis, and the other controlling switches giving varied effects in turning lights on and off. The globe is a representation of the earth, the continents and islands being shown by banks of incandescent lamps, and the water by a dark background. At night the effect is wonderful, the globe appearing to hang unsupported. The location of St. Louis is indicated by a red lamp of unusual brightness. This globe is perhaps the centre of attraction. Three thousand incandescent lights are used for this piece.

At Broadway and Chestnut street is the "Presidential Arch," spanning Broadway. In barrel-shaped cylinders are life-like oil paintings of all the presidents, clearly brought out by the electric lights inside the cylinders. There is another large transparency of Washington at Broadway and Washington avenue. The latter thoroughfare is also one sea of light. The central electroliers, serving also as brackets for the trolley and feed wires of the Lindell Electric Railway system, support myriads of gas and electric lights. There are six special ornamental designs each requiring two hundred incandescent lamps.

The gas illumination also continues out Washington avenue, and on Franklin avenue and Fourth street, with span and sidewalk arches. There are numerous smaller

HINT FOR LAMP TRIMMERS.

special figures in gas and electricity which cannot here be described in detail, but which add greatly to the effect. The many colored lamps and globes give an almost perfect result, and the whole must be seen to be appreciated.

The incandescent lights used on Twelfth and Olive streets are furnished by the Missouri Electric Light & Power company, those on Washington avenue by the Laclede Gas Light company, and those in the globe on Broadway by the St. Louis Electric Light & Power company. The arcs are all furnished by the Municipal Electric Light & Power company and the gas by the Laclede Gas Light company.

Power Transmission by Alternating Current.[1]

BY GISBERT KAPP.

Some two years ago the municipal authorities of Cassel, in Germany, determined to become purveyors of electric light and to place the generating station on the site of the waterworks pumping station, which is situated on the river Fulda, about four miles from the town. The object in choosing this site was partly to bring both undertakings under the same management, and so reduce administrative expenses, but chiefly to utilize an existing turbine plant which had been erected for driving pumps to augment the natural supply of water by gravitation, which was found in the hot summer months to be scarcely sufficient for the requirements of Cassel. The gravitation supply being abundant during the rest of the year, the turbine plant and an auxiliary steam engine, erected as a standby to the turbines represented so much idle capital during all the time that motive power was not required for pumping. It was thus obviously good policy to put the central electric station upon the site occupied by the waterworks, using for motive power the turbine plant and stand-by engine already existing, and this the more so as the two services—namely, water and light supply—do not scarcely, if at all, overlap. In summer, when the greater part of the power obtainable from the turbines is required for pumping, the demand for light is a minimum, while in winter, when the whole of the turbine power is required for lighting, the pumps need not be worked, the power supply by gravitation being, as already stated, amply sufficient.

Having laid down this policy, the problem to be faced was how it could be carried into effect; and this was not such an easy matter as might appear at the first glance. It would of course, have been possible to lay down an ordinary alternating current station, but this would not have been a good solution to the problem. In the first place the total number of lamps that could have been installed would not have exceeded 2,500 of 60 candle power, corresponding with the maximum of 200 horse power available at the pumping station; and, in the second place, the low

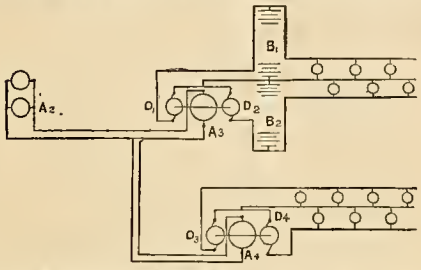


FIG. 1. POWER TRANSMISSION BY ALTERNATING CURRENT.

load factor of alternating current supply would have operated against the very object the municipality had in view—namely, to make the best use possible of their existing power plant. In order to carry out this object, it was obviously necessary to adopt some system of storage so that the turbines could work at full power continuously. With such a system the number of lamps installed could, at the same time be materially increased. Thus, an ordinary direct current station with batteries might have given these advantages but for one, and that a very serious, obstacle—namely, the great distance between the generating station and the town. It was evidently necessary to work at high pressure and to use some system of transportation at a sub-station in the the town, but high pressure direct current dynamos present difficulties which one would rather avoid than face, while the insulation of some 1,000 storage cells in series when charging, and their grouping in 10 parallels of 100 and regulation while discharging, present very serious difficulties and introduce complications. It will thus be seen that neither the ordinary alternating current system, nor the ordinary direct current system with batteries, nor the so-called Chelsea system, presented a satisfactory solution of the problem involved in the lighting of Cassel. It was nevertheless solved in a very successful manner by a German engineer, Herr Oscar von Miller, who had been called in by the municipality to carry out the work. The plan adopted by von Miller was briefly this: He determined to transmit power by single phase alternating current from the generating station to a sub-station, or rather to two sub-stations in Cassel, and to use this power for the supply of direct current on the three-wire system. At one of the sub-stations he established a battery which is charged during the hours of light load, and assists the dynamos during the hours of heavy load, so that the maximum power available shall suffice for 3,500 60 candle power lamps wired.

The general arrangement of this installation is shown in the accompanying Fig. 1: A_1, A_2 are two 60 kilowatt alternators at the generating station. These can be used singly or in parallel, and the current is transmitted through an underground concentric cable over a distance

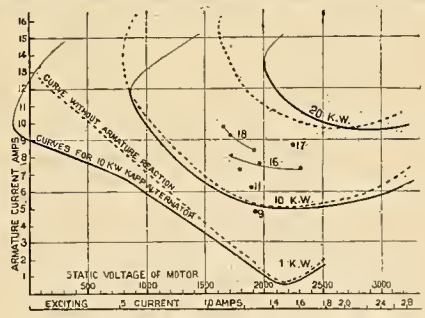


FIG. 3. POWER TRANSMISSION BY ALTERNATING CURRENT.

of about four miles to the sub-stations shown in the right of the diagram. The sectional area of each conductor is .093 square inch, and the total resistance about 3.5 ohms. The alternators are designed for a terminal pressure of from 2,000 to 2,200 volts, so that the loss in transmission, when both are working full power, is under 10 per cent.

Each sub-station contains an alternating continuous current transformer, consisting of a 60 kilowatt alternator, A_3, A_4, coupled with two continuous current dynamos, one on either side, D_1, D_2, and D_3, D_4 respectively. The latter machines are connected with each other and with the mains, in the usual way adopted in three-wire distribution. At one of the sub-stations there is a battery, B_1 B_2, also arranged on the three-wire system. The mains throughout the district are coupled so that the battery sub-station can supply current to the other sub-station through the town mains. To start any one of the two transformers it is only necessary to switch on the two dynamos, which begin to work as motors, and after observing by a synchronizer that the speed of the alternator has reached the required amount, to close the high pressure alternating current switch, when the alternator works as a motor supplying power to the two dynamos which are directly coupled to it. It will thus be seen that not only are the two alternators at the generating station worked in parallel, but also the two sub-station alternators erected in different parts of the town are worked in parallel. The dynamos are Brown's design, and the alternators are my design, both made by the Oerlikon Engineering Works, but I must distinctly state that I can claim no credit whatever for the Cassel installation, and that the whole credit for this (probably the earliest) example of power transmission by alternating currents, is due to von Miller, who, at a time when most electricians were still in doubt as to the possibility of parallel running, boldly laid down a plant, the success of which was not only dependent on parallel running, but also on the economical and safe transmission of power by single phase alternating current, using for this purpose the ordinary type of alternator as made for lighting. The plant was started on May 15th last year, and has been working since then without a hitch.

The arrangement of the synchronizer is shown in Fig. 2 where A_1 and A_2 are the two alternators which can be coupled in parallel by closing the switch, S. The terminals of the alternators are also connected by the two primaries of the synchronizer, the two secondaries being joined in series and connected by two 100 volt lamps as shown. When the synchronism has been reached the lamps become bright, and at that moment the attendant closes the switch.

As will be seen by Fig. 3, the armature current is a function of the exciting current for any given load, and there is always one of the exciting currents for which the armature current is a minimum. It is obviously advantageous to work with this particular excitation because the plant efficiency of the machine is then at a maximum. In Fig. 3 are shown curves representing the relation between armature and exciting current or static voltage of motor. These curves are determined theoretically and for three loads of 1 kilowatt, 10 kilowatts, and 20 kilowatts respectively. The dot at the curves represent the relation between the armature current and exciting current when the action is neglected, the full curves when it is taken into account. Having found this relation theoretically, I endeavoured to verify it by experiment, using for this purpose an ordinary 10-kilowatt alternator as made for lighting. The mechanical output of the alternator was determined by measuring the volts and amperes obtained from a direct current machine which

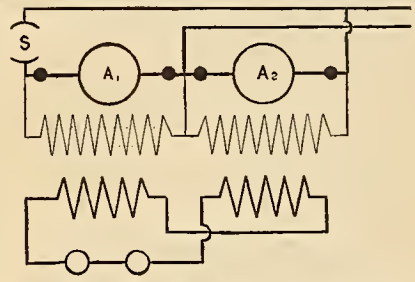


FIG. 2. POWER TRANSMISSION BY ALTERNATING CURRENT.

it drove, and making a suitable allowance for the efficiency of the latter. If the results arrived at theoretically are correct, this point should fall upon the curves, as shown in Fig. 3. As a matter of fact, it was impossible to increase the load to 20 kilowatts, but readings were taken with loads varying from 9 to 18 kilowatts, and the corresponding points are plotted in the diagram, showing a fair, though by no means perfect, agreement between theory and experiment.

ALTERNATING TO CONTINUOUS CURRENT TRANSFORMERS.

Alternating current motor.				Continuous current generators.			
Speed.	Exciting current.	T'rminal volts.	Armature current.	Machine I.		Machine II.	
				Volts.	Amps.	Volts.	Amps.
500	10	1,820	23	130	120	134	130
460	10	1,800	20	112	120	113	120
475	10	1,840	20	111	125	117	115
475	10	1,800	22	120	128	116	118
470	10	1,900	22	112	127	128	110
465	10	1,920	22	122	115	120	122

By the courtesy of Herr Von Miller I am able to give the foregoing readings of the working of the battery sub-station, taken at my request about a month ago. Although at that time of the year the load is necessarily light, the total efficiency of the transformer, even if we neglect the correction due to lag, is satisfactory.

Hint for Lamp Trimmers.

The accompanying cut shows the novel adaptation of the bicycle to electrical purposes at Concord, N. H. The arc lamps used for lighting the streets are scattered over a large area, and it necessarily takes the trimmers a long time to make the rounds. The introduction of the bicycle enables one man to trim many more lamps than before, even with a team. The patrol finds the wheels a great addition to the equipment, enabling the men to look after a large number of lamps easily and quickly and with the further advantage of making better time than a horse.

1. Paper read before the British association at Edinburg.

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CORRESPONDENCE relating to electricity, or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

PAGE.

Electric Railways on the Pacific Coast. Illustrated.....133, 134
Electricity at the World's Fair. Illustrated.....133, 134
New Isolated Electric Light Plants in Chicago..... 134
Underground Wires for Rochester, New York..... 134
Elihu Thomson's Telephone System. Illustrated 134, 135
The Carpenter Enameled Rheostat. Illustrated..... 136
Electric Cigar Lighter. Illustrated..... 136
Fall Festivities, Illumination at St. Louis..... 136
Hint for Lamp Trimmers. Illustrated..... 137
Power Transmission by Alternating Current. By Gisbert Kapp. Illustrated 137
Editorial..... 138
Electric Railway in the South 139
British Association Meeting..... 139
New York Street Railway Convention..... 139
New English Electric Locomotive..... 139
Electricity in Sweden..... 139
The Railway of the Future. By Oberlin Smith.....139, 140
Electric Railways for Oakland, Cal..... 140
Wide Awake and Progressive..... 140

DEPARTMENTS.

Correspondence..... .....140, 141, 142
New Incorporations..... 143
Electric Lighting..... 143
Electric Railways..... 143
Telegraph..... 143
Telephone..... 143
Miscellaneous.....143, 144
Trade News..... 144
Business..... 144
Electrical Patents..... 144

It is not often that designers of heavy electrical machinery invade the field of the telephone engineer, but Prof. Elihu Thomson's researches have led him into this very promising territory. A result of his investigations is given elsewhere in this issue in a description of a new telephonic system that he has devised. The new Thomson system is presented in detail and telephone men will doubtless examine it with more than usual interest. Prof. Thomson employs on the lines of the system, instead of a continuous current, an alternating current of such a slow rate of alternation that its interference with speech is practically *nil*. The rate of vibration may be as low as thirty-two per second, or even below sixteen per second. In the latter case the tone produced would be almost inaudible on account of the small volume of air set in motion by the receiver diaphragms. There are no local batteries at the subscribers' ends of the lines; the system is a closed circuit one, and possesses considerable flexibility. To signal the exchange it is only necessary to momentarily open the line by, say, lifting the receiver off the hook, while the act of replacing it is made to signal the exchange that the line is once more out of service. No circuits need be actually grounded; connections to earth may be made through condensers. Prof. Thomson's system is replete with ingenious features many of which are suggestive of broader development.

A SHORT time ago the Worcester, Mass., *Gazette* gave to the world a story to the effect that the New York, New Haven & Hartford railroad was preparing plans to operate a portion of its system by electricity. The statement made by the Worcester paper went the rounds of the daily press throughout the country and excited much comment. Not long after this bit of gossip was published, Vice-president and General Manager Tuttle was questioned about the rumor. His amusing and most positive denial of the truth of the statement referred to was published in the WESTERN ELECTRICIAN of July 30th. The latest news now, however, is that the *Gazette* has noticed General Manager Tuttle's denial with a reiteration of its first statement. The *Gazette* now says:

Perhaps Mr. Tuttle is not in the secret. It is not generally known on the road. Our information comes from a somewhat more prominent official than Mr. Tuttle. Unless our informant has gone suddenly insane—and we have his statement in writing—our assertions about the N. Y., N. H & H. were literally and absolutely correct. Of course the change is not going instantly into operation.

From the above it would seem that either the Worcester paper has been led into making a mis-statement or the vice-president and general manager of the road is not cognizant of his company's business. Doubtless the *Gazette* published its story in good faith, but to those familiar with methods of railway management it would indeed be a peculiar railroad company that would keep its general manager in ignorance of so important a move as this. If there is really no foundation for the rumor other than the fact that the railroad in question is building four tracks, it is to be deplored that such stories should be set afloat eventually to be contradicted, as such reports work to the detriment of branch of the electrical industry which already has enough trials. But on the other hand, if the paper in question has authentic information that the railroad's intention is to employ the electric system in such an extensive manner, it should lose no time in vindicating itself, and no better method could be found than the publication of the "statement in writing" from the "somewhat more prominent official than Mr. Tuttle."

Attention has frequently been directed in these columns to the importance to foreign manufacturers of electrical apparatus of representation at the World's Fair. In the case of the French manufacturers it is claimed that they have been discouraged by the failure of the government to make a special appropriation for the electrical section In England it appears the prospect is not much better at the present time. The secretary of the electrical section of the London Chamber of Commerce recently sent out a circular, but it is reported that it has not met with a single favorable response. Commenting on this rather gloomy outlook the London *Electrical Review* says: "The American Commissioner has already declared in London that the object of this great exhibition is to wrest from us a considerable portion of the trade which we now carry on with South America, Canada, and our other colonies in the new world, who, they contend, by geographical and other conditions, ought to make them more their neighbors than they are ours. Our Yankee friends bid the world come and see at Chicago the result of the inventiveness and perseverance of their citizens. With our exports decreasing seriously month by month, it might be supposed that the necessity for not only retaining our present markets, but the necessity for finding new openings, would prove an irresistible argument why we should endeavor to prove that our creations are made of sterner stuff than to be hopelessly snuffed out by a McKinley tariff. If we can at such an exhibition prove that we have a superior class of goods, or that we can do what the American has not yet done, then the history of trade confirms us in the belief that we will be called in to supply goods, then the people will have them irrespective of the price, and that which is wanted will command an entry for itself into foreign ports in spite of all the hostile tariffs that statesmen can possibly devise."

Now that the cholera is threatening the country, sanitary precautions are the order of the day. The arrival in New York of the first plague stricken ship warned the country of impending danger and impressed on the officials the necessity of precautionary measures. Municipalities are engaged in the commendable work of cleaning streets and alleys, houses and outhouses. The people of Chicago should take to heart the lesson now being taught with terrible earnestness on the Atlantic coast and totally eradicate all material which would favor the spread of the plague if it should slip past the sentinels on the borders. The authorities have entered on the work of cleaning perhaps as vigorously as the circumstances permit, but, it is claimed, they have shown a culpable negligence in delaying arrangements for burning all the objectionable and putrefying substances. The city has, we believe, been experimenting with garbage crematories. To any reasonable man the burning of the disease breeding refuse would appear as the most sensible course to pursue. But to consume thoroughly all the decomposing garbage and other filth of the city, something more extensive than an experimental garbage crematory must be provided.

European cities have set an example in this respect. The "destructor" is made to burn up everything in the shape of refuse, including old shoes, rags, etc. These cities have gone even further. They are experimenting in utilizing the heat of the crematory furnace for municipal electric lighting. At the present time, when the employment of the heat produced by the destruction of town refuse for generating steam for electric lighting purposes is before the scientific world, it might be well for the Chicago city fathers to obtain information as to what is being done elsewhere in this line. The city engineer of Liverpool, England, Percy Boulnois, recently announced that he had received valuable information on the subject of the thermal value of house refuse. It is calculated on the basis that two pounds of coal is required for providing the power equivalent to one brake-horse power per hour, that the amount of refuse which would be required to effect the same dynamic effect would be 20 pounds or ten times the weight of coal required to do the same work. Of course these figures establish the fact that refuse is not first class fuel, yet there is no question but that crematories capable of properly meeting Chicago's needs would produce an amount of heat that, if it could be turned to good account in work, would furnish considerable current. It is not however an easy matter to utilize waste products but the cholera scare may be the means of bringing an indifferent city council to a knowledge of the value of the crematory as a garbage destroyer, and should this method of cleaning the city be resorted to, the further step might be taken of instructing the city engineer to consider or, perhaps, provide for, a possible utilization of the heat which otherwise would be wasted.

THE department of electricity of the World's Columbian Exposition has received assurances through General E. T. Eckert of the Western Union Telegraph company that the late Cyrus W. Field's collection of souvenirs of the laying of the first Atlantic cable would be exhibited at the World's Fair. General Eckert has written that the Rev. Stephen Field has arranged for displaying this valuable collection as a part of the exhibit of the Western Union company. This will be good news to the friends of of the fair generally and it will be of especial interest to the electrical fraternity. When Mr. Field's will was admitted to probate it was found that his collection of souvenirs and presents was about all that remained after the wreck of his once princely fortune. By the provisions of the will these memento's were to be divided. At that time the WESTERN ELECTRICIAN called attention to the value of these articles from an historical viewpoint and urged, that before the distribution be made, according to the provisions of the will, they be placed upon exhibition at the World's Fair. Mr. Field's great work had entitled him to a prominent place among the great men of the age and these mementos which he had cherished and clung to through all of his reverses, if exhibited at the World's Fair, would serve as an object lesson of one of the greatest projects of the age.

The value of the collection will at once be appreciated when it is considered that it comprises a complete record of the project. From the editional already alluded to the following abstract is taken:

One of the favorite reminders of the great work of his life was a set of paintings, six in oil and forty-seven in water color, illustrating the principal scenes connected with the laying of the first cable. These have been bequeathed to the New York Historical Society. There were also preserved the American and English flags that were floated from the Niagara and Great Eastern in the cable laying expeditions. Another valuable reminder is the table on which was signed the contract for the laying of the cable. This was a dinner table, and has always been carefully preserved, together with the chairs and ornaments about the room in which the contract was executed. Numerous medals presented by congress, legislatures and private individuals in this country, together with marks of distinction bestowed by foreign governments and scientific bodies, go to make up one of the most interesting collections of the kind in existence. Now it is proposed to distribute these mementos among the members of the family. When once divided it is hardly possible that the collection will ever again be gotten together.

It is suggested that the World's Fair authorities take steps to secure the loan of these treasures for exhibition in the electricity building. They would make an unique and interesting display, and would add greatly to the value of the historical feature of the electrical exhibition.

There is no doubt that this collection will form one of the most attractive features of the great exposition. The electrical fraternity will take pleasure in honoring the memory of the man who contributed so much to the world at large, and in showing that the value of his great work is appreciated. The department of electricity is to be congratulated upon having secured this attraction.

Electric Railways in the South.

The electric railway has made rapid progress in the South, and although some of the cities were slow in introducing the new system, they soon appreciated its advantages and adopted it on an extensive scale. This appears to be particularly true of Savannah, Ga , where the slow going mule car has been superseded entirely by the electric motor. Sandtown has an electric system comprising 40 miles of electrically equipped roads, and the people are well satisfied with the service.

According to the *Morning News* of Savannah, that city is to have the most powerful electric street car motor in the United States running at a speed equal to that of the average railroad passenger train and drawing enough cars to accommodate about 300 passengers. It will be used on the Thunderbolt branch of the system of the Electric Railway company, and will effectually prevent the overcrowding of cars running to that popular resort. The motor will be equal to sixty horse power, and will be placed on the largest and heaviest car owned by the company. Three or four trailers will be added to the motor car as business demands.

"Experts who have been here recently," says the *News* "state that Savannah has the best electric street car, lines in the world. This is now also one of the leading cities in regard to mileage of electric roads, and is probably the only city of any size where electricity has entirely superseded all other motor power. The success that has been achieved by the new lines will doubtless lead to others in the next year or two, and there are many who believe that before long the present mileage will be considerably increased."

British Association Meeting.

At the closing session of the British Association meeting at Edinburg August 10th, Lord Kelvin made an address in which he announced that a very important piece of work had been accomplished, and that was an arrangement for the final adoption of a system of electric measurement which promised to become thoroughly international. Two congresses were held in Paris in 1881 and 1884, and a great deal of work had been done in connection with the proposals of those congresses, and in continuation of work partially finished when they were held. Things seemed coming to an issue for the very important practical object to which he had referred, and the British Board of Trade had appointed a committee with a view to a final settlement of what should become legal in this country in regard to electric measurement. That committee a year after had very nearly come to a conclusion when there was happily obtained assistance and co-operation from Germany and from France, through Prof. Von Helmholtz and M. Guillaume respectively. They had affirmed in a satisfactory manner the proposed resolution of the Board of Trade in the main, and they had made exceedingly valuble suggestions for amendment, which had been adopted by the representative of the Board of Trade, who was present on the occasion. If for nothing else than a settlement of this question, with a view of it becoming legal and putting it into a strongly favorable position for being adopted as an international system by the governments of Germany, France, America, and, he thought, he might almost say, therefore, of the rest of the world, the meeting had been of very great importance. In this great work they had had assistance from America also, alike in the persons of Professors Carhart and Rowland, although the latter had not been present. They had now a distinct system of measurement for practical purposes of the quantities of electricity used and the quantity of energy supplied for illumination and other objects, the whole worked out in a form which, under successive acts for controlling the action of the Board of Trade in respect to the public distribution of electric light and power, would become the fundamental means of securing that justice was done between the supplier and the customer in those great public affairs. But the brilliance of this meeting of the association had been very remarkable in other respects besides that to which he had alluded. The papers communicated to the different sections and the discussions thereon had certainly made this meeting of greater scientific interest than almost any other he could remember. He begged to propose a vote of thanks to visitors from other countries for their communications to the sections—the Prince of Monaco, Prof. Helmholtz, Dr. Lindeck, Dr. Kahle, Prof. Carhart, Prof. Atkinson, Dr. Guillaume, Prof. Ostwald, Prof. E. Wiedeman, Prof. Errera, Prof. Goebel, Prof. Elving, Baron Richthofen, Prof. Fritsch, Dr. Schoute, Prof. Otto Pettersson and Prof. Renard.

New York Street Railway Convention.

The Street Railway association of the State of New York will hold its 10th annual convention at the United States hotel, Saratoga Springs, beginning Sept. 20th. The feature of the meeting will be the discussion of the relative merits of the electric and cable systems of street railway propulsion. George W. McNulty will read a paper on "Receat Improvements in Cable Traction" and L. H. McIntire of the Union Railway company, New York city, will read a paper on "Recent Improvements in Electric Traction."

The Kalispell Water & Electric company, Helena, Mont., has been incorporated by J. A. Coram, Frank E. Corbett, John B. Welcome, with a capital of $250,000.

New English Electric Locomotive.

At the recent meeting of the British association, E. H. Woods of London, read a paper, before the Mechanical section, descriptive of a new electric locomotive which had been designed, in the first instance, to meet the requirements of heavy traffic on metropolitan railways in substitution of steam. It was intended to run the ordinary passenger trains from the main line of the Great Northern railway to the heart of the city without change of carriage over the projected Great Northern & City railway. Engines of much greater power than those on the City & South London railway were required, and it was claimed for the new engine that it would fulfil all the conditions the line demanded, while if made on a smaller scale it would be more economical. It was proposed to work on a central rail similar to that used in the Fell system, and to arrange the electric motors vertically, so that the driving wheels might be horizontal. The necessary adhesion was to be obtained by means of springs which would press the driving wheels against each side of the central rail. The great advantage of this was that it enabled the electric motors to be kept constantly running, even when the engine was stationaary, thus avoiding the loss of power incidental to the starting of the engine now in use.

Electricity in Sweden.

Little is heard on this side of the Atlantic of electrical progress in Sweden, yet the number of electric installations in that country is constantly increasing. Of quite recent and interesting installations may be mentioned one at Ostrand saw mills, where two Lavel new steam turbine duplex dynamos, of respectively 100 and 50 horse power, have been placed. The dynamos are coupled directly with the turbines, and owing to the efficiency of the regulator, the current is absolutely constant. The larger turbine is fitted with condensing appliances, and the smaller can be used with condensing or non-condensing. Both turbines have governors. The current from these generators operates thirty electric motors, each of 4 horse power.

At the Onan's company at the Tralhatta canal an electric crane has just been installed. The crane in question had previously been worked by hand power, four men being required. An electric motor has been placed at the crane, and current is supplied by the lighting machine already at hand. The motor is easily tended by one man, so three men's wages are saved. The electric motor has been fitted with a special appliance, whereby one single handle is enough for completely working the motor.

The Railway of the Future.[1]

By Oberlin Smith.

Recent statistics tell us that there are now running, in the United States alone, nearly 4,000 electric street cars, upon 2,000 miles of track, with as much more similar plant in course of construction. These cars run faster, more cheaply and under far more perfect control than do their predecessors, the horse cars. In America this system of propulsion is commercially but four or five years old, and is barely out of its experimental stage; yet it is a magnificent practical success—with more than $50,000,000 invested in it—and this under some of the worst conditions possible for railway work. Some of these conditions consist of very narrow wheel flanges; rough tracks, obstructed with water, snow, mud, gravel and foreign vehicles, curves as sharp as thirty feet radius, grades as steep as 12 per cent., etc. A service more nearly resembling that of our present steam roads is that performed by the City & South London railway, which is practically the first underground electric road in the world and is already a great success, having during the eighteen months of its existence carried more than 7,000,000 people, with a run of over 500,000 train miles. Although not entirely perfected, a road like this forms one of the notable object lessons by which we are learning how to travel.

In the light of such experience there is no question whatever about the success of either a subterranean or an elevated electric road, if properly designed to meet the new conditions involved—and the running may be at any speed which can be made safe. We may, therefore, in our further study of the ideal railway, positively leave out of the question the steam locomotive. Great as have been the performances of this wonderful and beautiful monster, he not only refuses to climb very steep grades but he has utterly failed, in the matter of speed, to keep pace with his improved behavior in other respects. In proof of this we have records of English engines going at the rate of 75 miles an hour, forty years ago; and that is the maximum work of our present machines, although they may have occasionally touched a 90 mile rate as a phenomenon.

Until quite recently railroad men have been inclined to smile at the mention of electric propulsion, but a great many of them now admit that it is probably the proper thing for elevated lines and other special constructions. Comparatively few, however, are yet ready to accept the probability of electricity displacing steam upon the ordinary railways already in existence. These, who are among the most progressive in our great corps of railway managers, are carefully watching developments, and stand in a waiting attitude ready for whatever revolution may come. The electrical engineers, as a rule, are quite sanguine about the future use of the electric current on all classes of railways, and they are naturally proud of the great achievements that have already been made in the street car service. The attitude of the mechanical engineers in general is one of doubt, especially as regards the ordinary railway. Several carefully studied papers have been written lately with long arrays of figures which, in their author's estimation at least, respectively prove both sides of the argument. The writer confesses that he has hardly made up his mind upon this difficult question, but he inclines to the opinion that the experiment will be tried in the near future, and that it will result in a fair measure of success, especially if the cars are made lighter. We cannot, however, expect extremely high speeds with our present form of roadway, on account of the liability to derailment and collision with foreign vehicles.

A question which has been agitated a good deal among engineers who admit the desirability of electric propulsion in general is, whether a train shall be drawn by a so-called electric locomotive, or whether each individual car shall be made self-propelling, by having the electro-motors upon one or more of its axles. There are many who favor the former method, but it is difficult to see why—unless because it is a less radical departure from the old system. The arguments in the case of steam propulsion are all on one side of this question, and absolutely show the necessity for a separate locomotive, it being entirely impracticable to divide up the boiler and engine, with their complicated mechanism and the necessity for skilled attendance, among a number of separate cars. Fortunately the heavy load which it is necessary to carry, in the shape of fuel, water, boiler, etc , gives nearly enough weight for traction purposes—that is for the friction necessary to keep the wheels from slipping on the track: although there are frequent exceptions in the case of wet rails and up grades. If we could do as the old woman in the story advised the Mississippi steamboat captain to do, "bile our water on shore," and if, furthermore, the steam thus generated could be picked up in small quantities as it was wanted, along the track, and could be used in a small simple rotary engine attached to each car axle, then the best course might be to abolish the locomotive and run the cars as self-propellers.

In using electricity we have just the conditions that we cannot have with steam: a rotary motor which is as simple, as far as its motions are concerned, as a churn or a grindstone; which can be mounted upon or geared to the car axles direct; which requires but little or no attention while running and which picks up the current of electricity that drives it by a simple wire connection, as it progresses along the line. Furthermore, this electricity can be generated in stations located at proper intervals along the route, where the water is boiled "on shore" to run the great engines which produce by means of dynamos the required current. This water, moreover, is boiled with a far greater degree of economy than it possibly can be in the locomotive, with every advantage in saving of fuel and attendance which can be gained by large triple or quadruple expansion condensing engines. The great economy thus obtained in coal consumption will undoubtedly go far to offset, if it does not entirely overbalance, the loss of electricity by waste along the line, and by a certain inefficiency in the dynamos and motors.

One of the most obvious advantages of this system being the absence of any real necessity for a locomotive, it would certainly seem very foolish to nearly or quite double the total dead-weight propelled by building such a machine, and ballasting it with enough iron or brickbats to get the necessary traction, when each car can itself carry the required simple motor mechanism; and when, with its own weight and that of its passengers, no matter how lightly it may be built, it will be sufficiently heavy for tractile purposes.

It is of course unlikely, for many years to come, that there will be any radical change in the road-beds of the vast net-work of our existing railways, except in the matter of stronger tracks and bridges, and the avoidance of grade crossings and some other evils which are now being reformed upon our richer lines. Such reforms will bring them only to the high grade of efficiency and safety already existent upon English and some other foreign roads. It is probable, however, that some form of highly organized elevated railway, built with scarcely any regard to the saving of first cost, and with a vast amount of dead weight in the track, rather than in the rolling stock, will before many years be built upon some route where the traffic is large enough to pay the interest charges on an enormous first cost, in addition to meeting the comparatively light-running expenses. This road will be so built as to make derailment impossible; will be without switches or crossings; will have running upon it, driven by electricity, light narrow cars, either singly or in short trains, which will be sharp in front and smooth upon the sides, after the manner of a bird, in order that air resistance may be reduced to a minimum. If, as is probable, the electricians succeed in perfecting a block system (something that has already been experimented with in England by the lamented Professor Jenkins and others) which shall make it physically impossible for one train to approach another, either before or behind it, within a pre-determined distance, then there need be no speed limit except that due to the requirements of not braking a car so rapidly, within a given available stopping distance, as to throw passengers violently from their seats.

The actual speed which will be obtained is of course extremely problematical as yet, but there seems to be no inherent mechanical reasons why we should not, on long and absolutely clear stretches of track, obtain a velocity approaching two hundred miles an hour. There will of course be no drawbridges or other artificial gaps, and everything about the roadway and its foundations will be built with such an enormous surplus of strength, toughness and rigidity that no ordinary causes can possibly disturb it. The cars of this ideal track will be so confined that they

1. Abstract of an article in the *Engineering Magazine* for August.

cannot leave it, even should the wheels and other machinery be entirely broken up. Such machinery will of course be made of the toughest material, but will be so placed as to do little damage should it meet with accident due to hidden structural weaknesses.

These cars will be so lightly built that the coefficient of dead weight will be very small, and the stopping and starting quickly, even at the high speeds attained, a comparatively easy matter. The old-fashioned notion that the power required to move a vehicle is as the square of the speed has in recent years fallen into disrepute, and although we have not yet made sufficiently definite experiments to accurately formulate a law concerning this matter, it seems tolerably certain that while the air-resistance may approximate this rate of increase, it will not entirely follow it, if the front of the train is shaped to properly cleave the atmosphere. The other resistances, due to friction, etc., probably increase very nearly as the speed, and will, therefore, cause but little more loss of power at a high than at a low speed, when a given distance is considered. What refinements our inventors may attain to in the way of roller bearings, as they have already done in the bicycle, and what they may do in the way of guiding the car sidewise by roller friction, rather than by the grinding friction of wheel flanges, we cannot yet determine.

The cars in question will of course be lighted, and probably heated, by the same electric current which drives them. If it should prove practicable to use rubber tires upon the wheels it is easy to imagine the delightful smoothness and quietness with which they will run—and this through air untainted with sand, cinders, or steam whistles. If, to secure lightness they are not to be fitted with as many hotel conveniences as our present "Pullmans," it must be remembered that the trips will be so shortened that the want of them will scarcely be felt, at any rate upon roads of moderate length.

To make the high speeds referred to practicable, curves will be avoided as much as possible, and when they do exist they will be made of the greatest practicable radius. This method of line location will, however, be favored by the elevated form of construction, and by the fact that it will not be necessary to pay so much attention to avoiding grades as is the case of our present roads. Not only, as before stated, can an electric car mount a much steeper grade than we now deal with, but from the inherent nature of this method of transmitting power it is possible (though the principle is not yet fully developed) to brake a car electrically upon a down-grade, so that for the time being its motor becomes a dynamo. This generates an extra current and restores it to the line, which in its turn supplies some of the necessary excess of power at the up-grades. Thus, a track may undulate up and down to a considerable extent without the disadvantage of great loss of power inherent in our steam railways. This principle will, therefore, favor the arching upward of bridges in mid-channel, for clearance of boats, without elevating the approaches to so great an extent as is now done.

In regard to the location of the pioneer railway of the type indicated, it seems reasonable to infer that it will be built either between London and Liverpool or between New York and Philadelphia, for the reason that the traffic is probably of greater volume upon these routes than anywhere else in the world. It is not likely, however, that sufficient capital could be procured at the start for so large an experimental investment as would be required to build, for instance, the whole ninety miles between the last named two cities. It would seem better that a small portion of such a line should be built first, but long enough to give a proper trial to the high speed desirable, without spending all the time in starting and stopping. It may be that when one of the proposed new bridges is built across the Hudson River, the best place to try the first section of this "railway of the future" would be from the heart of New York city to some central point in a busy city like Newark, keeping in mind an open route for the future as an extension to Philadelphia.

Should a few hundred miles of such a road as this be built, and become a success as regards safety, comfort, speed and economy, as undoubtedly it eventually will, after sufficient experimenting, the new system would gradually spread throughout the world, obviously concentrating itself at first about large cities, where the traffic was sufficient to warrant the expenditure. The lessons learned by such a system of transportation would enable the ordinary roads to adopt many of the new principles involved, and we should see a gradual evolution of new methods, leading to changes of which we now can scarcely dream. These changes would spread gradually away from the large cities to the more thinly populated country districts. They would at first affect passenger lines only—the old roads, with their old methods, being kept mainly for freight purposes, and perhaps for local short distance passenger traffic. The new principles and methods would probably eventually extend, in whole or in part, to freight traffic also.

It is difficult now to say how the changes indicated will come about, whether by a comparatively slow process of evolution, adding improvements little by little to our present methods, or whether capitalists will be found with sufficient nerve to precipitate the sudden change of methods which our rapidly gained electrical experience would seem to call for. If it be asked how the actual work is to begin, the answer is: by the earnest co-operation of a body of engineers and scientists, backed by a syndicate of bankers. Such a great work cannot, if it is to prove successful, be left to a few individuals, or to an ordinary company, whose sole object is to build as cheap a structure as possible upon which to run their trains. The matter should be taken up by a powerful syndicate of capitalists, who should employ a commission of the ablest engineers available. This commission should not be composed of railway engineers alone. Such men, although perhaps of great ability in practically constructing and managing our present systems, are educated too much in conventional grooves to take the broad view necessary in instituting so radical a change of methods. In their defense it should be said that it is their business to be conventional, and their employers, the railways, could not afford to have them otherwise. There should be, however, enough of them in the new commission to give ballast and conservatism. Then there should be thoroughbred mechanical engineers, with an eye to all possible constructions based on correct principles, no matter how novel the form. There should be a sprinkling of professional inventors, to give originality, and, last but not least, a corps of electricians of the highest standing, especially in regard to practical experience in street railway work. That it is possible for such a body of men to devise something better than our present system, at any rate for special locations, is a matter hardly to be doubted.

Electric Railways for Oakland, Cal.

Oakland, Cal., seems to have become thoroughly aroused to the necessity of improved facilities for rapid transit. Several street ordinances have been introduced granting the right to change the motive power to electricity. There are also several proposed new lines. One of these is proposed in an ordinance granting to J. L. Davie, R. M. Fitzgerald and E. L. Fitzgerald a franchise, right of way and permission to construct, maintain and operate a street railroad by electricity, commencing at the intersection of the Southern line of First street with Harrison street, running thence northerly along Harrison street to Fourteenth street; thence westerly along Fourteenth street to its intersection with Franklin street; thence northerly along Franklin street to its intersection with Twentieth or Delger street; thence easterly along Twentieth or Delger street to its intersection with Webster street; thence northerly along Webster street to its intersection with Broadway street; and thence northerly along Broadway street to the northern boundary line of the city.

Wide Awake and Progressive.

From the *Popular Electric Monthly*.

Cyrus W. Field died on the morning of July 12th. On that same day the WESTERN ELECTRICIAN went to press with its issue of July 16th, yet upon the first page there appeared a most interesting biographical sketch of the "Father of the Atlantic Cable." Th's certainly is an indication that the electrical press is wide awake and progressive.

CORRESPONDENCE.

New York Notes.

NEW YORK, September 3.—Beyond last week's excitement over the sure and rapid advance of the "noisome trolley" New York city, electrically speaking, has been about as dull as one could well imagine. By the use of the word "dull," though, it is not intended by any means to convey the idea that all work has stopped. For instance, in spite of the fact that most New Yorkers like best to work hard in winter the Rapid Transit engineers have done their duty, and the corps of draughtsmen who have been working assiduously on the plans of the rapid transit underground route, under the direction of John Bogart, have now so nearly completed their labors that they expect to reach the end in ten days more at the utmost. This work has been of a painstaking and laborious nature, as it has included the making of detail drawings. These plans and the accompanying specifications are to be submitted to those contemplating bidding for the franchise. One reason for the great care taken in producing the plans is that the Rapid Transit commission is by law charged with the supervision of the work of construction. It is intended that the plans and specifications shall be such that there will be no possibility of shirking. The plans have been essentially accepted by the Rapid Transit commission. When the working plans are completed there will remain for the commission the legal advertising of the sale of the franchise at public auction. The interest already displayed and the favorable reports of competent engineers seem to indicate that there need be no apprehension that the franchise will not fall into the hands of good men who will go ahead with the work of constructing the road.

Brooklyn may be progressive in that it appreciates the advantages of electric street railways, but that city has a most unpatriotic concern within its limits. Numerous cases of shabby treatment by employers of members of the National Guard who were ordered to Buffalo from Brooklyn are cropping out. Gen. McLeer, commander of the Second Brigade, has had five cases reported to him. Two members of Company E, Twenty-third regiment, who have held clerkships with the Union Phonograph company of Brooklyn, reported that when they returned to their desks they were told their places had been filled and the company had no use for men whose presence could not be relied upon.

Arc lamps for constant potential circuits are to be introduced into the city for street lighting, and the lamps will be used on Fifth avenue. Fifty cast-iron poles, 20 feet in height, and each carrying two lamps of about 1,000 candle power, will be erected from Washington square to Fifty-ninth street. There will be one lamp at every cross street. The poles will be ornamental in character, as will also the lamps, which will have artistic ground-glass globes and brass trimmings. The wires will conduct the electricity through the poles from the Edison company's subways. The lamps used will be those of the New York Electric Equipment company.

Rumors were rife in Wall street on Thursday to the effect that efforts were making to form another copper combination. Two schemes were said to be on foot—one to establish a corporation selling agency for all American copper, and the other to form a big company to gather in the producers of copper. American mine owners were said to have been in Europe for several weeks dickering with owners of copper properties resident there. Efforts were made several months ago to get the producers into an agreement by which the trade could be controlled, but they failed to be successful. Some of the leading producers have been trying since then to arrange matters, but there is supposed to be a good deal of doubt as to the success of the new scheme.

A dispatch from Newburg, N. Y., last Wednesday stated that the storage battery yacht Electron will be used by the Astor family for a pleasure craft the rest of the season. Mr. Astor arrived from Newport on Tuesday, the dispatch stated, to effect its lease from James Bigler, its owner. He will have the yacht taken to his Rhinebeck home to be in readiness for the family when they return from the seashore. W. F. O.

New England Notes.

BOSTON, Mass., September 3.—The fire underwriters of New England are aroused over electrical risks. A great many fires have occurred lately, which the insurance people have attributed to poor installations, and the executive committee of the Boston Board of Fire Underwriters are considering the question of how uniformity in their code of rules applying to electrical risks can improve the character of the risks. In almost everything that has been said or written about this matter the fires are said to be due to imperfect wiring. The danger comes from the fact that telephones, electric clocks and incandescent light apparatus are constructed to receive and dispose of a moderate current and not of a heavy one that may be switched upon them at any moment by contact with arc light or fire alarm wires. The Boston Manufacturers' Mutual adopted some simple rules in 1881 that were followed by an entire immunity from fires for ten years. Last year there was a loss of a million consequent upon the dampening of a switch board by escaping steam. Two of the most important rules insisted upon by this company are as follows:

"If any wires carrying high tension or strong currents are to be carried over or under other wires on the property of the insured, they shall be attached to poles so near each other, with one wire so far above the other, that if a break should occur the pendent wire between these poles may not be long enough to come in contact with the wire below, or, if not carried on poles, these wires shall be so placed and protected with guard wires as to render a contact between different wires impossible.

"If the high and low systems are in use in the same yard, even when developed within the works, the wires must be kept separate, and so wide apart that no contact or cross can be made."

An important source of danger in Boston will be removed shortly. When Supt. Flanders gets the fire alarm system running by means of a current from dynamos, the mass of batteries in the City Hall, which is one of the most dangerous spots in the city, will be removed.

The big street railway syndicate with headquarters in Philadelphia has been casting its net in New England lately. The purchase of the Lynn & Boston road, one of the best paying properties in this section, has been effected by this syndicate. With this road have been bought up the Lynn Belt Line road and the Naumkeag street railroad of Salem. The banking house of E. W. Clark & Co. of Philadelphia heads the syndicate, and associated with it are others bankers of Philadelphia and New York. This house has been at the head of most all the large syndicates formed for the purpose of buying street railroads and equipping them with electricity. This syndicate will consolidate the three roads, and about the first of next year it will be put under one management. Benjamin Orne, president of the Naumkeag road, was offered the presidency of the consolidation, but declined it. It is rumored that this syndicate is also after the street roads of the Merrimac valley.

Some New England lumber mill men are considering the use of electrical mill tramways. The insurance companies charge such high premiums on risks where locomo-

tives are used that the mill men are forced to look about for something to substitute for steam power. Where there is much work of shifting to be done and the companies are bound to have reasonable insurance rates and immunity from fire, there seems to be nothing to do but to adopt the electric tramway.

The initiatory step in a measure that will prove of great importance to the residents of the Intervale region at the eastern approach to the White mountains has just been taken. This valley comprises the villages of North Conway, Intervale and Lower Bartlett. The water power of East Branch falls, near Pitman Hall in Lower Bartlett, has been sold by Mrs. Gray of North Conway to C. Atkinson of Portland, Me., who is a summer guest in that place. It is the first step toward introducing a system of electric lighting in the villages mentioned. The falls afford over 500 horse power, and an organization has been perfected with a capital of $25,000 to build a plant and put in the necessary dynamos a short distance in the rear of Pitman Hall. It is proposed to have arc lights through the main streets in addition to those taken by the hotels. Mr. Atkinson has taken a large share of the stock.

The electric search light on Mt. Washington is proving a great attraction to the summer boarders in that vicinity. Its light when thrown upon the Maplewood at Bethlehem, seventeen miles away, makes it possible to read a newspaper by its rays. A curious phenomenon is noticed when the light brilliantly illuminates the point of the hotel. Across its front dark spots float, probably shadows cast by the particles of dust or vapor in the air near the arc lamp. Although very minute, their shadows become the size of maple leaves at the Maplewood. At a greater distance it appears as a comet of great brilliancy.

Dr. Louis Bell has been appointed engineer of the long distance transmission of power department of the General Electric company for Boston.

A novel feature of the electrical railway system of Springfield is the letting of electric cars to excursion parties. The price of a car is $2 an hour. The Springfield cars are operated with much less noise than those in Boston. This is probably because the roadbed and equipment is in better shape.

S. F. Van Choate of Boston has invented a magnetic photometer whose results, he claims, can not be questioned, because the personal equation is entirely eliminated. Errors resulting from the unreliability or inaccuracy of the human eyesight or the possible dishonesty or unreliability of the person making the test are impossible in this machine. Mr. Van Choate has not patented his invention, but gives it to the public free. He employs selenium in its construction. Lantern shaped vehicles are arranged with lateral projecting tubes extending horizontally towards each other. The lanterns and tubes are made of thin brass or any other suitable material, about six inches in diameter. A hood above the neck of the lantern is arranged underneath to admit of ventilation and to carry off the heat from the lamp, and a round, flat disk is for damping the external light from the ventilation openings above. The lanterns have each a door on one side to admit the lamps, and have sockets at the bottom properly arranged to hold them, and with connections for the conducting wires or gas pipes, as the case may be; and if required slides can be fixed between the lamps and selenium disks to shut off the light, but this may be done by turning it off with key sockets at the base of the lamps. There is a selenium disk at the right corresponding to the lamp being tested which is permanent. Another at the left is movable, and has a smaller brass tube attached to it in the center and extending out to the left to a pointer. This small tube has a rack and pinion or screw gear underneath and connected with a thumb screw knob for moving the selenium disk on that side and for adjusting and balancing the light, all of which is accomplished by turning the knob right or left, as the case may require. By this means the selenium disk is made to slide in and out of a tube, and in order to provide a soft, flexible, tight joint a layer of soft felt is placed around the rim of the movable disk. This keeps out the daylight. The movable tube carries at its right hand end a pointer which travels back and forth along an index scale. Behind selenium disks are placed plates of insulated material to which the strips of selenium are secured by glue or cement. Zero point, needle and magnet coils are arranged to act as a very delicate galvanometer, or a mirror reflector may be used. Mr. Van Choate prefers the latter, as it must be extremely delicate. The coils must be wound right and left to neutralize each other. Connected with the right hand circuit is an adjustable resistance to regulate the resistance between the two circuits and bring the needle to zero. This must always be carefully done before placing the lamps in the lanterns. These two circuits are supplied with current from a battery. The current for the lamps is made from lines or leads. If gas light is being tested these connections are made with gas pipes. The strips of selenium must be adjusted accurately to each other as to resistance. As the current must be of high potential and the resistance of the coils very great, the wires of the resistance regulator, as well as those in the connections with the mirror or galvanometer, and also the selenium disks, must be of such size as not to heat in the least degree. Both the standard or test lamp, as well as the light or lamp to be tested, are supplied with gas in one instance and by electricity in the other from the same source. Consequently both lights are subject to the same variations of resistance and current or pressure of gas. With this instrument the dark chamber is dispensed with. There is no necessity for the operator to see the light.

The capital stock of $50,000 needed to build an electric road between Norwalk and South Norwalk, Conn, is all subscribed. The work of building and equipping will be begun at once, and it is expected that cars will be running by November.

The new electric light station at Willimantic, Conn., is about completed. The first machinery installed will be a 500 light dynamo for direct incandescent lighting, and will be in place soon.

The annual meeting of the Malden, Mass., Electric company shows that corporation to be in a healthy condition. The capital stock was increased $100,000, making it now $250,000. This is to provide for the construction of the new power plant which is to furnish additional lights for Malden and several circuits of street lights for Melrose. The new station just finished will be supplied with 600 horse power engines, dynamos and other facilities for supplying the rapidly increasing demand for electric lights. The company now supplies all the lights for Melrose, Medford and Everett in addition to Malden, and also supplies them for most of the public buildings, stores and factories. Over 170 private houses are using electric lights, and a long list of additional houses are to be connected and arrangements made for enlarging this branch of the service. Motor generators are also to be installed, which will enable the company to furnish day service in the way of power.

The Cohasset, Mass., Electric company has elected the following directors: Amos A. Lawrence, Edward F. Ripley, Silas Pierce, John C. Howe, Lyman R. Wilcutt and Charles A. Welch. Mr. Lawrence was chosen president, and Mr. Ripley secretary and treasurer.

The Yuma Water & Light company has been organized at Saco, Me., for the purpose of manufacturing water pumping and electric light machinery. The capital is $100,000. The officers are: President, C. P. Hemenway, Boston; treasurer, J. Dodd, Boston.

The Eddy Electric Manufacturing company of Windsor, Conn., has increased its capital stock from $100,000 to $225,000.

Messrs. R. Hollings & Co., leading Boston dealers in gas and electric light fixtures, have made a most important move by securing a twenty year lease of the premises at Nos. 523 and 525 Washington street, where they will occupy the first and second floors.

H. C. Spaulding, late electrical engineer of the Thomson-Van-Depoele Mining company, has left the electrical field to accept the position of general manager of the John A. White company of Dover, N. H., manufacturers of wood-working machinery. Mr. Spaulding was one of the pioneers in the commercial field of electrical business.

The Thomson-Van Depoele company is working the field of manufacturing electric mining apparatus very successfully. The company now has on hand contracts for eleven underground locomotives. These are distributed among gold, silver, copper, iron and coal mines.

An electric road is to be built from Dedham to Mattapan, Mass., through Hyde Park. The company is trying to secure privileges from the city of Boston which will enable it to extend its lines to Forest Hills.

The electric road between Rockport and Camden, Me., is doing an enormous business. The distance is about nine miles. For the first fortnight the company carried over 30,000 passengers. The only previous means of conveyance between these delightful points on the coast was by stage, and the surrounding populace are riding back and forth just for the novelty of the thing. J. C. E.

"If Savannah was given to blowing, she might justly claim to be the electric city; the center of electric development in the South," says the Savannah *News*. But the possession of thirty miles of electric railways and the most powerful electric railway motor in the United States will be looked upon as merely incidental to her steady growth and continued prosperity.

Northwestern Notations.

MINNEAPOLIS, Sept. 3.—The Minneapolis exposition will be brilliantly illuminated by electricity and will have for its most novel feature an elevated electric railway. There will be 2,000 lights of 16 candle power in the big building, not including the incandescent illumination for the central hall, where there will be 510 lights. There will be a central chandelier of 254 lights arranged in a pyramid of circles. From the center a wire will run to each corner of the hall; upon each wire there will be 64 red, white and blue globes. The electric railway will circle entirely around the inside of the building, affording a trip of 900 feet. A miniature motor and trailer will carry ten passengers. Some striking novelties in construction and operation are promised. The electrical exhibit at the Minnesota State fair at Hamline next week promises to be unusually elaborate.

The exhibition of that marvelous mechanism, the "revolution motor," devised by a Minneapolis stock broker, has not yet been made. When asked about it, the inventor said there had been some unavoidable delays in perfecting the thing, but it would soon be ready for the public exhibition. It seems, by the way, that instead of supplanting electricity, the new motor is to use that subtle fluid. Wood now admits that it will be "partially operated by electrical short circuit to be used in connection with the leverage plan."

The Western Union Telegraph company has not yet taken possession of its new quarters in Minneapolis. One reason why it has taken so long to prepare for the change is the fact that provision is being made for the transfer of the Northwestern relay station from St. Paul to Minneapolis. This will mean an addition of about fifty operators to the working force of the Minneapolis office.

One of the funny freaks of a recent electric storm in Minneapolis was the killing, by lightning presumably, of hundreds of sparrows that were hovering over a down town corner. It took two men an hour to remove the dead bodies.

Parties from Aberdeen, S. D., and New York, have organized the Black Hills Mineral Belt Electric railway, with $200,000 available capital. The proposed line extends over fifteen miles, connecting the towns of Deadwood, Central, Terraville, Lead and Bald Mountain. The plan is to utilize water power. J. F. W. Zietlaw, the expert electrician, and the Pioneer Electrical company of Aberdeen have a hand in the enterprise.

When the electric light mast epidemic was raging, Minneapolis put one up at Bridge Square a little higher than any other then in existence—257 feet. and made a great fuss about it. It didn't pan out very well for street lighting purposes, but it was nice to talk and write about After a while the light cage was run up only half way, and now it has been ordained that it shall not be lighted at all.

The Cooper-Hampton Electric company, with headquarters in the Edison building, Minneapolis, has issued a neat little prospectus. Its specialties are electric railway equipments, electric elevators, mining machinery, fire engines and pumps.

The St. Paul aldermen are now wrestling with the street lighting problem. They talk of substituting electricity for gas because it is cheaper.

President Lowry of the Street Railway company, and the St. Paul city fathers have not yet come to an understanding, and but little headway has been made in that direction. It is not likely the Como line will be built this year. The company will hereafter fight its own damage cases. An accident insurance company that tried it the past year claims to have lost $60,000.

The removal of the company's repair shops from St. Paul to Minneapolis has aggravated the soreness in St. Paul, where they say Mr. Lowry is always working things in the interest of Minneapolis. The building on Third avenue North is being utilized.

Some seventy-five men are employed. The lower floor has been converted into a planing mill, and there is a rush of work all the time.

For the first time in several years the company hasn't a particle of construction work on hand. The Bryn Mawr line has been completed, and is in operation. The bracing up of the tracks on the Fourth avenue south line was a big and expensive job.

The other night a trolley wheel on a Minneapolis line broke in two, and the car was stranded. The motor man ingeniously rigged up a substitute. He pulled out the axle of the wheel, and through the holes ran a strand of common telegraph wire, fastening it securely. It worked nicely.

Newton Crane threatens to apply for an injunction to restrain the city of Minneapolis from using the Gamewell

system of fire alarm boxes. Electrician Morrison is somewhat worried over the matter, but is inclined to think the Gamewell company will protect its rights. Minneapolis has invested some $50,000 to $75,000, in this system, having 215 boxes.

The Carpenter-Nevins Electro-Heating company has sought an injunction in the Minneapolis district court to compel Frank Nevins to carry out an agreement made in March, 1890. It is claimed he promised to relinquish all right to certain patents, and also any improvements which he might afterwards become interested in. It is alleged that he, together with Thomas and Arthur Morford, has secured certain improvements, and that Nevins has assigned his rights to the Morfords.

The Brush Electric Light company has been removing more of its overhead wires and poles in Minneapolis. Many of the business streets are now pretty well cleared. In a recent storm many wires were knocked down, and a number of horses and dogs were killed. No human beings were injured.

In St. Paul the matter of getting the wires into subways is still being discussed, although much has already been accomplished in this direction. The Western Union is figuring on putting in its own conduit system, and wants a franchise. So does the St. Paul Light, Heat & Power company.

The Leffler Electro-Magnetic Railway company has been incorporated with $1,000,000 capital. It proposes to manufacture electrical machinery and apparatus on a large scale. The incorporators are Minneapolis men: N. F. Hawley, Freeman P. Lane, F. A. Dunsmoor, John Gruenberg, Simon Gruenberg, and F. Freemont Reed. Hawley is president, Dunsmoor vice president, Leslie C. Lane, secretary, A. L. Brice, treasurer, and Paul W. Lefler, mechanical superintendent.

Shell Lake, Wis., will have an electric light plant.

Citizens of Robbinsdale, a Minneapolis suburb, are figuring on having electric lights.

The Electrical Manufacturing & Repair company has been organized in Minneapolis with J. H. Clark, E. J. Clark, treasurer, and H. E. Thompson, general manager. The factory is at 25 South Sixth street.

Manager Paul of the Western Electric Light company of St. Paul is organizing a company to operate a plant at Red Wood Falls, Minn.

Graceville, Minn., wants an electric light plant.

The Marshfield, Wis., Electric & Power company has elected W. H. Upham president and W. H. Fitchman of Peoria, Ill., secretary and treasurer. Moffat, Hodgkins and Clark of Syracuse, N. Y., are interested in the enterprise.

The new Wesley Methodist church in Minneapolis has on the top of its tower a cross eight feet high on each of the four sides. It is illuminated by thirteen electric lights of 10-candle power each.

C.

Detroit, Mich.

DETROIT, Mich., September 3.—Judge Swan of the United States Supreme court has issued a decree of foreclosure and sale against the Lansing, Mich., City Railway company in the action brought some time ago against that corporation by the Continental Trust company of New York. The latter company held a mortgage of $73,000 of the $160,000 worth of bonds issued by the railway company. The affairs of the company have been in bad shape for some time, the foreclosure being brought about by the failure of the company to pay the interest on its bonds. The auction will include all the railway company's franchises and leases, the equipment, rolling stock, and all the real estate and other property of the corporation. The date of the sale has not yet been determined upon.

Last fall James F. Maloney of Cheboygan and Frank E. Fisher, the Detroit electrician, entered into a contract with the city of Cheboygan, Mich , to light that place with electricity for five years. After the contractors had got their poles all up, preparatory to stringing the wires, the common council voted to declare the contract invalid. Maloney and Fisher intimate that this action was taken under the influence of disappointed contractors, and they have begun suit in the United States Circuit court against the city to enforce the contract.

G. E. Fisher, chief of the electrical department of the Detroit exposition, reports that during his trip to Chicago and since his return he has arranged with about twenty-five manufacturers of electrical apparatus to display their wares at the coming exposition. He also expects to have the Detroit electrical manufacturers well represented. The success of this portion of the exposition display is fully assured.

Frank B. Rae, electrical engineer for the new Union Depot company, has prepared plans and specifications for an electric light plant for the depot, and the contract will be awarded next week. There will be 800 incandescent and thirty-five arc lights, and the plant will consist of two engines and three dynamos. Mr. Rae has also equipped a new line of railway from Toronto to Mimico, Ont., with his new system of single reduction motor cars.

The representatives of the Citizens' Electric Light company of Windsor have had a meeting with the creditors and endeavored to effect a settlement, but nothing was done, and those who have been using the light will have to return to the use of gas. The secretary of the lighting company says their plant will undoubtedly be sold. The Electric Railway company is ready to purchase the plant.

The ferry boat Victoria, plying between Detroit and Windsor, will be lighted by electricity. The wires are now being put in.

The Electrical Equipment company, which decorated the City Hall during the G. A. R. encampment last year, has received an order to furnish 1,500 lights for the encampment at Washington. It will reproduce the Grand Army badge as it appeared on the front of the City Hall and two or three other emblems in colored incandescent lamps.

The Fort Wayne Electrical company wants a franchise from the Jackson, Mich., city council. The concern will put in a $100,000 plant for supplying private residences with electrical light.

The first consignment of the new grooved rails have at last been received by the Citizens' Street Railway company, and the work of laying them on Woodward, Grand River,

George C. Baker has had the old battery of the submarine boat repaired and will take the boat down to Amherstburg, where the water is 30 or 40 feet deep, and there give her another trial. If this trial is satisfactory, the boat will go to salt water for her final tests.

The Mt. Clemens common council has refused to grant a franchise to the Detroit & Mt. Clemens railway on South Gratiot street. The road will have to enter the city on some less pretentious street.

The board of commissioners charged with providing Lansing, Mich., with an electric light plant is having some difficulty in the purchase of the plant of the Lansing Electric Light company.

G.

Milwaukee, Wis.

MILWAUKEE, September 3, 1892.—By the middle of the month the Milwaukee Street Railway company expects to run cars on the new Fond du Lac avenue line from Walnut street to Twenty-seventh street. Beyond the latter point work is being prevented by the injunction served by the plank road company. The Forest Home and Brady street line is nearly completed and electric cars will be running over it in about two weeks. The tracks on Brady street and Warren and Cambridge avenues are already laid.

October 1 is the date set for the transfer of the West Side railway from Washington Becker, who has maintained and operated it for many years, to the Villard syndicate. The Milwaukee Electric railway will then be the only street car line in the city not controlled by the Villard company and that system will go into the same hands as soon as the litigation concerning it is settled. After the Villard people take possession of the Becker line they will make one rather important change, important because it tends to show the correct method of electric railway construction. The Becker tracks on Wisconsin street consist of rails fastened to wooden stringers by means of iron braces. The road bed although new, is rickety, and the Villard company will lose no time in substituting a new method of construction. The company will lay heavy T rails laid upon wooden ties, securely fastening them together and then tamping the roadbed, just as such work as is done on a steam railway.

Vice-President Payne has informed Cudahy Brothers that there is no doubt of the Milwaukee Steel railway being extended to Cudahy as soon as the packing house and stock yards are built. An ordinance has been drawn up and, with a petition signed by the owners of the property abutting upon the proposed route, will be submitted to the town board. In the ordinance it is provided that the electric railway shall be exteuded to St. Francis before September 31, 1893, and to Cudahy before December 31, 1893. Mr. Payne, while in New York recently, laid the matter before the directors of the company, and the assurances that he has given Cudahy Bros. are the result of the conference. The fare from the city to Cudahy will be 6 cents.

Dr. Herman C. Block has brought a suit against the Milwaukee Street Railway company that will test the question of an electric railway company's responsibility for damage caused by unguarded trolley wires. In his complaint Dr. Block states that on the evening of February 2d he was driving on Green Bay avenue when his horse stepped on a broken telephone wire that had fallen across a trolley wire. The animal was thrown down and the plaintiff was thrown from his buggy and permanently injured. He demands $21,300 damages.

The common council of Oshkosh has carried out a scheme that has been agitated in Milwaukee off and on for several years. It is that of compelling street car companies to carry working people at reduced rates. In granting an electric railway franchise the Oshkosh council made it a condition that between 6 and 7 o'clock, A. M., and 6 and 7 o'clock, P. M., the fare would be only 3 cents. The company is a Westinghouse concern and pays the city a bonus of $25,000.

A report coming from New York, that Henry Villard has drawn out of the Edison General Electric company, has been confirmed by Henry C. Payne, the Villard representative in Milwaukee. He still retains his interest in the North American company and his withdrawal from the Edison company, according to Mr. Payne, would in no wise effect the Milwaukee interests.

The matter of transportion to the State fair grounds, which at one time threatened disorder to the big pumpkin show, has been satisfactorily settled. The St. Paul Railway company has finally decided to run passenger trains to the grounds over its freight tracks, at intervals of a half hour, and the Northwestern, of course, will run numerous special trains. The National avenue electric line has practically been completed to within less than a mile of the fair grounds, from which point passengers will be transferred in busses. The Milwaukee & Wauwatossa Motor company will run as many extra trains as possible, its new line to the grounds beings practically completed. The Wauwatossa electric line will be extended to the grounds before the next fair.

The attempt in the East to form a strong organization of telegraphers has not caused any enthusiasm in Milwaukee. Commercial telegraphers here declare that they were badly "done up" in 1885 and don't care for any more strikes.

The sale of the Fond du Lac street railway to W. G. De Celle, of St. Paul, western agent of the Westinghouse company, has been consummated. The Westinghouse company will make improvements aggregating $75,000. The railway will be equipped with electricity and an electric light and power plant erected.

The Green Bay-Fort Howard electric railway enterprise will probably be abandoned until next year, as Jackson Case, of Racine, the promotor, and the Fort Howard common council have been unable to agree upon terms.

The Villard syndicate has ordered from the Filer & Stowell company, of Milwaukee, two large triple expansion engines for its new power house. They are to be of 600 horse power each and have dynamo attachments. One is to be delivered December 1 and the other January 20. They are to be like the Jumbo engine recently put in and two more of them will be ordered in the near future, making five 600 horse power engines in all. They will occupy the entire first floor of the power house. Several smaller engines will be ordered soon and placed on the second floor. With the large engines already in place it will be a rarely complete plant of electric machinery.

From the Pullman company the Villard people have just received ten handsome and substantial electric motor cars. They are part of the order given after a competition in which all the manufacturers in the country took part, and forty more will be received inside of thirty days. The cars are 18 feet, 7 inches long and will accommodate seventy-five passengers. They are finished throughout in oak, quartered oak ceilings, and are excellent in every respect.

C.

PERSONAL.

George A. McKinlock, treasurer of the Central Electric company, Chicago, nothing daunted by cholera reports, has gone abroad for a month on his vacation and will visit Ireland and Scotland, besides going to London and Paris in a semi-business capacity for his company.

Walter M. Lenhart, formerly of the Westinghouse Electric & Manufacturing company, and lately with the Brush company, has been appointed assistant general manager of the National Electrical Manufacturing company, with headquarters at Eau Claire, Wis. The National company is to be congratulated on its excellent choice.

NEW INCORPORATIONS.

Eagle Electric company, Columbia, Ill.; capital stock, $7,000; to furnish electric light for Columbia, Ill.; L. Wamock, Columbia, Ill.

Union Telephone Electric Manufacturing company of New Jersey, Jersey City, N. J.; capital stock, $250,000; to purchase patents and patent right inventions and im-

provements relating to and concerning telephone, electric and accoustic appliances, etc.; Simpson & Werner, 15 Wall street, New York, N. Y.

Queens County Electric Light company, Hempstead, N. Y.; capital stock, $30,000; to manufacture and use electricity for light, heat and power.

Santa Cruz Electric Railway company, Santa Cruz, Cal.; capital stock, $500,000; to build and conduct a street railway; Wm. J. Joten, Santa Cruz, Cal.

Electric Light & Power company, Van Wert, O.; capita stock, $50,000; electric light, artificial gas and artificial ice manufacturing; G. L. Marble, Van Wert, O.

Dayton & Springfield Electric railway company, Sandusky, O.; capital stock, $50,000; constructing and operating electric railway; Jno. L. Moore, Sandusky, O.

Piatt Electric company, Decatur, Ill.; capital stock, $100,000, to manufacture and deal in electric machines, appliances, and operate electric light plants; R F. Piatt, Decatur, Ill.

Kingston Electric company, Kingston N. Y.; capital stock, $280,000; consolidation of Kingston Electric Light, Heat & Power company, and Rondout & Kingston Gas Light company.

Chicago Electrical Construction company, Chicago, Ill.; capital stock, $150,000; to manufacture and deal in electrical and mechanical appliances; Wm. C. Jones, 805 Ashland Block, Chicago, Ill.

Alameda, Oakland & Piedmont Electric railway company, Oakland, Cal.; capital stock, $500,000; to build and operate a street railway in Alameda, Cal., and elsewhere; Geo. De Golia, Oakland, Cal.

Universal Electric company, Cleveland, O.; capital stock, $25,000; manufacturing, repairing, purchasing and dealing in electrical machinery, appliances and supplies; Estep, Dickey, Garr & Goff, Cleveland, O.

Salem Light & Power company, Portland, Ore.; capital tock, $150,000; to manufacture, furnish and sell and supply electric currents for the purpose of generating and producing light, heat and power; Paxton & Paddock, Portland, Ore.

Seattle Gas & Electric Light company, Seattle, Wash.; capital stock, $1,500,000; to operate and maintain gas, electric light and power plants, deal in gas and electric light fixtures and furnishing, etc.; Struve & McMicken, Seattle, Wash.

Sussex Electric Light, Water & Power company, Deckertown, N. J; capital stock, $7,000; to construct and maintain electric light plant or works for the distributing and supplying of electricity for street and interior lighting purposes, etc.; J. F. Conklin, Deckertown, N. J.

La Burt Automatic Electric Block Signal System & Car Coupler company, New York City, N. Y; incorporated in West Virginia; capital stock, $5,000,000; to deal in letters patent and to manufacture any articles thereunder; Wm. H. E. Jay, 371 Fulton street, Brooklyn, N, Y.

Gonzales Electric Light & Power company, Gonzales, Texas; capital stock, $20,000; constructing and supplying electricity and furnishing electric lights for private and public houses and for streets and supplying electricity for power and heating purposes; W. S. Ely, Gonzales, Texas.

ELECTRIC LIGHTING.

The Dyersburg, Tenn., Water & Electric Light company, will put in a new dynamo and engine.

Charlottesville, Va., & University Electric Light company will erect a new plant at a cost of $30,000.

The Edison Electric Illuminating company of Martinsburg, W. Va., will add a new engine and dynamos to its plant.

The Weston, W. Va., Electric Light, Power & Water company is preparing to enlarge its plant. New dynamos will be added.

Siemens & Halske, Berlin, have received an order for the electric lighting of two new Cunarders now building at Fairfield, Glasgow.

The Huntsville, Ala., Electric company, will put in a 1,000 light dynamo to be furnished by the Westinghouse Electric & Manufacturing company.

The Cumberland Light, Heat & Power company of New Cumberland, W. Va., will add two 750 Westinghouse alternating dynamos to its plant.

The Central Railroad of Georgia will erect an electric light plant in connection with the Macon shops for lighting its yards, depots and offices.

Arthur D. Bosley of Philadelphia, Pa., has obtained privilege from the city of Maryland, Md., to install an electric light plant, erect poles, and lay underground wires.

The Shelbyville, Ill., Light & Water company has made a contract with the city to furnish electric light every night in the year and all night long for $80 per lamp.

An electric light or gas plant is to be erected in Georgetown, Ky. The chairman of the board of trustees will receive bids until September 19th for lighting the town either by gas or electricity.

The Four Lakes Light & Power company, which has secured control of the electric light business in Madison, Wis., has been granted a franchise by the city council and will begin operations at once.

La Crosse, Wis., is enjoying a public illumination at present. Twenty-four arches span the business thoroughfare, and these are made up of red, yellow and blue lights. Along the sides of the streets are ranged a large number of lights, and the scene presented when the current is turned on is fairly dazzling.

The Thomson-Houston Electric Light company's works at Augusta, Ga., last week was the scene of an accident which temporarily disabled the plant. A big fly-wheel burst, some of the pieces going through the wall.

William C Clarke of Wakefield, R. I.; Frank S. Arnold and Robert S. Fletcher of Providence, R. I., and Richard P. Williams of New Berne, N. C., have incorporated the New Berne Water, Electric Light & Railway company to build water and electric light works, etc. The capital stock is $160,000.

An electric light company has been organized at Dawson, Pa., by James and P. G. Cochran, Joe Loughrey, John S. Newmyer, and several others. The company will be capitalized at $20 000. The towns of Dawson and Vanderbilt will be wired. It is the intention of the company to have the plant completed by November 1st.

The Board of Public Works, Seattle, Wash., has asked for proposals for street lighting and also for the illumination of the city buildings. An isolated plant will be installed. The board has begun the task of making an approximate estimate of the cost of providing the city with its own electric lighting plant, and the city electrician has submitted an estimate of the cost of the plant complete, including 509 double arc lights, 300 hoods, 125 miles No. 6 B. & S, weather-proof wire, 300 pole rachets for suspending lamps, 600 pulleys for suspending lamps, 7,200 feet of cable, 600 pins and insulators, 300 globes, construction and labor, 300 horse power engines (two of 150 horse power each), and 3,000 thirty or thirty-five foot cedar poles. The estimate places the cost at $800,000, which includes freight and labor.

It has been customary, heretofore, to expend a considerable sum for public illumination in St. Paul during the State fair, but this year the city council failed to pass an appropriation. The local merchants, who have been relying upon this feature of the display to keep visitors to the city on the streets evenings, and thus give them an excellent idea of the city and its enterprises, have been very much exercised over the failure of the city officials to make the appropriation. Petitions were freely signed by business men asking for a reconsideration of the subject, but the council flatly refused, for the second time, to devote public money to such purposes. Now it is proposed to raise a fund by subscription to defray the expense of the illumination. The merchants of St. Paul seem to be of the opinion that the State fair would be looked upon as a failure without street illumination.

ELECTRIC RAILWAYS.

An electric street railway is being built at Niles, O.

An electric street railroad will be built at Pekin, Ills.

An electric railway at Durham, N. C., is contemplated

Osceola, Iowa has voted to have an electric street railway.

An electric street railway is being built at Vicksburg, Miss.

The electric line of Golden Gate, Cal., will be extended.

An electric railway is to connect Columbus and Lakeside, O.

An electric railway is to connect Marquette and Negaunee, Mich.

Work has commenced on the new lines of street railway at Topeka, Kan.

The street railroad will soon be changed to an electric line at Anderson, Ind.

An electric road will connect Pasadena and Los Angeles, Cal., in the near future.

Dixon, Ill., is trying to make a deal with a local company for an electric street railway.

A movement is on foot to build an electrical railroad from Norfolk, Va., to Willoughby Spit.

The Cumberland, Md., Electric Railway company will probably extend its lines before winter sets in.

An electric street railroad is to be built from Milwaukee, Wis., to the town of Lake along the Howell road.

The Sandusky, O., Street Railway company has been granted permission to extend its lines of street railway.

An electric railway is to be built on the north shore of the Chautauqua lake to connect Jamestown and Mayville.

An electric line is to connect Deadwood, S. D., with Central, Terraville, Lead and Bald Mountain. Work will soon commence.

Sargent & Lundy, Chicago, are building a new electric railway at Sioux City, Ia., which will be ready for operation in about sixty days.

The Westinghouse Electric company is anxious to put in a street car line at Oshkosh, Wis., and has offered to pay the city a bonus of $25,000 for a franchise.

The Tampa, Fla., Suburban railroad has begun suit against the Tampa Street Railway & Power company for $50,000 damages for appropriating its right of way on Seventh avenue in Ybor City.

The Brightwood Railway company, Washington D. C., which applied to Congress several weeks ago for the renewal of its franchises, intends to build an electrical railroad to Brightwood and Tacoma Park. George B Crittenden, one of the promoters of the project, says that the road will be completed within five months; work to begin September 18th.

John R. Owens has been appointed receiver of the People's Street Railway & Electric Light & Power company of St. Joseph, Mo. It is announced that over $100,000 will be expended at once in improving the street railway system, and unless needed improvements are made without unnecessary delay the city council threatens to declare the company's franchise forfeited.

R. C. McFarland, J. P. Roach and J. B. Mattingly, of Vicksburg, Miss., and E. F. Fuller, of New York, have petitioned the city council, of Vicksburg, for a franchise to build an electrical railroad. They propose to begin work within 60 days and complete the line in eight months from date of franchise. The Hill City Railroad & Electricity company will also apply for a similar privilege.

TELEGRAPH.

Carson City, Neb., has granted the Western Union Telegraph company the right to erect its poles in the streets of the city, under the direction of the board of trustees, on condition that that the company allow the city the free use of its poles for stringing the fire alarm wires.

Railroad telegraphers met at Buffalo recently and according to the news dispatches decided that four of the five men who were recently discharged from the Lackawanna on the ground that they belonged to a labor organization must be re-instated immediately. It was also decided that the organization force the Lackawanna to recognize the Order of Railroad Telegraphers in the same way that the engineers and firemen are recognized. Possibly the management of the road may haev some plans that will conflict with these arrangements.

An old telegrapher is quoted in the New York *Sun* as saying: "I notice that the papers are very loud in their praise of the admirable service rendered during the late conventions by the United Press, a very deserving thing to do, but we think you have over looked speaking a word of praise to those hardworking and faithful servants of the public, namely, the telegraph operators, by whose skill it was sent and received, whose skill went far in permitting the papers to so quickly set the news before their readers. True enough, the telegraph operator is little thought of and seldom mentioned. Still, we think he is a very important instrument in the progress of our country and would like to be encouraged.

According to a Philadelphia dispatch last week "Peter A. B. Widener refused to deny a report that he and William L. Elkins were to succeed Jay Gould as the controlling power in Western Union. He also refused to confirm it." The dispatch continues, "Although rumors have been current in Wall street for some days that a big change in Western Union was impending, it was not until last Saturday that any definite prophecies were made that Jay Gould was to retire from the company, and Messrs. Widener and Elkins were to absorb the major portion of his stock and become the guiding spirits of the company. It is known that Mr. Gould has been wishing for some time to concentrate his attention as much as possible upon his railroad interest, and this lends color to the story that he has sold or is to sell his Western Union stock, and it is believed that Widener and Elkins are, or are to be, the purchasers." Russell Sage pronounced the report absurd and said: "The facts are that neither Mr. Gould nor myself have sold a share of Western Union, and, so far as I am concerned, Western Union could sell much higher without my parting with any of my stock."

TELEPHONE.

The telephone company is burying its wires in Los Angeles, Cal.

The East Tennessee Telephone company has completed and put in operation a telephone exchange.

The Wisconsin Telephone company will proceed at once to reconstruct its lines at Janesville and introduce several improvements in the service.

A handsome uniform of blue cloth with silver plated buttons bearing a bell in relief, the insignia of the telephone company, has been adopted for the inspectors and repair men of the Southern New England Telephone company.

An ordinance was presented in the common council of Madison, Wis., Aug. 27th, providing for the regulation of telephone poles and wires. The poles must not be less than 50 feet high, and no wires shall hang less than 40 feet above the ground. The poles must be painted and they may be occupied by wires of other companies upon the payment of a proper sum of money. The ordinance was referred to the committee on streets.

The telephone companies in Tennessee are kept poor by the boys who steal the wire from the poles. A local paper says: "The common abuse of the property of our telephone syndicate and the total disregard of the law passed by the last Legislature prohibiting this peculiar species of vandalism, is an aggravation to the mountain country. The bill introduced by Hon. E. Story, of White, touching upon this, is one of the prominent features of that gentlemen's legislative record. But this law is of no avail. Small boys continue to pull the wires down with forked sticks, and squirrel hunters make targets of the insulators. Every buggy in Cumberland county is patched up with telephone wire."

MISCELLANEOUS.

Sprinting by electric light has proved a great attraction at Streator, Ill.

The Grand Rapids, Mich., *Herald* recently published the following item: "Wenona Beach, a resort owned by the Bay City Electric Railway company, where they have balloon ascensions, music, etc., but no liquor or beer, has been boycotted by the Christian Endeavor societies. It is now patronized by several thousand people every Sunday."

The agitation for the introduction of electricity as a means of propulsion of canal boats has not been dropped. The New York *Telegram* says: "Electricity is the proper motive power for canal boats. The old fashioned method of drawing boats by horse power is slow, inconvenient, costly and incapable of further development. Many attempts have been made to introduce steam propulsion, but none of them have been more than moderately successful. The Belgian cable system is clumsy, and it offers no advantages that would compensate for the cost of its introduction. In applying electric power lies the true key to the problem. It would be an easy task to construct a trolley system along each bank of the canal and supply ample power to boats."

TRADE NEWS.

George Cutter is about to enlarge his shop so as meet the demands for the new enamel rheostats which he is developing.

A ordinance has been introduced in the city council of Mobile, Ala., authorizing the electric railway company to build an electrical railroad on Jackson, Manasses, Hamilton and Beauregard streets.

The Peninsula Electric Light & Power company is wiring the new Methodist church at Calumet, Mich. There will be 118 incandescent lamps in the building, including one large center reflector, with thirty-five 1-6 candle power lamps. The Sunday-school rooms in the basement and the galleries will be fitted up with handsome 2-light bracket lamps.

The Gosben Milling company, Goshen, Ind., write as follows to James Leffel & Co., Springfield, O. "We are using a 66 inch wheel of your make, and it works very well indeed. We use it to drive a thousand light dynamo, as well as to run our 500 bbl. mill. We have a governor furnished by you, and the regulation is as near perfect as can be made. We use steam as an auxiliary power when the water is low. The steam power is also very uniform and steady; as we have a parallel compound condensing Corliss engine of 300 horse power. When we change from steam to water, the users of light cannot tell the difference." All of which speaks well for the Leffel machinery.

Charles D. Shain, New York, formerly district manager of the Edison General Electric company, has established headquarters at 303 Electrical Exchange, 136 Liberty street, New York, as electrical engineer and manufacturers' agent. He has been appointed selling agent for the Weston Electrical Instrument company. Mr. Shain is one of the most popular men in the electrical business. He has had wide experience. Before going to New York he represented the United States company in the West and was connected with other electrical enterprises. He has been singularly successful and his experience and wide acquaintance will prove advantageous in his new undertaking.

A new company to be known as the Midland Electric Works has been organized, with office and work-shop at 224 E. Washington street, Chicago. The officers of the company are Ray Griggs, president, and C. F. Samms, secretary and treasurer. Mr. Griggs has been with the Western Electric company for nearly five years, and during a part of that time was engaged in the installation of arc lighting plants, thus acquiring an experience in the field as well as in the factory. Mr. Samms has had a wide experience in different lines of electrical work and with Julius Wantz, who has been for several years with the Knapp Electrical Works and now has an interest in the new company, will make a strong combination. The preliminary work on a new motor embracing many new ideas is well in hand, and orders will soon be taken for the manufacture of two sizes—1-20 and ¼ horse power. Patterns have also been prepared for a small incandescent generator and plant complete of 10 or 20 lights, as may be desired, to be sent out for house or shop lighting, and which can be set up by the users without expense or without any knowledge of electric lighting. A number of pieces of new machinery is being put into the factory, giving facilities for turning out quite an amount of work, and with the practical experience enjoyed by these young men there should be no doubt as to the success of the enterprise.

BUSINESS.

General Manager E. R. Rand of the Newton Rubber company, of Boston, was in New York last week, during which time he took several good sized contracts.

The Wilder Watchman's Duplex Register company, New York, is installing a large plant of this well known system at Wichita, Kan., and also five of its systems in Kansas City, Mo. Since July first the company has averaged 10 installations per day.

W. F. D. Crane, manager electrical department of the W. Johns Manufacturing company, of New York, reports the sales of vulcabeston as being unusually large. This product is composed of asbestos, combined with water proof and acid proof materials compressed and vulcanized.

"Data Concerning Platinum, Etc," is the title of a little pamphlet just issued by Baker & Co., gold, silver and platinum refiners, 408-414 N. J. Railroad avenue, Newark, N. J. This house is daily receiving many inquiries in regard to this metal, and this valuable little book was prepared in consideration of the many requests for information which have been received from customers.

The Franklin Electric company, New York, is sending to the trade a circular giving the capacity, weight and price of type "A" to "F," of the Franklin mutipolar accumulators, built on the Irving system. This accumulator was developed by Prof. Frank Irving after a great number of experiments and careful investigation. There are many advantages embodied in the new system. The company states that there are no lead plates or grids with pasted or applied oxide of lead used, with the result of a total absence of danger of short circuits or buckling. The high availble electric-motive force which is 2.4 volts enables a less number of cells to be used. The cells are so constructed that a novice can handle them. This company solicit correspondence in reference to anything in the storage battery line.

ELECTRICAL PATENTS.

Issued August 29, 1892.

481,560. Secondary Battery. William W. Griscom Haverford College.

481,573. Volt Ammeter. Frederick A. La Roche, Philadelphia, Pa.

Two soft iron cores are mounted within the coils of an electro-magnet, one being stationary, the other connected with the index. When current traverses the coils of the electro-magnet both cores are magnetized alike and repel one another.

481,590. Auxiliary Fire Alarm System. Joseph Sachs, New York, N. Y.

The system consists of a fire alarm mechanism and a separate electro-magnetic tripping device for the fire alarm mechanism, a circuit controlling device directly connected with the tripping device and an auxiliary operating device at the other end of the circuit consisting of a circuit closer and a return call.

481,613. Signal Timing Apparatus. Henry A. Chase, Boston, Mass.

481,617. Lightning Arrester Cut-out. James P. Freeman, Washington, D. C.

A magnetic needle is nominally held by a magnet parallel to a conductor traversed by the current close to the circuit, and any abnormal current overpowers the magnet causing the needle to swing transversely to the conductor and close the circuit to ground until the current again becomes normal.

481 624. Ceiling Rosette Cut Out. James Pass and Albert P. Seymour, Syracuse, N. Y.

481,646 Electric Fan. Franklin H. Beers, Newark, N. J.

A suspended motor carries upon its armature shaft a beve friction gear wheel adapted to engage a friction ring carried upon and enveloping casing to which the horizontal fan blades are attached, whereby the fan blades are rotated in a horizontal plane.

481,652. Trolling Spoon. Henry Loftie, Syracuse, N. Y

481,664. Galvanic Battery. William J. Eggledue, Byfleet, England.

The battery is filled with active material to such a height that a part only of the electrodes will be immersed and after the active material has become weakened, the cell can be inverted to bring more of the electrodes under the action of the active material whereby a steady current may be obtained without refilling the battery.

481,665. Safety Attachment For Electric Conductors. Rudolph Furgang, Boston, Mass.

A frame is provided with a slide way open at the end and a block to which is attached the end of the wire fits in the slide way and is held in position by a spring pressed piston so that if the wire should break the piston will push the block out of the side way thus disconnecting the broken wire from the circuit.

481,666. Safety Attachment For Electric Conducting Wires. Rudolph Furgang, Boston, Mass.

481,677. Duplex Lamp. Charles E. Scribner, Chicago, Ill.

The different pairs of carbons are placed in parallel circuits and a single electro magnetic device for controlling a cut out is placed with its coil in circuit with one set of carboos and its armature and back stop in circuit with the other set.

481,678. Multiple Switchboard Telephone Exchange System. Charles E. Scribner, Chicago, Ill.

The annunciator is bridged across the two sides of the metallic circuit and a switch is included in the circuit of the test battery, and the circuits and connections arranged so that when a plug is lifted the test battery will be connected to indicate the busy test, and when the plug is inserted in the switch of the line called for the line, with which connection is thus made, will test "busy."

481,679. Telephone Exchange. Charles E. Scribner, Chicago, Ill.

One strand of the pair of cords, is provided with a branch circuit through battery to ground, the other strand being provided with bridge wires to the first strand, one including the operator's telephone the other including the clearing out drop and a condenser.

481,683. Method Of And Apparatus For Extracting Gold And Silver From Their Ores. Jonas W. Aylsworth, Orange, and Arthur C. Pain, Elizabeth, N. J

The ore is first subjected to the amalgamating action of a magnetic mercurial amalgam and then passed through a magnetic field, extracting the remaining amalgam.

481,692. Electric Cigar Lighting Lamp. William J. Eastman, Waterville, N. Y.

The lighter is ignited by a spark produced by breaking a battery circuit as the lighter is withdrawn from its case, the flame being smothered by the replacing of the lighter in its case.

481,701. Electric Motor or Dynamo Electric Machine, Robert Lundell, Brooklyn.

Two hemispheres made of magnetic material are provided with internal over lapping pole pieces and a single field magnet coil surrounds the pole pieces.

481,711. Electric Door Alarm. Merton W. Bessey, Waterville, Me.

Metallic strips are carried upon the door casing and a plate upon the door is adapted to close the circuit through the strips and a piece of insulating material is adapted to be interposed between the strips and the plate as the door moves in one direction only.

481,726. Electrically Controlled Stop Motion For Knitting Machines. Veeder S. Clute, Cohoes, N. Y.

481,739. Electric Motor And Regulating Device Therefor. Frank J. Sprague, New York, N. Y.

Two regulating switches are provided for the electric motor and connected in multiple, each being provided with contacts and circuits for varying the mechanical effects in the motor and with contacts and circuits for reversing the direction of rotation of the motor.

481,775. Electrically Driven Machinery For Cutting Coal. Llewelyn B. Atkinson and Claude W. Atkinson, London, England.

481,781. Rheostat. Charles E. Carpenter, Minneapolis, Minn.

Claim 1 reads:
A rheostat or resistance comprising a base plate corrugated, ribbed or recessed on the rear face thereof and provided with a coating of enamel or similar vitreous material on the front face and resistance coils or sections embodied in such coating.

481,785. Electric Lighting System. Pitt Cravath, Whitewater, Wis.

481,814. Extension Chandelier. F. Overholt.

The chandelier is composed of tubes adapted to telescope one within another, and the conductor is coiled within the tubes.

481,817. Trolley Carriage For Conduits. Stephen L. Platt, Elgin, Ill.

481,833. Device For Removing Armatures. Stephen H. Sharpsteen, Honesdale, Pa.

481,842. Magnetic Brake. Armand de Bovet, Paris, France.

A magnet core is provided with curved plates constituting pole pieces which are adapted to fit the tread of the wheel and from which they are normally held by springs. Upon a current traversing the magnet coil, the plates are pressed against the tread of the wheels.

481,847. Fire Alarm Telegraph. Andrew J. Coffee, Portland, Ore.

A system of auxillary boxes is used in connection with the main district or signal boxes, and means are provided for locating the exact auxiliary that has been turned in so that no two boxes can interfere in a way to cause confusion.

481,878. System Of Telephony. Elihu Thomson, Swampscott, Mass.

A set of transformers is used, the primaries being fed by an alternating machine producing alternations of such low frequency that they are inaudible upon the line, the secondaries being connected into the speaking circuit

481,899. Pipe Insulator. George E. Dixon, Chicago, Ill.

481,903. Coin Signal Sounding device. Charles W. Holbrook, Windsor Locks.

A telephone toll collector embodies a signal plate having a series of coin-channels arranged in succession across the plate and signal bells project into one or more of the separate coin-channels.

481, 904. System Of Electric Lighting. Ernest Huber, New York, N. Y.

The translating devices are included in two or more circuits which are continuously supplied by a generator and means are provided for placing the translating devices in the successive circuits alternately in multiple and in series.

481,905. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa.

481,912. Conduit For Electric Conductors. Augustus Noll, Mount Vernon, N. Y.

The conduit is composed of metallic tube sections inclosed in tubular coverings of insulating material, tubular insulating material forming the connection between one metallic tube section and the next.

481 913. Conduit For Electric Conductors. Augustus Noll, Mount Vernon, N. Y.

A lining of insulating material adheres to the inside of a metallic tube and an insulating covering encases the tube:

481,914. Electric Circuit Connection. Augustus Noll, Mount Vernon, N. Y,

481,916. Electric Central Clock. Nicolaus Prokhoroff. Kiev, Russia, Patented in Germany Mar. 27, 1890, No. 56,652; in Belgium Oct. 28, 1890, No. 92,510; in France Nov. 3, 1890 No. 209,254, and in England Nov. 22, 1890, No. 18,993.

481,919. Electric Guest Call. Franklin Benner, Minneapolis, Minn.

11,266. Dynamo Electric Machine. William S. Andrews, New York., and Thomas Spencer, Philadelphia, Pa.

Coils included in series in the armature circuit are carried upon the pole pieces and wound in a manner to oppose the demagnetizing effect of the generating armature coils that lie between the planes passing through the points of commutation perpendicular to the lines of force.

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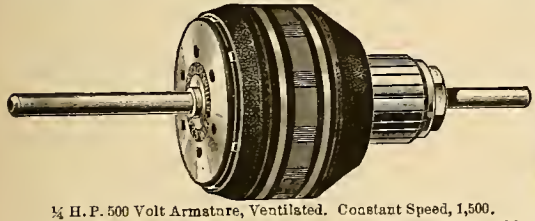

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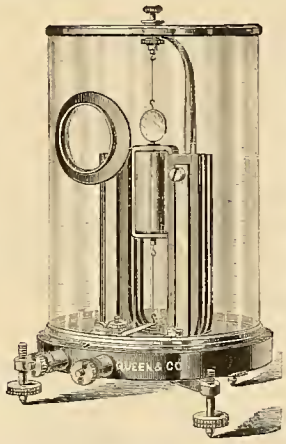

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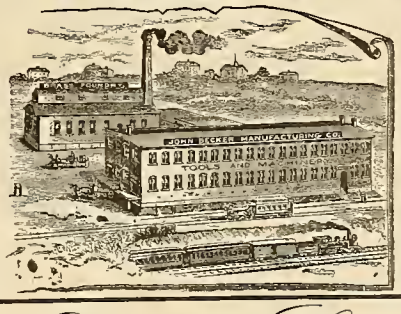

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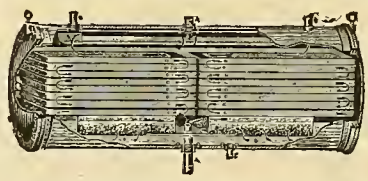

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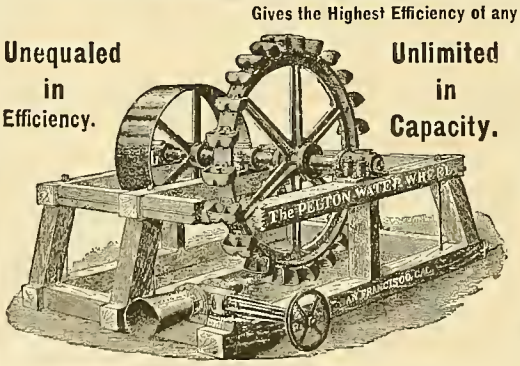

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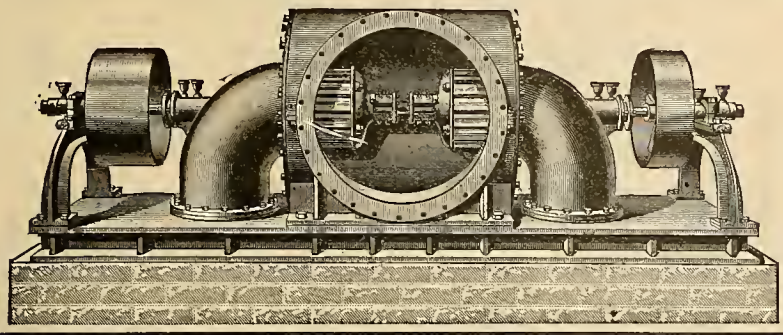

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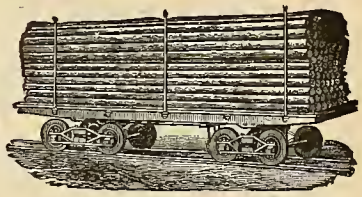

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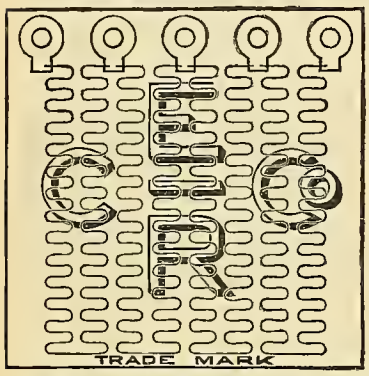

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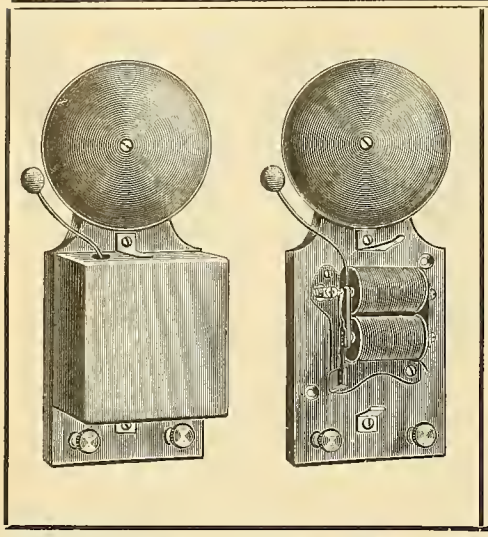

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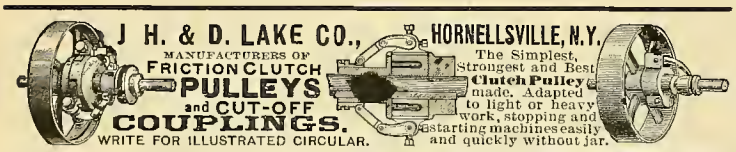

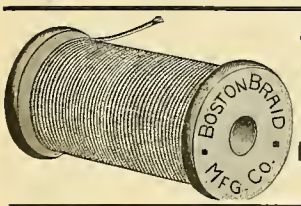

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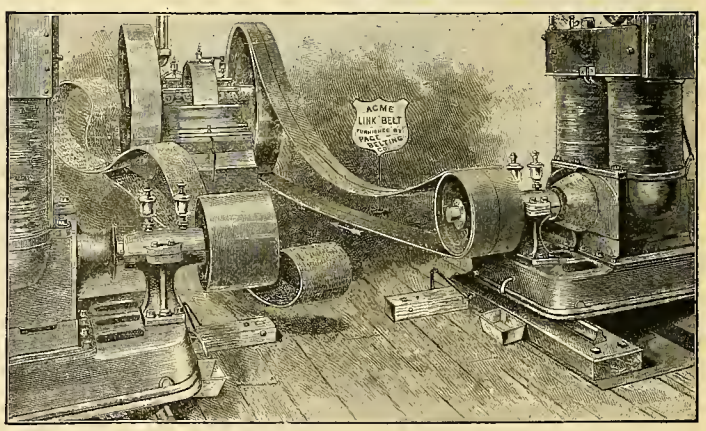

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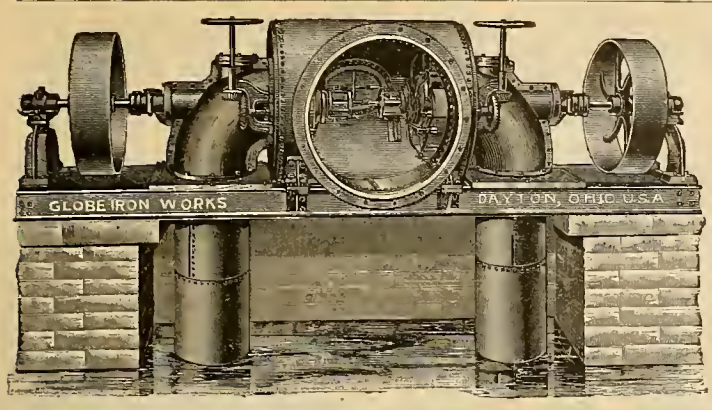

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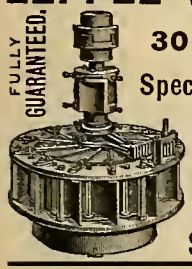

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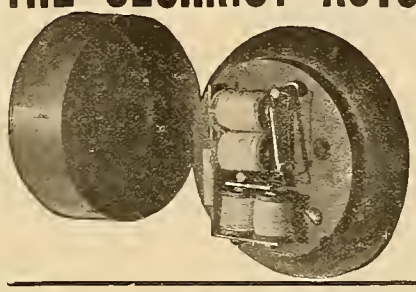

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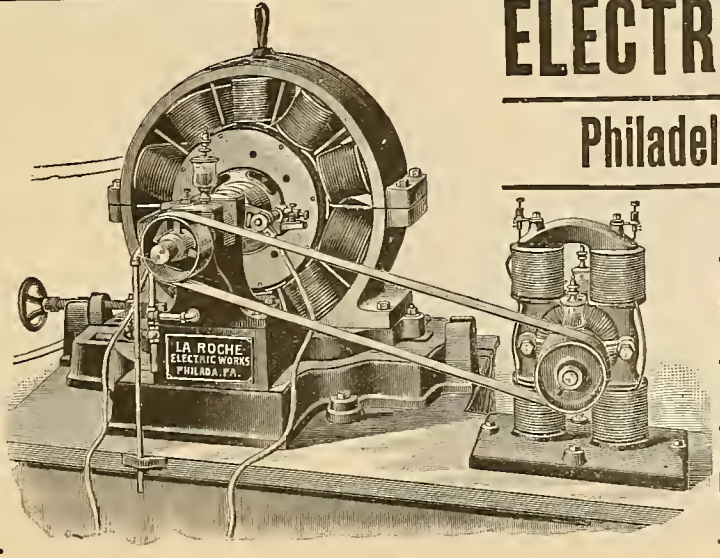

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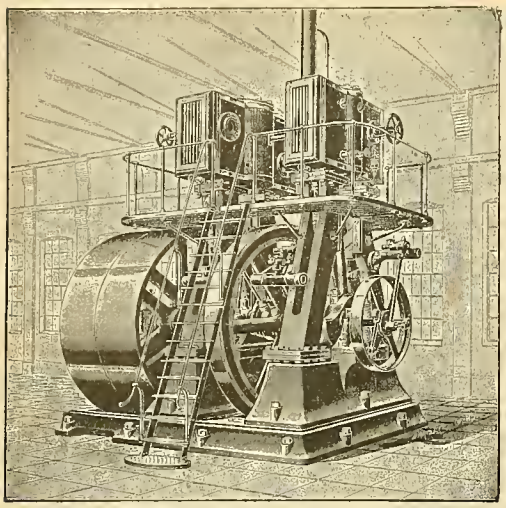

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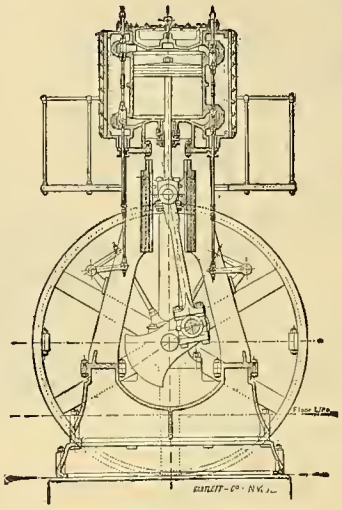

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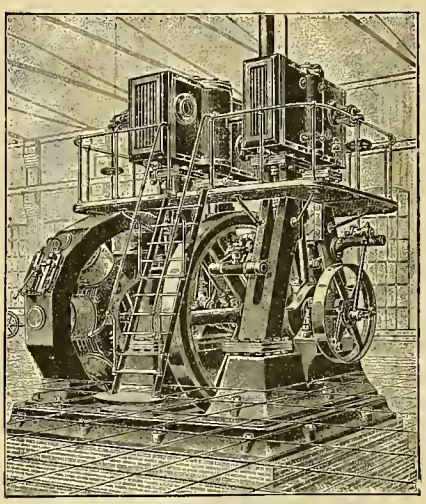

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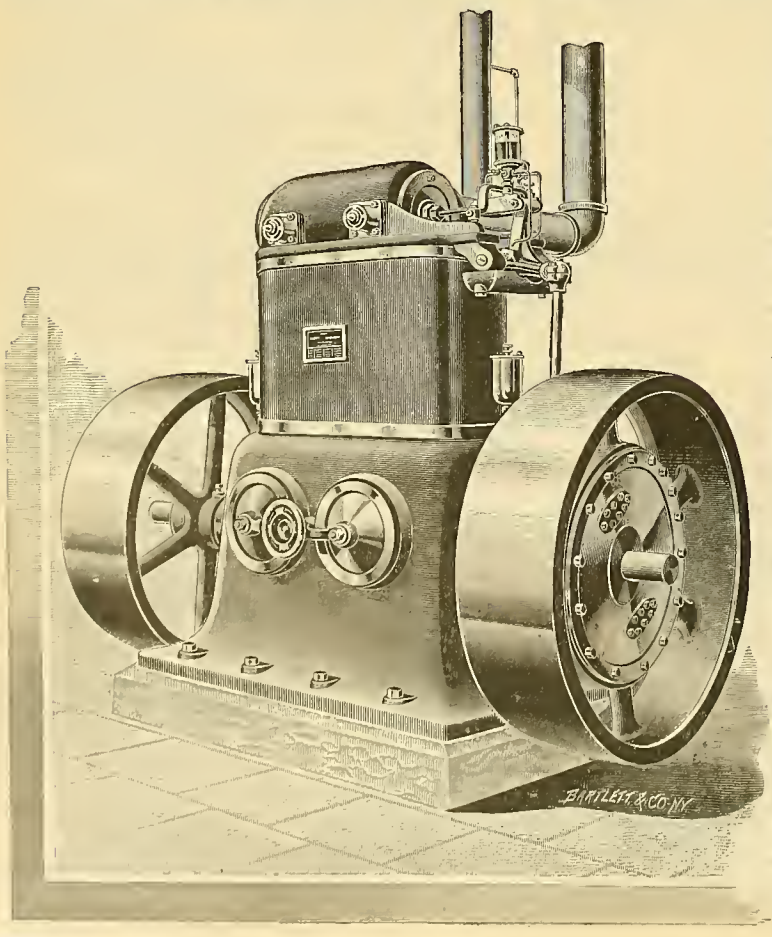

The Compound Engine, when non-condensing, so far from possessing an economy superior to the Simple Engine, has been decisively proven, "much to the disgust of the stockholder," to show normal economy only at or about its rated power, and to fall off in economy faster than a Simple Engine as the load falls off; moreover, very much faster under the extreme light loads that are common in Electrical Generation. This point is at last reluctantly admitted by the more candid builders of such engines, most of whom now advise against compounding for variable loads. The reason is in their inability to divide the load and range of temperature proportionately and automatically between the cylinders at all points of cut-off. Hence, the low-pressure cylinder expands its steam below atmosphere under a moderately early cut-off, thus converting itself into an Air Pump, and becoming a load upon the high-pressure cylinder instead of a co-laborer with it. This point was distinctly foreseen by the designers of the Westinghouse Compound Engine, and an entirely new principle was worked out, making expansion below atmosphere impossible under any load, however light. **For the first time in the history of Steam Engineering, either Simple or Compound, is built an Engine which maintains essentially uniform economy, irrespective of load,** and hence for the first time the Compound Non-condensing Engine has been made practicable. The results, demonstrated by test, show that where an ordinary Compound will range from 25 lbs. to 70 lbs. water per H. P. per hour from full to quarter load, the Westinghouse Compound, between the same limits, will range from 23 lbs. to 29 lbs. We have not deceived ourselves in this matter, and propose that the facts shall be understood. To those interested in the nicer points involved, we will be pleased to send a reprint of the paper read by Mr. F. M. Rites on this subject at the late meeting of the American Society of Mechanical Engineers, at San Francisco.

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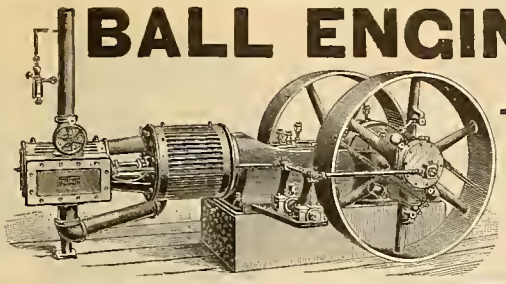

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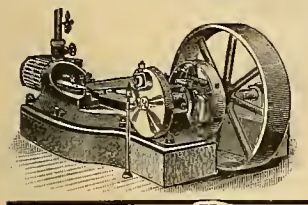

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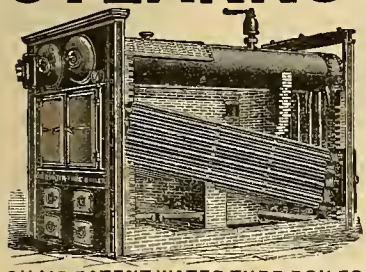

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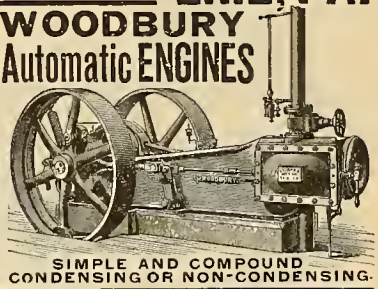

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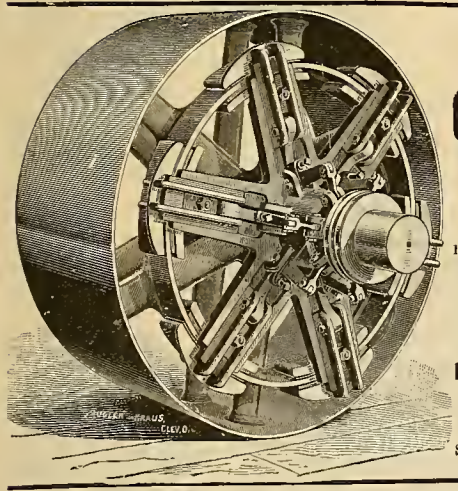

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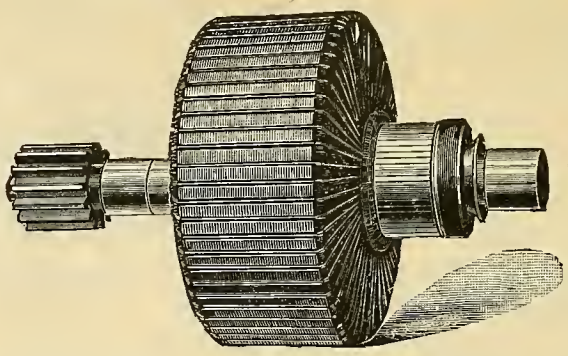

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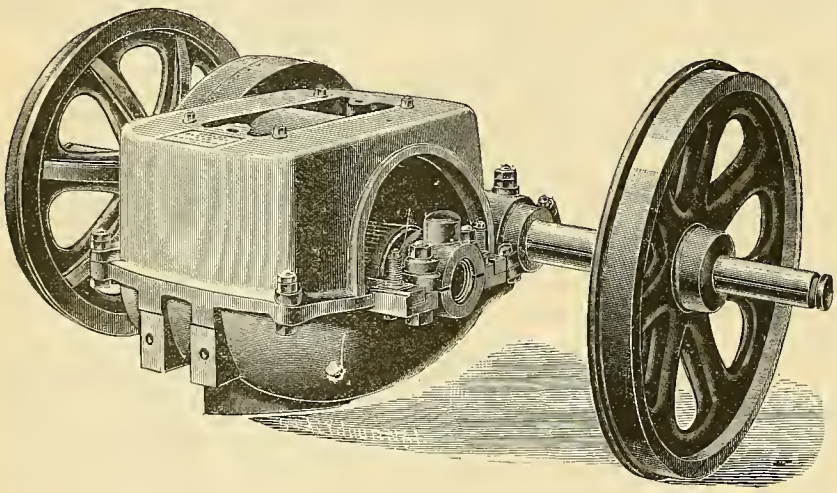

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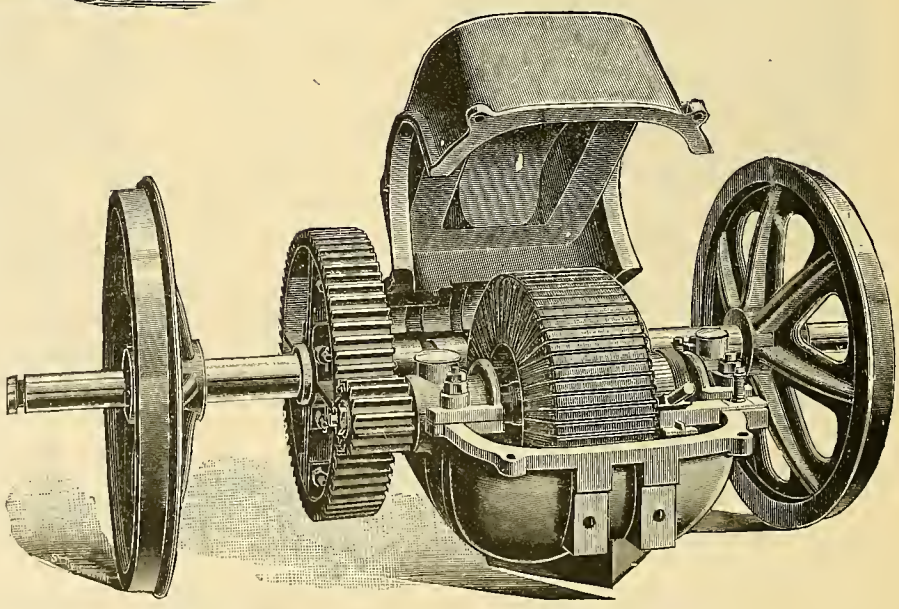

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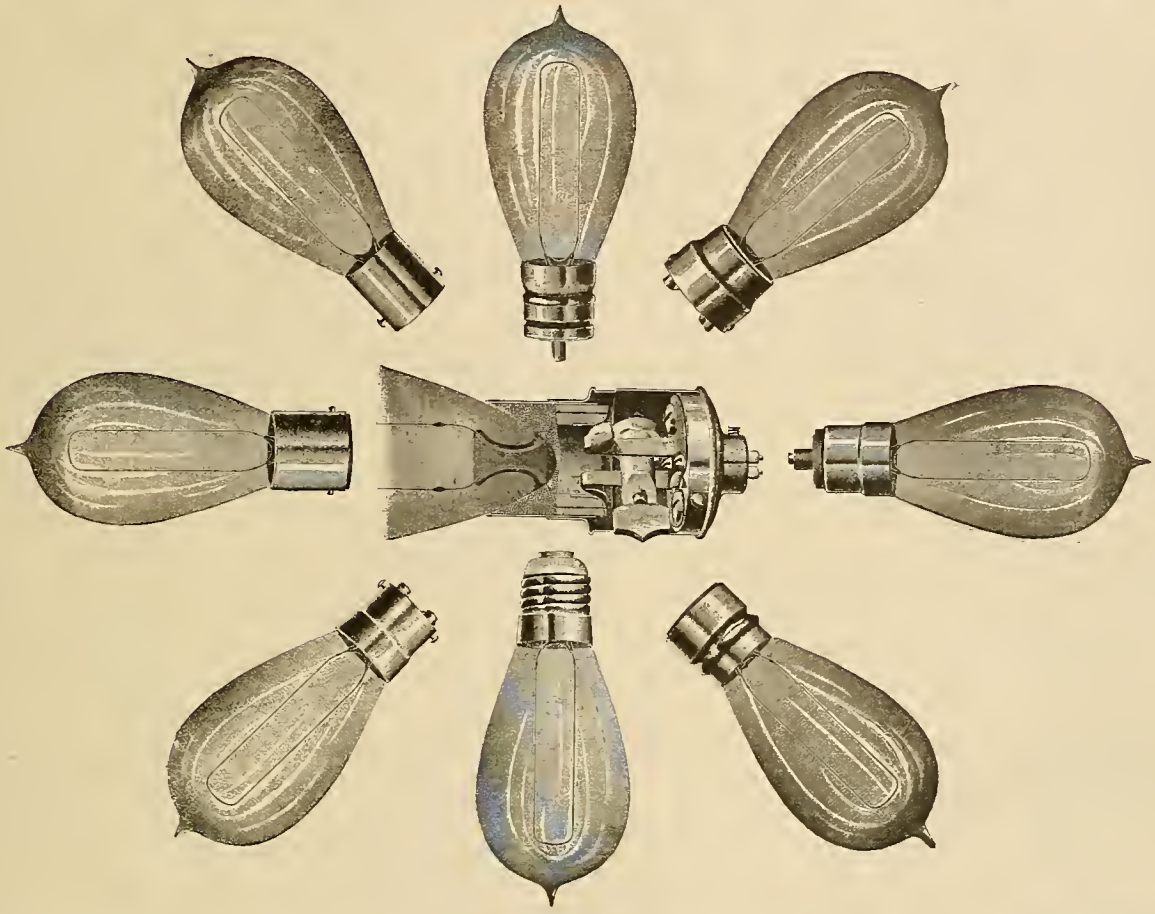

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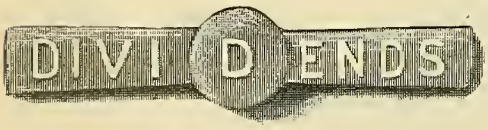

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The society reporter took his assignment and boarded a West Side cable yesterday. Swinging lightly into his seat, he nodded pleasantly to the conductor. He knew all the boys on that line, and it paid him to keep on the feathery side of them. No. 247 was a jolly conductor and had given him several pithy pointers. At the next corner a heavy weight Hibernian matron waved her hand at the grip; the cars slowed up but started again before she was comfortably fixed with her basket. 247 passed down the aisle.

"Fare, please?"

"Yer moighty pert, ye are, shtartin th' cayers before a body gets on."

247 was respectfully silent and came back to the platform smiling. Another passenger got on and he passed the old lady again.

"Run yer old cayers like ye was goin' to a fiarr."

The society reporter snickered audibly. Thinking she was the butt of his amusement, she turned on him.

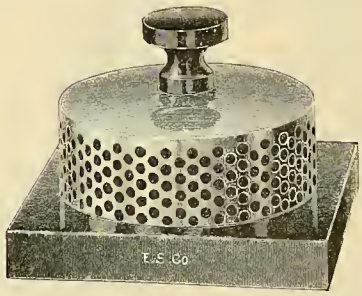
"Phwat the devil be ye laafin' at? Yer a nice man to make fun of a poor owld woman, you little doode—doode—yer too nice; a pussy cat couldn't wipe her feet on ye."

By this time the other passengers were convulsed and chuckling. The society reporter was red in the face and uncomfortable, but still laughing. She wasn't content to let him off with that and kept up her tirade—"Nice little doode." He couldn't stand it any longer and stepped off, saying:

"Good day, old lady, good day, you are one too many for me." As the car passed she gave him a parting shot.

"Doode! pussy cat!"

"Garfield Park!" called 247.



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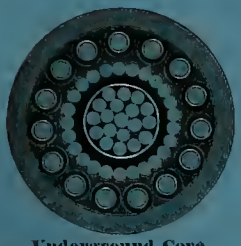
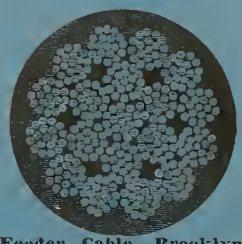
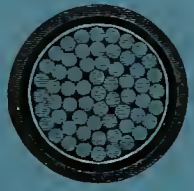

Underground Core.


Feeder Cable. Brooklyn Edison Electric Light Co.

Underground Core. N. J. Central R. R.


Feeder Core. Broadway Theater.

Submarine Work, Edison Electric Light Co., Easton, Pa.

Naval Core, United States s. s. "Chicago."

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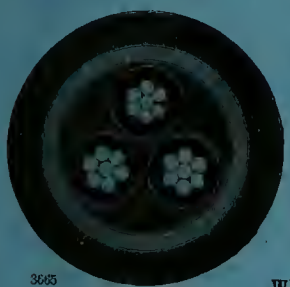
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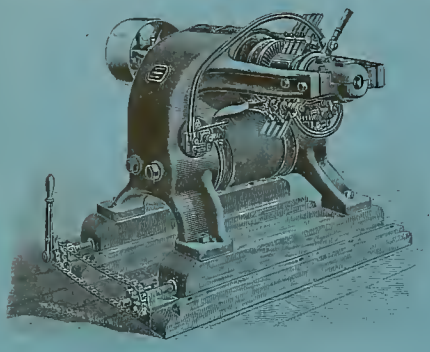

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Vol. XI. CHICAGO, SEPTEMBER 17, 1892. No. 12

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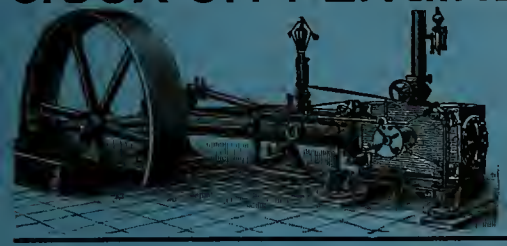

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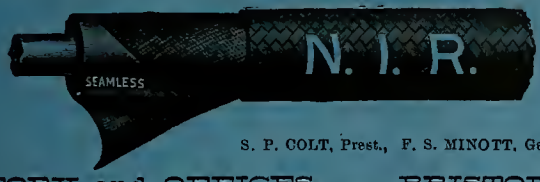

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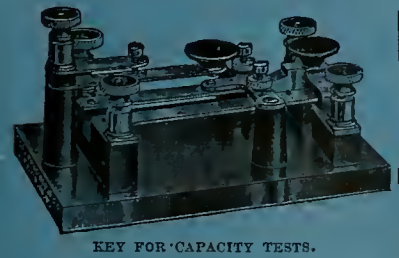

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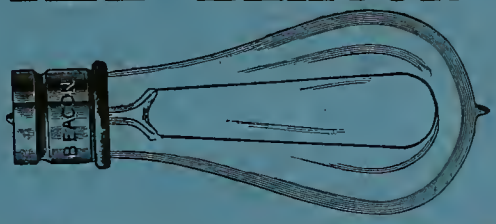

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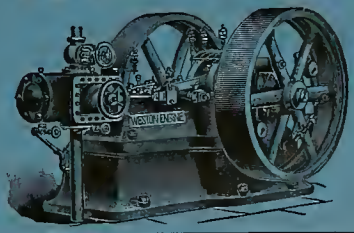

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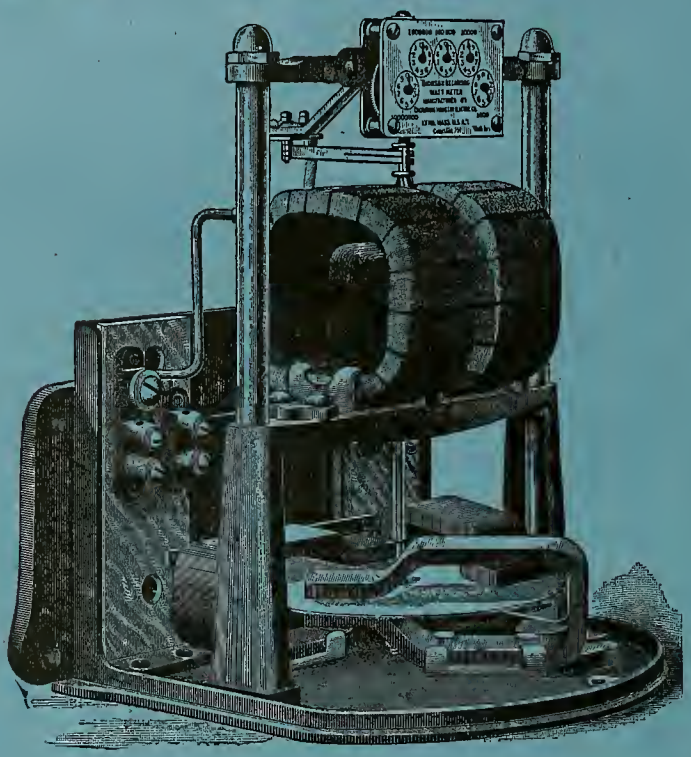

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GERMANTOWN ELECTRIC LIGHT CO.,

(Signed) Chas. M. Allen, Supt.

LANSING, MICH., April 6, 1892.

Thomson-Houston Electric Co.,
BOSTON, MASS.

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Yours truly,

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(Signed) E. F. Cooley, Supt.

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PRINCIPAL OFFICE,
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WESTERN OFFICE,
173 Adams Street, Chicago, Ill.

INDEX AND CLASSIFICATION OF ADVERTISEMENTS.

ALPHABETICAL LIST.

American Battery Co..... x
American Desk & Seating Co..—
American District Steam Co.... x
American Electrical Mfg. Co..—
American Engine Co..... xii
Andrews & Co., A. H..... xiv
Babcock & Wilcox Co., The.... i
Baggot, E..... xiv
Ball Electric Light Co..... xvi
Ball Engine Co..... xix
Ball & Wood Co., The 1
Beacon Vacuum Pump & Elec. Co.i
Becker Mfg. Co., John..... xiii
Beggs, J. E., Mch. & Supply Co. x
Bernstein Electric Co..... .iv, xiii
Boston Braid Mfg. Co..... x
Bowers Bros..... xvi
Bridgeport Mach. Tool Wks.. xii
Brookfield, Wm..... xii
Brush Electric Co viii
Bryan, W. H..... xiii
Bryant Electric Co.....—
Buckeye Electric Co., The..... ix
Carpenter Enamel Rheostat Co. xvi
Central Electric Co..... v
Chicago Rawhide Mfg. Co..... xix
Crescent Ins. Wire & Cable Co. xiii
Crocker-Wheeler Electric Co.. xiii
Cushing, F. W..... vii
Cutter, Geo .....—
Cutter Electrical & Mfg. Co... vi
Dayton Globe Iron Works Co..xvii
Densmore Typewriter Co.....—
Detroit Electrical Works..... xxiv
Diamond Electric Mfg. Co.... —
Dixon Crucible Co., Jos..... xix
Dudley & Co., W. W..... xvi
Duplex Electric Co., Ltd..... xii
Eastern Electric Cable Co..... xiii
Eastman Kodak Co..... xiv
Edison General Electric Co.....viii
Electric Cons. & Supply Co... vi
Electric Engr'g & Supply Co.. ix
Electrical Mfg. Co., The..... xv
Electric Secret Service Co..... xix
Electrician Pub. Co..iv, xvi, xviii
Electrical Construction Co. The. xii
Electrical Eng. & Supply Co.The. v
Electrical Supply Co., The ... xxii
Elektron Mfg. Co.....—
Empire China Works..... x
Enterprise Electric Co..... xv
Falls Rivet & Machine Co..... ix
Ferracute Machine Co.....—
For Sale Advertisements, x, xii, xiii
Fort Wayne Electric Co..... xxiv
General Electric Co..... ix
Gravity Purifier Co.....—
Great Western Elec. Supply Co..ix
Greeley & Co., The E. S.....1
Hart & Hegeman Mfg. Co..... xvi
Heisler Electric Co..... iv
Hill Clutch Works.....—
Hine Eliminator Co..... xii
Holmes, Booth & Haydens.... xiv
Hood & Co., Wm..... xv
Hughes Bros. Mfg Co..... xii
Illinois Electric Lamp Co..... xvi
India Rubber & G. P. Ins. Co. xxiii
Institute of Technology..... xiv
Interior Conduit & Insulation Co. x
International Okonite Co..... i
Jewell Belting Co..... i
Johns Mfg. Co., H. W.....—
Kartavert Mfg. Co..... xvi
Kelly Brothers xix
Klipstein, A.....—
Knapp Electrical Works..... xxi
Lake, J. H. & D., Co .....—
Lake Erie Engineering Works.xviii
Lane & Bodley Co..... xvii
La Roche Electric Works.....—
Leclanche Battery Co., The .. xvii
Lefmann, Julius xiv
Leffel, & Co., Jas xvii
Leonard & Co., H. W..... xviii
Link Belt Machinery Co..... xv
Loud, H. M. & Sons Lumber Co. xiv
Lovell Mfg. Co., Ltd..... xiii
Mather Electric Co..... iv
Midland Electric Wks.....—
Moore, Alfred F..... i
Morse & Co., A. M..... xv
Munsell & Co., Eugene..... xiii
National Carbon Co..... xiv
National Electric Mfg. Co v
National India Rubber Co i
New York Insulated Wire Co. xv
N. Y. Safety Steam Power Co. xix
New York & Ohio Co..... l
Ostrander & Co., W. R..... xviii
Page Belting Co.....—
Partrick & Carter Co.....—
Pearson & Co., W. B..... xviii
Pelton Water Wheel Co..... xiv
Perkins Elec. Switch Mfg. Co.—
Phoenix Glass Co.....—
Pioneer Armature Co..... xiii
Porter-Leavitt Elec. Motor Co.—
Queen & Co..... xiii
Racine Hardware Mfg. Co..... xii
Railway Equipment Co..... ix
Redding Electric Co..... x
Ries Electric Specialty Co..... x
Roebling's Sons Co., J. A vi
Rose Elec. Light Supply Co...—
Royal Electric Co..... xi
Samson Cordage Works. xii
Sawyer-Man Electric Co..... xi
Schuyler Electric Co.....xviii
Sechrist, Albert..... xvii
Shultz Belting Co.....—
Siebert, G..... xiii
Siemens & Halske Electric Co. xiii
Sioux City Elec. Supply Co... xiv
Sioux City Engine Works.... i
Smith, A. T..... xvii
Smith, Thos. G. Jr..... xix
Somoff, J. L..... xv
Sperry Elec. Mining Mach. Co. xvi
Standard Electric Co..... vi
Standard Paint Co x
Stanley Electric Mfg. Co.....—
Star Electrix Co... xv
Stearns Mfg. Co..... xix
Sterling, W. C..... xv
Stilwell & Bierce Mfg. Co. xiv, xv
Sunbeam Incand. Lamp Co...xxiii
Taylor Engine Co..... xix
Thomson-Houston Elec. Co.. ii, xx
Union Hardware Co..... xii
Utica Elec. Mfg. & Supply Co. x
Van Nuis C. S.....—
Vulcanized Fibre Co..... xv
Waddell-Entz Company..... xii
Wannopee Pottery Co.....xviii
Want Advertisements xiii
Washburn & Moen Mfg. Co.. —
Western Electric Co.....xiv
Westinghouse, Church, Kerr & Co..... xvii
Westinghouse Elec. and Mfg Co. xi
Weston Engine Co..... i
Woodhouse & Rawson, Ltd....—
Worthington, Henry R.....—

CLASSIFIED LIST.

Annunciators.
Central Electric Co.
Detroit Electrical Works.
Electrical Supply Co., The.
Knapp Electrical Works.
Ostrander & Co., W. R.
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Arc Lamps.
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American Battery Co.
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Detroit Electrical Works.
Electrical Supply Co., The.
Greeley & Co., The E. S.
Leclanche Battery Co., The.
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Enterprise Electric Co.
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Knapp Electrical Works.
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Detroit Electrical Works.
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Cutter Electrical & Mfg. Co.
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Ball Electric Light Co.
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Fort Wayne Electric Co.
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Greeley & Co., The E. S.
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Cutter Electrical & Mfg. Co.
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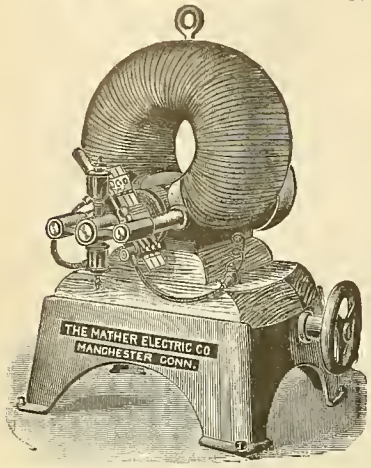

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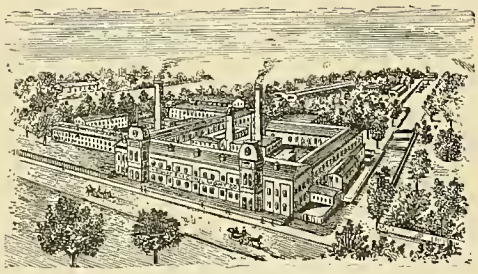

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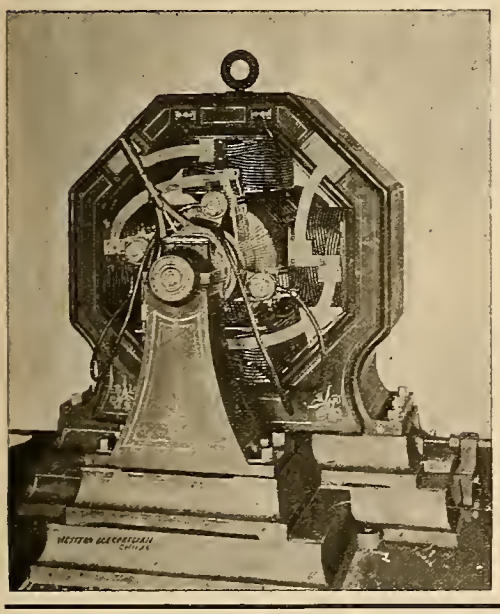

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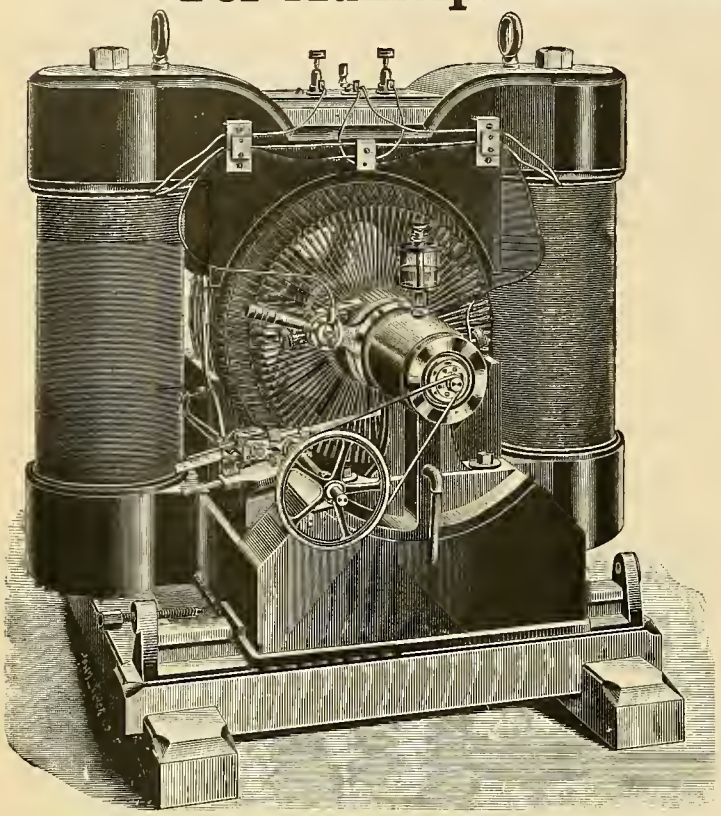

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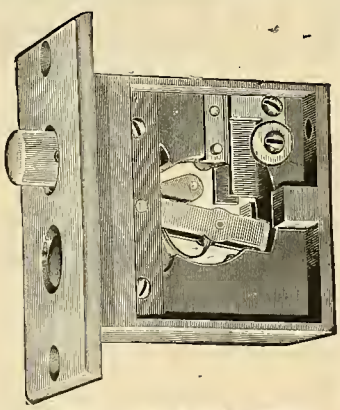

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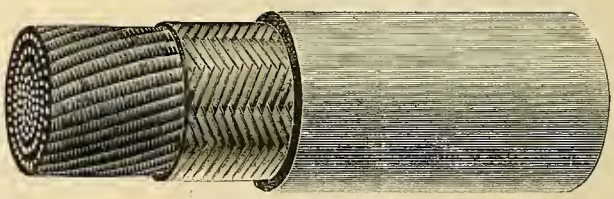

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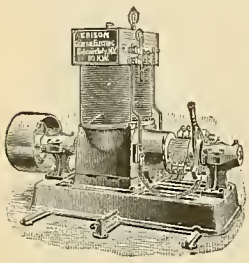

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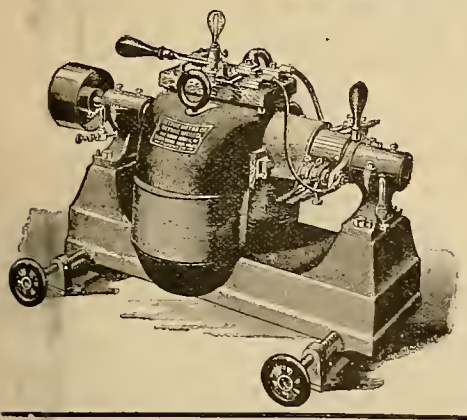

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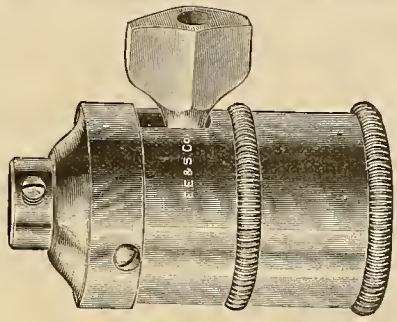

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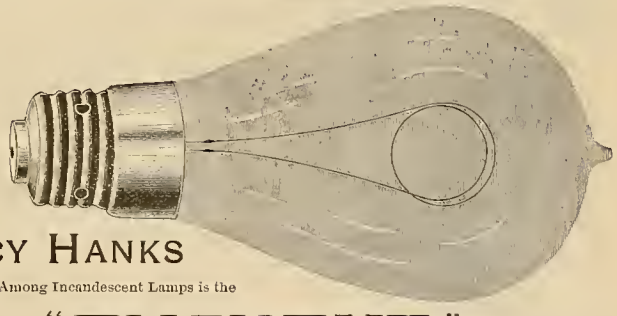

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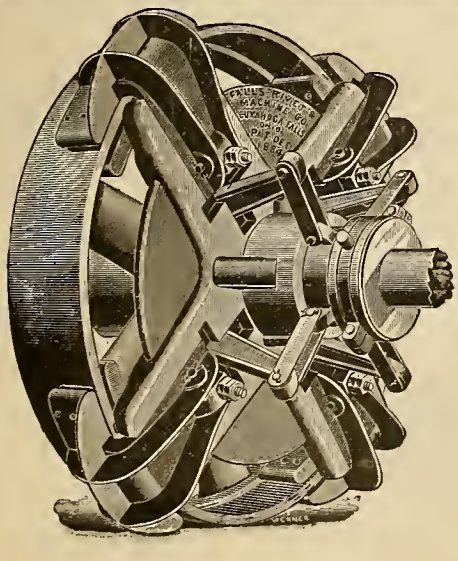

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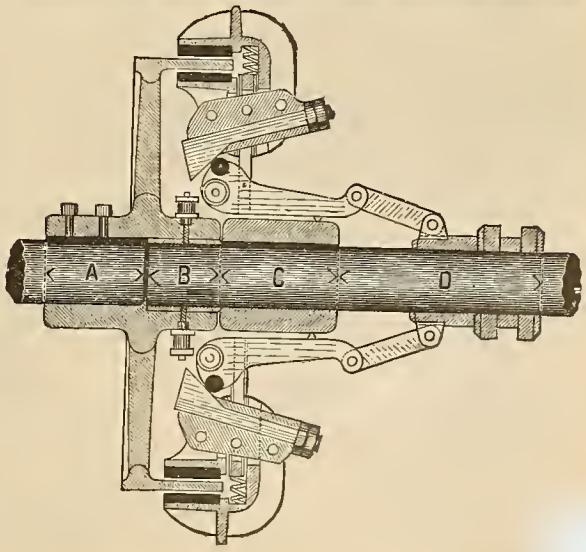

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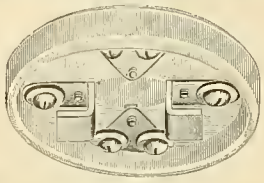

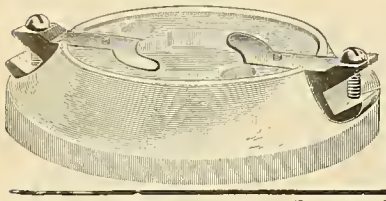

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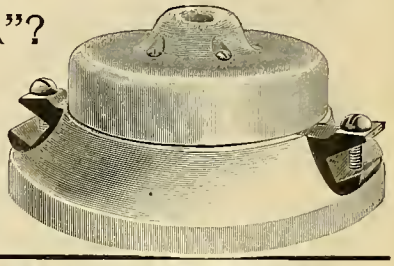

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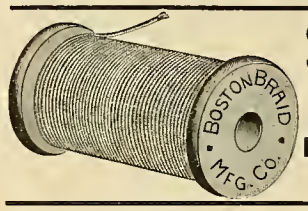

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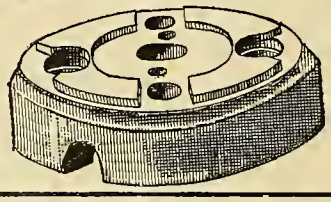

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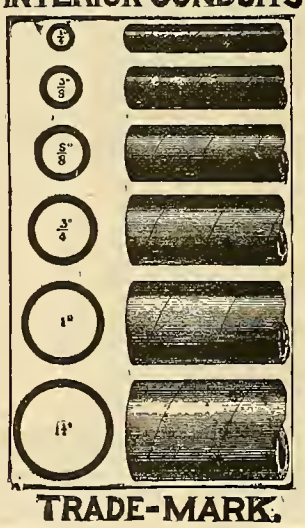

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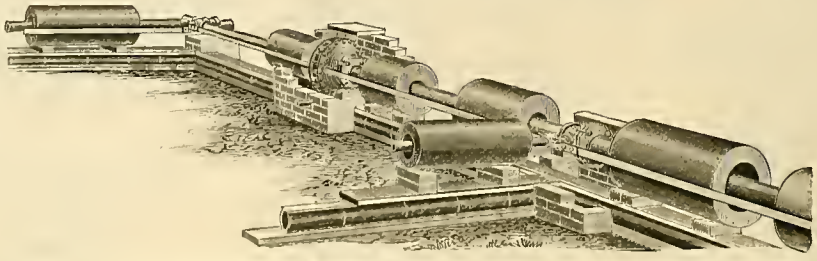

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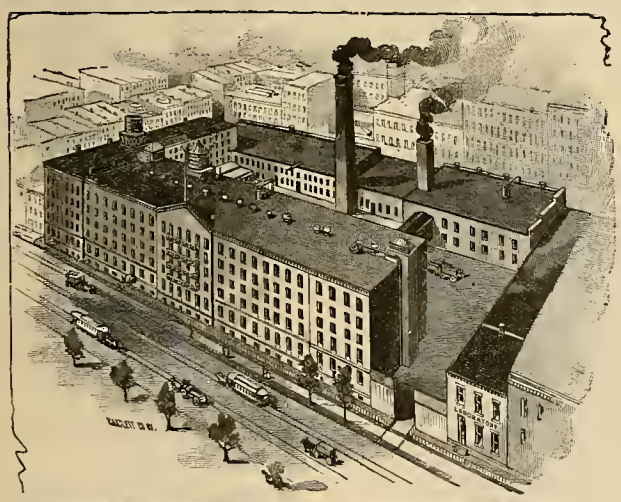

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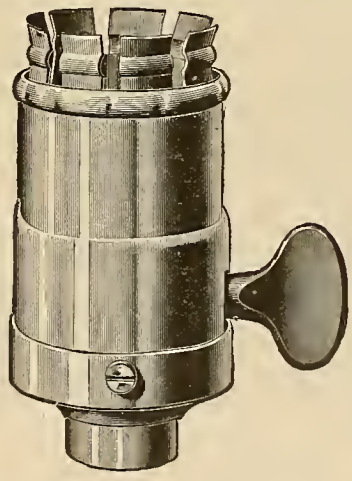

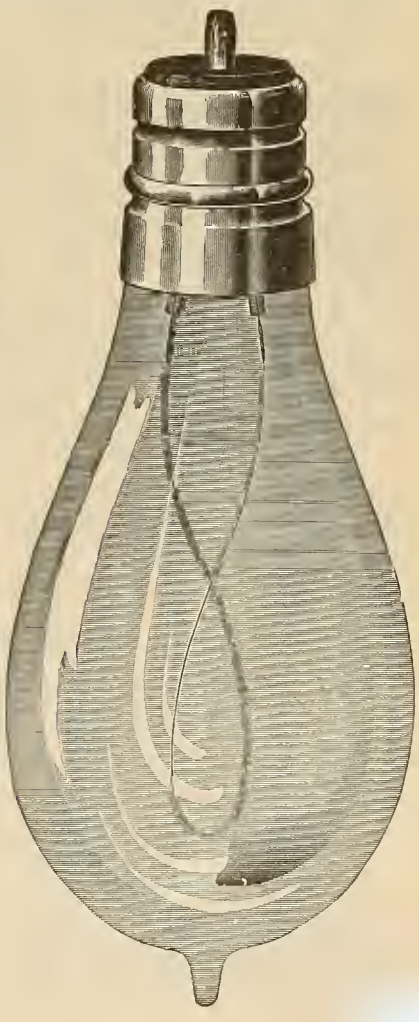

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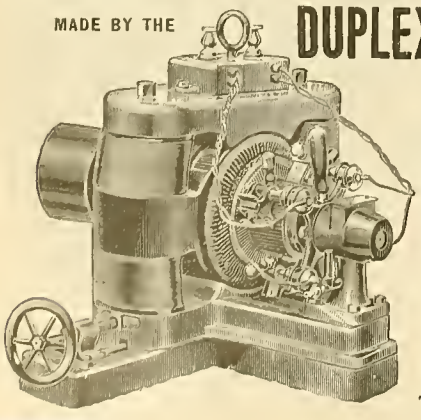

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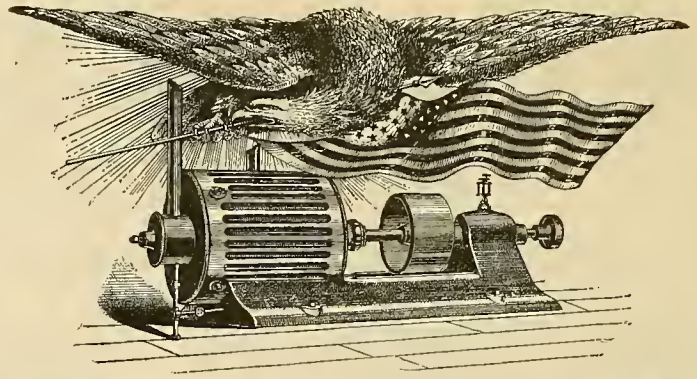

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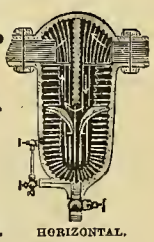

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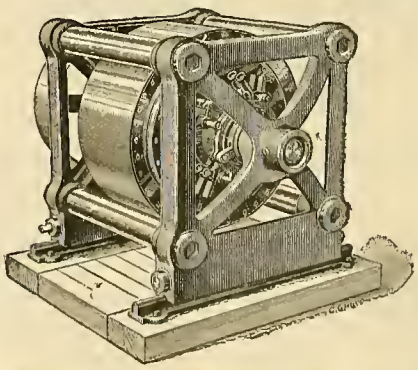

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Vol. XI. CHICAGO, SEPTEMBER 17, 1892. No. 12

First Electric Carriage on the Streets of Chicago.

In the WESTERN ELECTRICIAN of Dec. 5, 1891, there was presented a description and illustration of an electric carriage that had been built in Des Moines, Ia., by William Morrison. At that time nothing more than a general description could be obtained owing to the inventor's reluctance to divulge information as to details. Not long ago, however, this carriage was purchased by J. B. McDonald, president of the American Battery company, Chicago, and brought to this city. Ever since its arrival the vehicle has attracted the greatest attention. The sight of a well-loaded carriage moving along the streets at a spanking pace with no horses in front and apparently with nothing on board to give it motion, was a sight that has been too much, even for the wide-awake Chicagoan. It is most amusing to see the crowd gather whenever the vehicle appears down town. In a number of instances so great has been the curiosity of those on the streets that the owner when passing through the business section of the city, has had to appeal to the police to aid him in clearing the way for his carriage.

Since his purchase of the vehicle Mr. McDonald has been making daily use of it in entertaining friends and illustrating to the skeptical the merits of the Morrison storage battery; in fact, it may be said that his chief object in purchasing the carriage, which was of necessity more or less of an experimental apparatus, was that he might employ it to demonstrate that, with the Morrison battery, such traction might be made thoroughly practical. The American Battery company has purchased the rights to manufacture exclusively the Morrison storage and dry batteries, and there is no doubt now, but that the electric carriage is proving a most excellent means of testing the practicability of the batteries for the rough service on the streets.

On Thursday of last week a representative of the WESTERN ELECTRICIAN was given an opportunity to judge of the riding qualities of the carriage. Through the courtesy of Mr. McDonald a party of gentlemen were invited to a ride on the West side. Accordingly about 4 o'clock in the afternoon Mr. McDonald, Vice-president Geo. T. Burroughs of the American Battery company, Messrs. Lucius Otis, Jenkins and the WESTERN ELECTRICIAN representative, assembled at the American Battery company's factory on West Quincy street on the West side. The carriage was then backed up against the sidewalk in front of the factory, as the cells were receiving a fresh charge after a morning's trip. After a little delay to slip a new key into one of the gears and disconnect the charging wires, the word to "pile in" was passed, and all hands took their seats with Mr. McDonald at the wheel. It should be here stated that the back end of the carriage was on the pavement while the front wheels rested tire deep in a dirt pile which had been misnamed "the street;" in other words, the start was made under disadvantageous circumstances—against what might be called a dirt pile, and hence on more or less of an up-grade. Confidence though, in the reserve power of the little motor and batteries, was won the moment the starting lever was pulled, for the way the vehicle mounted out of the ruts in which its front wheels rested caused exclamations of surprise from those on board. The party was taken east on West Quincy street to Clinton, to Jackson street, thence west to the boulevard and then to Mr. McDonald's residence on the corner of Monroe street and Winchester avenue.

Of course there was nothing wildly exciting about the trip, but it is needless to say that as the carriage jumped in and out of ruts on the side streets, bounced over the car tracks, whisked around corners, etc., one felt licensed to predict that the day was not far distant when it would be possible to telephone for the electric dog cart instead of the horse and buggy.

On arriving at the McDonald residence the photographs from which the accompanying cuts were made, were taken, and the novel little vehicle was then housed in the stable for the night.

A very good idea of this electric carriage's construction may be had by an inspection of the cuts. The illustration Fig. 1 on the front page embodies a view showing the general appearance of the vehicle and also two different side views taken at close range so as to present the details of the motor rigging and the gearing. To any one familiar with electrical machinery the whole equipment is very simple and the views presented leave little to be explained.

The total number of cells on the carriage is 24. Each of these cells is of 150 ampere hours capacity, and their total electromotive force when in operation in series was 48 volts. On the carriage the cells are disposed in three sets of eight each, a set being placed under each seat as shown in Fig. 2.

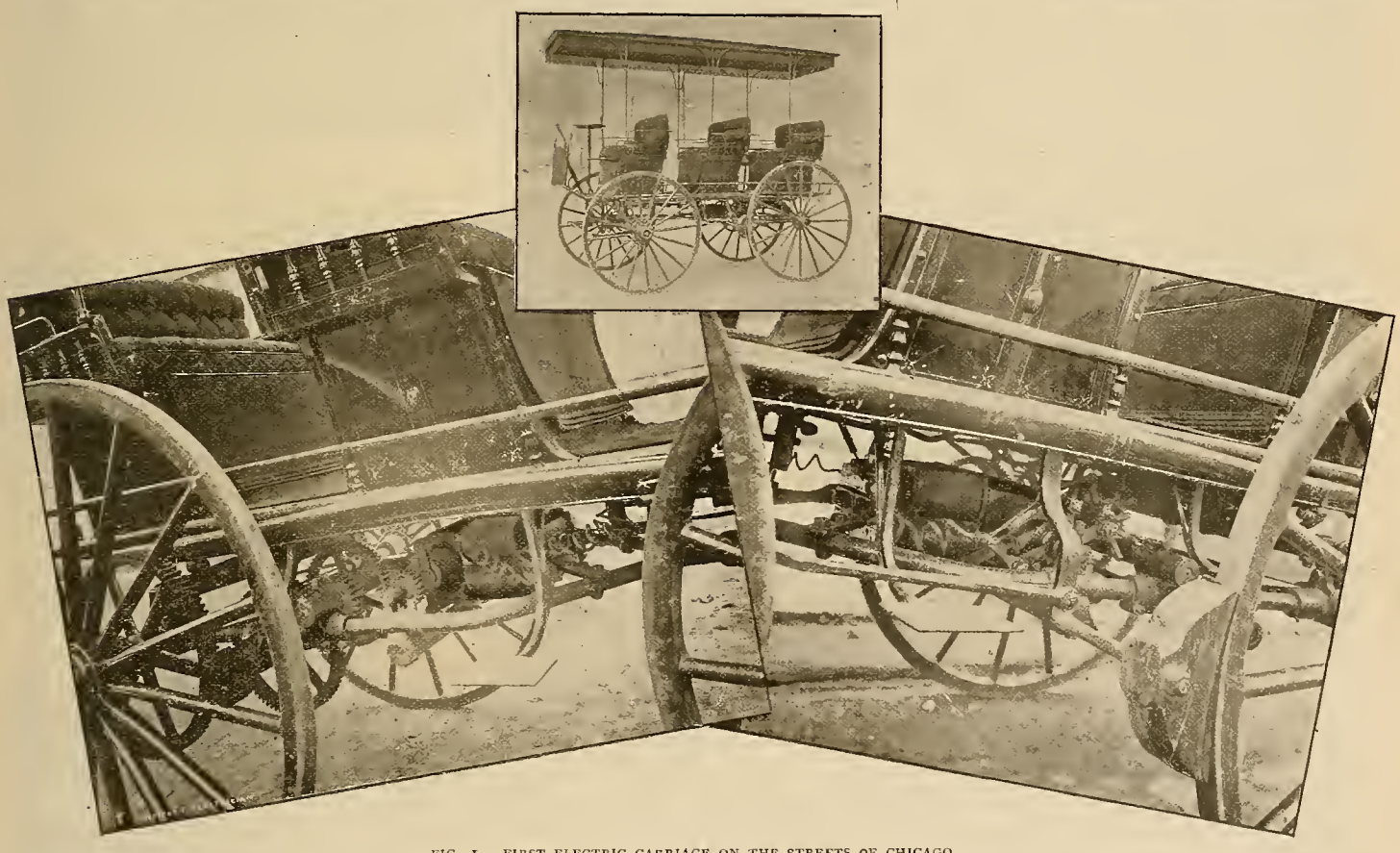


FIG. 1. FIRST ELECTRIC CARRIAGE ON THE STREETS OF CHICAGO.

The motor is of 2 1-2 horse power and is series wound. It is connected by the train of gearing to the right hand back wheel of the carriage. This wheel is 4 feet in diameter and is driven at a speed of 6 to 7 miles per hour. Carbon brushes are used, and these are set on an incline to the commutator, but the armature can be reversed without sparking.

The controlling apparatus consists of a contact board and a reversing switch both fastened to the underneath side of the carriage floor. It was impossible to obtain a photographic view of these parts, but the diagram, Fig. 3, shows the electrical connections of the entire equipment. The small lever, Fig. 2, works the reversing switch while the larger or speed controlling lever shown in the same picture, draws a commuting bar or contact over the contact board, Fig. 3, and throws the cells into the following combinations up to that for full speed: 8 in series, 3 in parallel; 12 in series, 2 in parallel; 24 in series.

A spring plug foot switch is also shown in Fig. 2. To

shut off the power the driver has only to remove his foot from this spring switch and allow the small contact plug to raise from the cup of mercury. This action breaks the circuit between the battery and the motor.

One of the most important features of the carriage is the arrangement of the front wheels to facilitate steering. The peculiar construction employed is shown in Fig. 4. Each of the two front wheels turns upon a bearing that is swiveled to swing horizontally and independently of the axle; the front axle is rigidly fixed in a position parallel to the back axle. A yoke bar carrying a rack couples the two front wheels, and a gear working in this rack and

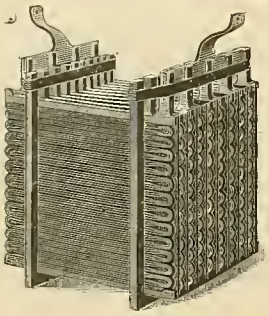


FIG. 7. FIRST ELECTRIC CARRIAGE ON THE STREETS OF CHICAGO.

operated through the steering wheel shaft, permits of the two wheels being swung to the right or left so as to guide the carriage. Where the two wheels, as in a previous experiment, were run on the one axle and the axle was pivoted at its center, as is the usual method in ordinary carriages, a great difficulty in guiding the vehicle over ruts, stones, etc., was experienced; in fact, this last named arrangement was found to be impracticable for the electric carriage and was abandoned for the one illustrated herewith.

As the source of the motive power for the carriage is its most important feature, the accompanying cuts of the Morrison battery, Figs. 5, 6 and 7, will be of interest, showing as they do the details of construction of the plates.

This secondary cell, although one of the latest on the market, is in reality in form one of the oldest storage batteries known. It is strictly a Plante cell, no applied active material being used in its construction. The peculiar feature of the cell lies in the fact that the active material is formed out of the pure lead plates by the Plante process in a remarkably short space of time.

The plates are first formed of pure strip lead, Fig. 5, three-eighths of an inch in width, being bent at the ends so as to form parallel layers. A slot is cut in the two edges of the plate, into which a strip is inserted, and the two edges of the plate are then firmly soldered together. The positive and negative plates are made exactly the same. In manufacturing the plates are put through the forming process, taking, it is stated, only about ten hours.

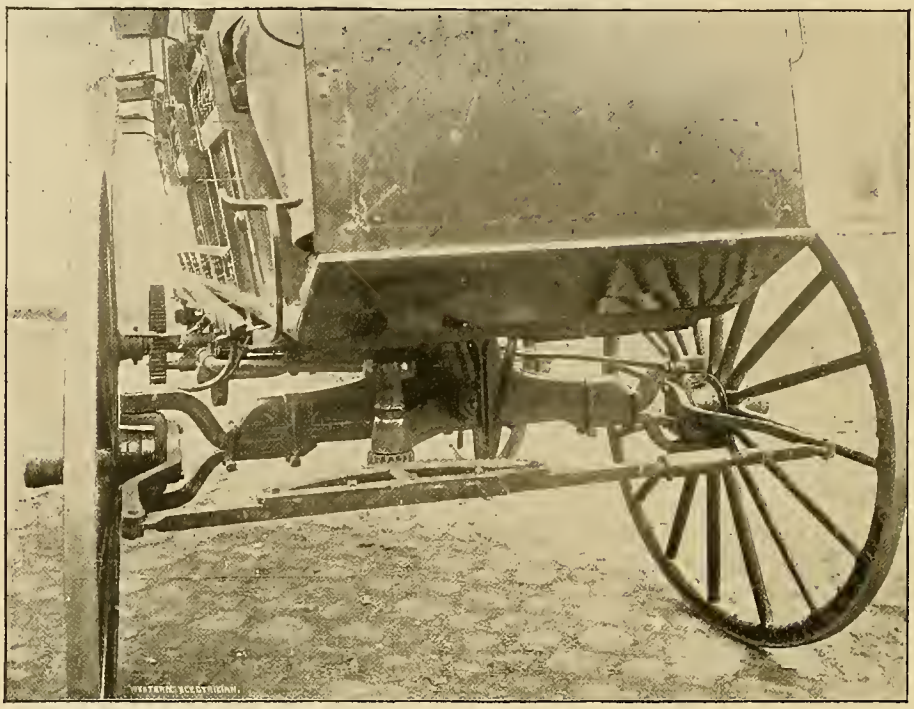


FIG. 4. FIRST ELECTRIC CARRIAGE ON THE STREETS OF CHICAGO.

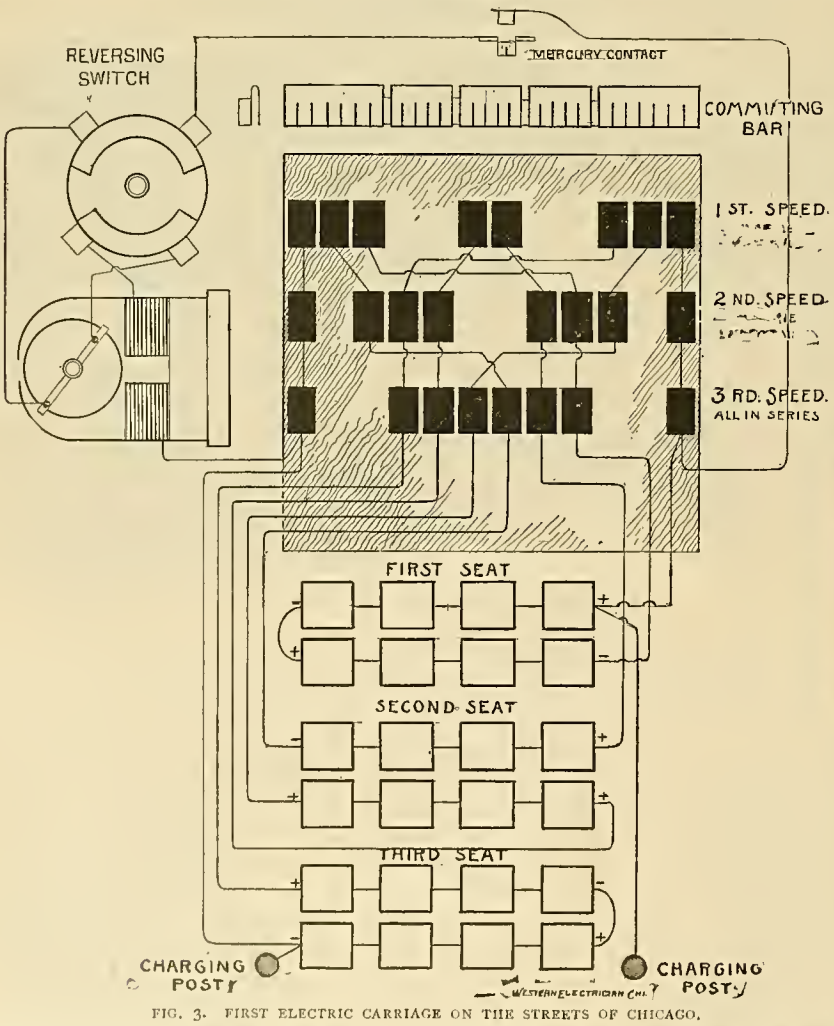
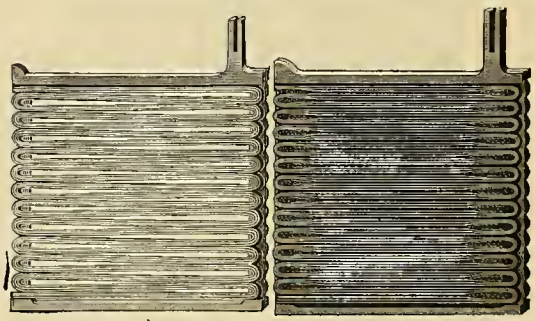


FIG. 3. FIRST ELECTRIC CARRIAGE ON THE STREETS OF CHICAGO.

About one-half of the lead is turned into an oxide, forming the active material, leaving the other half as a conductor or support, Fig. 6. This mode of construction allows great expansion and contraction in the line of the plane of the plate, and therefore, a very rapid charging and discharging is permissible without in the least injuring, or, to use the common expression, "buckling the plates." As the capacity of any plate depends to a large extent on the amount of surface exposed, the capacity of this plate is very considerable. The plates are six by seven inches, and nine plates are used in each cell, Fig. 7. Each plate contains, it is figured, about four square feet of surface. The cells when filled with electrolyte and ready for use, weigh thirty-seven pounds, with a capacity, it is claimed, of over 150 ampere hours.

As the question of the amount of power required by such a vehicle when traveling over different roads or pavements has a most important bearing upon the future usefulness of the electric carriage, an account of a test made soon after the carriage's arrival in Chicago by J. K. Pumpelly, will be of interest.

Mr. Pumpelly writes substantially as follows: "My object in making this test was to discover the nature of the different roads over which we were to ride by reading from the ammeter the current necessary to overcome every ob-



FIGS. 5 AND 6. FIRST ELECTRIC CARRIAGE ON THE STREETS OF CHICAGO.

struction. There were six heavy men in the carriage. The ammeter was connected in series with the batteries by flexible wires, so that it could be held conveniently on the seat at my side. The readings were taken every five minutes. Knowing from a previous experience that the battery would hold up its electromotive force to 48 volts under almost any output of current for several hours, I was thus enabled readily to estimate the number of watts and thus the horse power needed to carry our load over the various roads and grades met with on the trip.

"We left Mr. McDonald's carriage house on Winchester avenue, corner Monroestreet, about 4 o'clock in the afternoon, and turned into Jackson boulevard, going east, regulating the speed at six and one-half miles an hour, the speed allowed by the road commissioners. Jackson boulevard is a block pavement, and it was on this occasion very dry and dusty. The meter read 35 amperes unt

crossing a slight rise at a cross street, when it read 37 amperes. This cross street was asphaltum pavement, and during our passage over it, much to our surprise, the current rose at once to 38 and 40 amperes. Striking the pavement again the meter showed 35 amperes, sometimes 32. On reaching the end of this pavement at Canal street, a distance of about three miles, the figures taken showed that the current used averaged 35 amperes, thus, with 48 volts making the electrical energy consumed about 2¼ horse power.

"Canal street was rough and uneven. The meter jumped from 35 to 40, then down to 28, until reaching the incline of the fully 6 per cent. grade leading up to the Jackson street bridge, the instrument showed 40, 50 and 75 amperes, the carriage steadily moving on at a reduced speed of about four miles. Reaching the level bridge the reading was much lower, 28 and 27 amperes. Crossing the bridge we struck a rough cobble stone pavement, which demanded a pull of 40 and 42 amperes at a speed of six miles. Stopping to allow teams to pass, the starting again ran the current up to 50 and 52 amperes. On turning into La Salle street our average was 40 amperes.

"We stopped for a moment at Mr. McDonald's office on La Salle street, near Monroe, and two gentlemen alighted. Starting again, we had to push our way through a great crowd of curious people. Our departure was greeted with a hurrah.

"Running out Madison street to Washington boulevard, using about the same average of current, we turned west on Washington boulevard, which has an asphalt pavement. Here we expected to have easy work, but, to our surprise, the ammeter registered 38 and 40 amperes. I could only suppose as a reason for this that the day was hot, and as the vehicle was propelled by one hind wheel it sank into the pavement slightly.

"We rode on to Garfield Park, and when passing over the smooth McAdam pavement the current dropped to 28, 26 and 25 amperes. We returned to the McDonald stables after a ride of about fifteen miles; we alighted and tested the batteries for electromotive force. The pressure was 48 volts. After dinner we again took the carriage and rode about the streets of the West side until 10 o'clock in the evening. When the carriage was housed for the night in the stable the batteries still tested at 48 volts."

What Electricians Mean by "Earth."[1]

By Sydney F. Walker.

Perhaps no science has a more puzzling nomenclature than electricity. Electrical engineers have named their units after the great men who have worked in their ranks, and by so doing have perpetuated the names of those men, as possibly nothing else could have done. But the names themselves, volts, ohms, amperes, farads, etc., are sad stumbling blocks to those who would like to know a little of the science, but who have not time to make a set study of it.

But of all terms used by electrical engineers, probably "earth" is the most puzzling.

Even the trained electrical engineer, the man who has spent a large portion of his life in the service of the science, has sometimes to think what is meant by "earth," in a particular case. How, then, can those who have not studied the subject follow its different meanings?

In the early days of electrical science, before we knew anything like as much of it as we do now, and when its use was confined almost entirely to experiments shown in the laboratory, we had not these difficulties.

In those days "earth" meant earth, and nothing else. Electricity being looking upon then as something very much like water, only that it flowed in wires instead of pipes, it was natural to refer to Mother Earth as the great natural reservoir of electricity, just as she was supposed to be of water; and the resemblance was a very close one. As is well known, you can always procure water if you dig down far enough in the earth's crust, and the earth will always soak up or carry off, more or less readily, all the water that may descend on it. So, too, the early electricians found that by connecting one side of their frictional machines to earth—in this case the floor of the room—they could go on generating electricity as fast as it was discharged from the prime conductor. They found, too, that connection to earth in the form of their own person was fatal to a certain class of experiments.

Later on, also, when it was discovered that an electric current sent through a wire carried above the ground would return to the place of generation through the ground, the same idea prevailed. Old text books tell the student to regard a galvanic battery as an apparatus something like a pump drawing water from a well, able to draw an inexhaustible supply of electricity from the ground at one place, and to pour electricity into the ground, *ad infinitum*, at another place.

A study of old text books, and even some modern ones, will play rare havoc with the ideas held about "earth" in connection with electric lighting supply, for instance.

In charging the electrophorus, for example, the student is told to put the brass plate to "earth;" to discharge it, in fact, by touching it with his finger. And the plate was, and is, so discharged. Fancy trying to discharge a 10,000 volt transformer in that way!

About the time of the advent of the telephone, it began to be realized that the part played by "earth" as a return for telegraph circuits was not exactly what it had been supposed. It was gradually recognized that the return current passed through the surface of the earth's crust, using whatever paths might be open to it, very much in the same way that the current passed in the wire forming the other portion of the circuit above ground. The only difference between them was that, while the locality of the current passing in the wire was fairly certain, that of the current passing through the ground was not so certain. A portion of the return circuit from Manchester to London, for instance, might go around by way of Glasgow or Aberdeen, if there happened to be a path for it by either of those routes.

The development of the telephone, with its often troublesome "cross talk," which was traced to earth connections, in a great measure gradually drove the old ideas of the reservoir quite out of the field. Especially was this so when it was reported from America that messages sent in one telephone wire had been heard on another telephone wire separated six miles from the first, the only possible connection being the earth's crust, to which both wires were connected.

Gradually it came to be recognized by practical men that "earth" consisted of the conducting matter, such as moisture, mineral veins, etc., held in the earth's crust, with any metals buried there. But then came another trouble over this question of earth. How did "earth" effect a lightning discharge? and what was "earth" for a lightning rod? Surely the old idea held good here? Lightning came down the copper rod to "earth," and was discharged. Unfortunately, lightning does not always behave in this proper fashion. Prof. Oliver Lodge has rearranged our ideas upon this point. He has even maintained that the "earth" our forerunners worshiped is rather a drawback than otherwise. Some of us still believe in "earth" for lightning rods, though we prefer it of a different form usually to the old patterns; our views in the matter being based upon what we have learned as to the use of the conductors in the earth's crust and in connection with other apparatus.

And, now, when we are congratulating ourselves upon having at last reached the dignity of supplying electric light from generating stations, just as gas has been supplied during the memory of the oldest of us, comes "earth" again, but it means something quite different, and yet the same.

Now, if a man standing on the ground touches an electric light wire carrying a high tension current, and receives a smart shock, he is said to have "earthed" the line, or the electric light service, through his body. So, too, when a naked copper wire, used for delivering current to a series of arc lamps, touches an iron lamp-post, and thereby interferes with the working of the lamps beyond, it is said there is "earth" on. Again, when the possibility of users of electric light, who are supplied by high tension currents, getting shocks, is discussed, we are shown various devices for putting the circuit to "earth," should such a contingency arise.

But in these cases the meaning of "earth," though sufficiently the same as in those previously noticed to warrant the retention of the name, is really quite different. "Earth" is not necessary in these cases, as it was in the early days of electricity, with frictional machines. Nor do we use "earth" to save us one cable, as we do with telegraph wires, and as we may with telephone wires.

It is true that in a recent lawsuit over some electric lighting patents "earth" was brought very much in evidence but it was shown that what was meant was an insulated metallic return cable, and that the cable might be insulated if you liked.

It is also true that certain electric tramways in America and in this country use what they call "earth" for their return current; but they do not mean "earth" in the old sense; they mean a set of conductors, the rails that happen to be on the ground. In electric lighting work we get as far away from "earth" as possible. To any but electrical engineers of considerable experience a recent report that has been made by a Board of Trade inspector must be exceedingly puzzling. Shocks were obtained from the water service in a house in St. James, and a gas meter had one of its sides, which rested against a damp wall, eaten through by electrolytic action. The water and gas service is referred to as being several volts above the conduit in which the cables of the Electricity Supply company were laid; and further on it is stated in one part of the report that earth, which should be absolute zero of electrical potential, had a difference of 190 volts with one of the supply mains, the normal pressure of the service

FIG. 2. FIRST ELECTRIC CARRIAGE ON THE STREETS OF CHICAGO.

1. From the London *Electrical Review*.

being 220 volts. What does all this mean? What does "earth" mean here?

In connection with electric light supply, where two insulated cables are used, "earth" may be taken to mean conductor, such as water and gas pipes, iron conduits, etc., that may be present in the ground, and which are all more or less in electrical connection with each other, by reason of the moisture which is held in suspension in the soil, as well as in bricks, wood, and even in the hardest stones present.

But, here is the point where this "earth" varies from what we called "earth" before. These masses of metal, damp ground, etc., should have no connection with the electric lighting service at all; they are at absolute zero, because they are, or should be, absolutely neutral. Whenever they become connected, either directly or indirectly, with any portion of the electric lighting circuit. they are no longer at zero of electrical potential, because no longer neutral, and form part of the electric lighting system, just as if they had been regularly calculated for and laid as the cables were; and the danger, when such a connection exists, is not from any reservoir having been suddenly tapped, as a water-bearing fissure may be in a mine, but in the suddenly bringing within the influence of the electrical pressure created at the central station, of a system or conductors that are of uncertain and varying measurements, and quite beyond the control of the engineer.

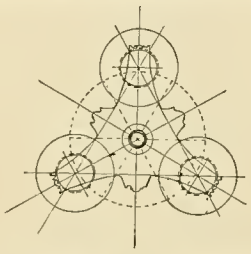


FIG. 3. ELECTRICITY AT THE WORLD'S FAIR.

Electric Power Transmission.

D. A. Tompkins contributed an interesting article to a recent number of the *Manufacturers' Record* on "Transmission of Power by Electricity." After enumerating the advantages of electric transmission and referring to the large number of undeveloped water powers in this country Mr. Tompkins concludes his article thus: "The field of power transmission by electricity has not been much explored. There is nothing in the way of its successful accomplishment, except that the shops in which the machinery can be built are pressed with orders for electric railway machinery, and really can hardly afford to abandon a developed line of trade to explore a field which is yet very little worked. When it is considered that in the United States over 400 electric street railways have been built in the last ten years, and that all the machinery has been constructed by what is practically now two companies, it will be appreciated that the wonder is that so much has been done."

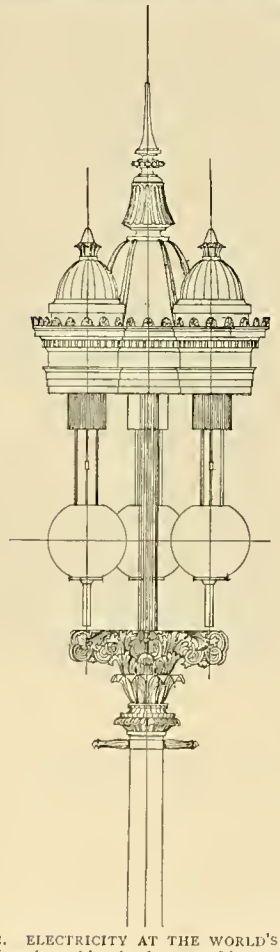


FIG. 2. ELECTRICITY AT THE WORLD'S FAIR.

Electricity at the World's Fair.

The contract for the single arc light posts approximately 1,000 in number, has been let to A. B. Ayers of New York. The contract for the posts for three lights has not yet been awarded. The accompanying cuts show the design of the two styles of posts; both posts, though, are of the same general design except at the top. The single light post, Fig. 1, in height measures very close to 17 feetfrom the ground to the arc in the lamp; the triple lamp post, Figs. 2 and 3, is a little higher. The column is supported as shown on a cast iron base. On the base there sets an ornamental cast iron shell 7 feet 4 inches high. This shell has fitted onto its top a wood shaft or mast of thoroughly seasoned clean white poplar. This mast has a hole through its center to contain the wires leading to the lamp. Surmounting the mast is what might be called the top or lamp casting, within which depends the lamp. The post is surmounted by a sheet metal hood of handsome design. This hood is made of No. 26 galvanized iron or zinc strengthened with iron straps and securely connected to the iron framework. The upper section of the sheet metal hood is made with a tight slip joint, so that it can be removed. There is a wooden frame supporting the sheet metal hood. This is made of two sections of dressed white pine scarfed together, the joints carefully lapped, glued and screwed together and formed to the outline shown. In general it may be said that all the cast iron work for these posts is to be of the best quality of tough gray iron. Where bolts are used to fasten the different sections together they will be of wrought iron with spherical heads and octagonal nuts. The base of all the arc lamp columns will be securely lag-screwed to the wooden foundations. In furnishing these posts the contractor will fit the different sections together and erect the posts in the grounds. The color the posts will be painted is to be selected by the director of works of the exposition.

H. E. de Ville, of Paris, was in Chicago last week, representing a French company which proposes to transmit by means of electricity, and reproduce in other cities, photographs of the proceedings at Jackson Park next month and of the naval review in New York city. M. de Ville claims that the invention which his company controls was conceived by M. Henri Courtonne, a French chemist. He has been diligently engaged in perfecting the details of the system for several years and in his work has been assisted by many noted French scientists. M. de Ville does not pretend to understand the method employed or the principles involved. He says the invention has plenty of financial backing and that his visit to Chicago is merely for the purpose of arranging for the transmission of the photographs to New York and other cities. M. de Ville in an interview says:

"The people in New York may stay in their own city and hear the speeches and see the dedication exercises in New York. In fact, they may stay in New York or San Francisco and see the whole of the World's Fair as graphically as if they were in Jackson Park, and almost simultaneously, too. This we know can be done. But we want to, if possible, produce the same effects in London and Paris and Madrid and Berlin and Rome and St. Petersburg. So much capital and energy and determination are back of our enterprise that it is not without the range of possibilities that the obstacle, the waste of water the Atlantic presents, may be surmounted, and, if so, the fair will indeed be the World's Columbian Exposition. For day in and day out during the six months of the great international show the sights and scenes and exhibits at Jackson Park will be reproduced in fac-simile in all the great centers of the civilized world."

The work at the grounds still continues in the same regular ruts. Orders have been received from Chief Burnham by Superintendent Keller of the Westinghouse company to light the south front of the electricity building. This will require 500 lamps, and plans for this decoration are now being prepared.

It is an interesting fact that over fifty miles of wire have already been placed in the art and administration buildings. This fifty miles is about one-half of the total amount that will be put in. The underground work on the outside is practically finished. The Westinghouse station, it will be remembered, is located in the machinery hall, and the total amount of conduit required is about twenty-four miles. The conduit employed is all of pump log and is laid eighteen inches below the surface. The joints are pitched. There will be in all about 180 miles of cable for primary circuits. The primaries that will be laid in the conduits will be lead covered, but those which will be strung in the subways will be without the lead cover and will be taped.

The New York *Herald* remarks editorially: "At the Centennial exhibition sixteen years ago people were pushed about on rolling chairs and shown the queer little toy called a telephone and told about the curious light which a man named Brush intended to exhibit if he could get it ready in time. At the World's fair next year some of the same people will ride about in electric carriages and won't even look at the electric lights and telephones. All in seventeen years!"

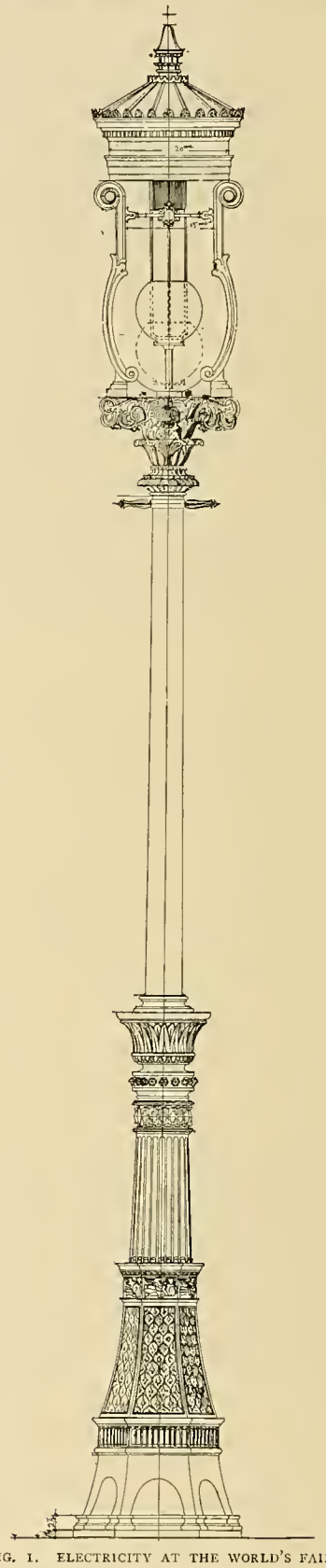


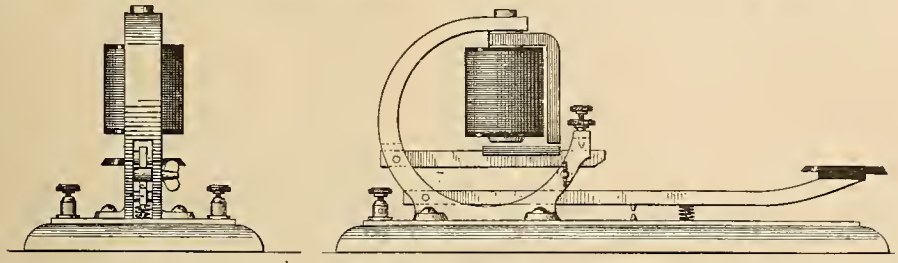
FIG. 1. ELECTRICITY AT THE WORLD'S FAIR.

R. E. Galaher, secretary, and A J. Tower, treasurer of the New York Insulated Wire company, are now at the World's Fair grounds. They arrived Monday, last week.

The new addition to the Edison electric light works at Philadelphia has been completed. A large force of men is engaged in building the foundations for the new engines and dynamos. These foundations are firmly laid and will be solid and substantial. When the improvements are furnished the plant will be one of the most complete in the state.

Ludwig's Combination Telegraph Key and Sounder.

In this peculiar looking instrument, which was designed by Dan J. Ludwig of New York city, the frame which supports the keys, the sounder magnet and armature, is made of metal ,shaped and constructed in substantially the following manner: It is in outline C-shaped. The ends of the C are solid, while the base or lower portion is bifurcated. The base is provided with feet by means of which it is secured to the base board of the instrument. To the higher end of the C-shaped frame the sounder magnet is attached and depends. This magnet has, as shown in the cut, an angular piece of soft iron connected with the upper end of its core and extending down parallel



LUDWIG'S COMBINATION TELEGRAPH KEY AND SOUNDER.

with the coil to a point in a plane a trifle below the lower end of the core. The armature lever is pivoted at the end of the frame and between its sides or bifurcations. The front end of the armature lever plays between stops, the upper one being an adjustable screw passing downwardly through the solid end of the frame and the lower one being an eccentric carried by a rotatable pin passing through the sides or bifurcations of the frame. In the organization shown, the armature lever falls by gravity, being unprovided with a retractile spring. The key is located below the armature lever, is pivoted in the rear of the frame, and works between its sides or bifurcations.

Electrical Standards.[1]

The meeting of the British association of Edinburg was a convenient opportunity for the consideration of electrical standards, but the position of that body in connection with this subject ought to be clearly understood. The value of the work done by the association is inversely as the prominence or publicity. There are two functions of the British association which have little to do with summer science and the popular element, but which are of very great importance; one of these is the distribution of annual grants of money to assist research, and the other is the work of the special committees. The Royal society contributes in a similar way to the advancement of science by grants of money, though of course without any competition or interference. But in the work of special committees, the British association stands practically alone. It would, indeed, be a pity if there were any competition, for this would be inevitably accompanied by interference. The real work of these committees is generally done by one man. The committees rarely meet to any practical purpose until the annual meeting of the association, when a report is drawn up for presentation to a section. The easiest way of doing this is to append the names of the committee, including all absentees to the report which is submitted. This gratifies everybody, and, thanks to the disinterestedness of the true scientific spirit, satisfies the man who has done all the work.

It is to such committee work that we owe the creation of the ohm, the volt, and the Weber, in 1863, and the original determination of the ohm by Maxwell and others, from the research carried out at King's College with the assistance of funds granted by the British association; and nowhere have the initials B. A. been more honorably employed than in the designation of the B. A. unit of resistance. An annual report upon the behavior of these standards, upon re-determinations and comparisons, and other very important matters, has been a feature of every meeting of the British association for several years. There has been no attempt or the smallest occasion for an attempt to transfer the responsibility to any other body, and it has been only when proposals have been made to secure the acceptance of the electrical units by other nations that the matter has been discussed by any other body. This was done at a congress at Paris in 1884, when a number of eminent but self appointed councillors attempted to create a unit which received the ineffectual and misleading name of the "legal ohm," which served only to create confusion. A similar congress is threatened at Chicago, but it is to be hoped that before that city becomes filled with Exposition-mongers and sight-seers, the necessary work will have already been accomplished by men of whom many would probably shun the bustle and excitement and exaggerated delights of a monster bazar, which seems the last place in the world for important scientific deliberations. The Chicago congress may adopt the henry, and few will grumble if they approve of megafarads and microholes; they may be induced by M. Guilleaume to accept a unit of radiation, and by Mr. Preece to re-adjust the volt and ampere for the sake of uniformity of indices. The Chicago congress may be the occasion of the acceptance of the ohm, the volt, and the ampere by the United States government, if it is thought worth while to delay for a twelvemonth or so what has been already well settled by others. It was very wisely proposed, we believe by Prof. Von Helmholtz, that some international understanding should be arrived at, and no better opportunity could have presented itself than the meeting of the British association at Edinburgh. Here it was found by the committee, who really hadsomething to do, that Germany and France were in complete accord with the proposals; and although Prof. Rowland, who has been turning his attention of late to that branch of electrical science known as optics, was not present, it was understood that neither opposition nor modification would be pressed from America.

It may be asked, what has the British association got to do with the Board of Trade and the Privy Council? and the answer is simple. The Board of Trade sought the advice of three bodies, the Royal society, the Postoffice, and the Institution of Electrical Engineers. It was recognized that at the meeting of the British association a good representation of these bodies might be expected, and Major Cardew attended officially, although the committee meeting had no official authority. The adoption of its report by the three advising bodies, will be a matter of course; and it may be expected that one of the first duties of the new government will be the placing of the ohm, the volt and the ampere of Queen Victoria on the same footing as the yard and the pound, and the other standards of the imperial system of weights and measures which were made legal and compulsory by the Act of 1824.

1. From the London *Electrician*.

Electrostatic Switch and Phase Indicator.

This device is designed, mainly, for automatically throwing alternators in parallel. It may also, however, be employed to indicate when the line currents or machines are in phase.

The construction of the instrument is based on the well known law that when two electrically charged bodies are of unlike sign they attract each other, and when of like sign they repel each other.

As will be seen by reference to Fig. 1 of the accompanying cuts, the parts of the device are arranged on a horizontal base plate of non-conducting material, having upon it a post supporting on its top the knife-edge bearings of a balance or rocking beam, the travel of which may be adjusted by thumb-screws. The supporting post is coupled with the alternator that is to be thrown in parallel. The beam carries at one end by a non-conducting link, a copper or aluminum link, arranged above two disconnected mercury cups. One cup is connected with the main circuit and the other to the disconnected machine, this connection having an interposed hand switch.

At the other end of the beam there is carried by conducting links an aluminum disk, arranged above a corresponding metallic disk upon the base. This disk on the base is connected to the alternator that is in circuit, the suspended disk being in contact through the beam and the post with the machine that is to be thrown in. There are distance pieces as indicated to prevent metallic contact of the disks. A scale is attached to the post and a finger attached to the beam to allow of its position being noted.

The instrument is shown and described as only applied to one pole, though it would be preferable to utilize it in practice for both poles of a machine.

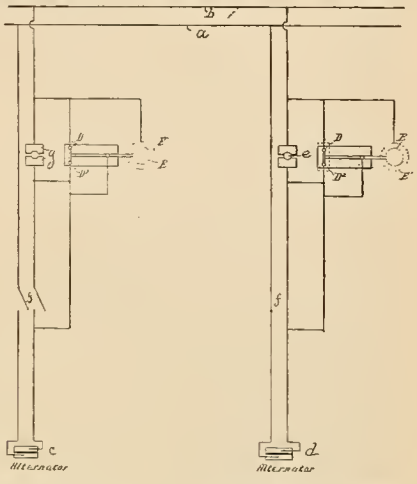


FIG. 2. ELECTROSTATIC SWITCH AND PHASE INDICATOR.

The operation of this instrument when it is desired to throw an alternator into a circuit being fed by other machines, is as follows: Having brought the machine to a potential corresponding to that existing on the mains and thrown in an artificial load corresponding to the load it will take up on the circuit, one pole is now switched directly onto one main and the other through the electrostatic switch. The action of the switch will prevent the machine going into main circuit unless in phase with the running machines, as it follows should the machine not be in phase then the disks of the balance will be oppositely electrified, and hence attraction, which results in lifting the link on the other end of the rocking arm out of the mercury cups and leaving the circuits open. But the moment the machines are synchronized the disks will be similarly charged and repel one another, resulting in the circuit being completed and throwing the machines onto the mains.

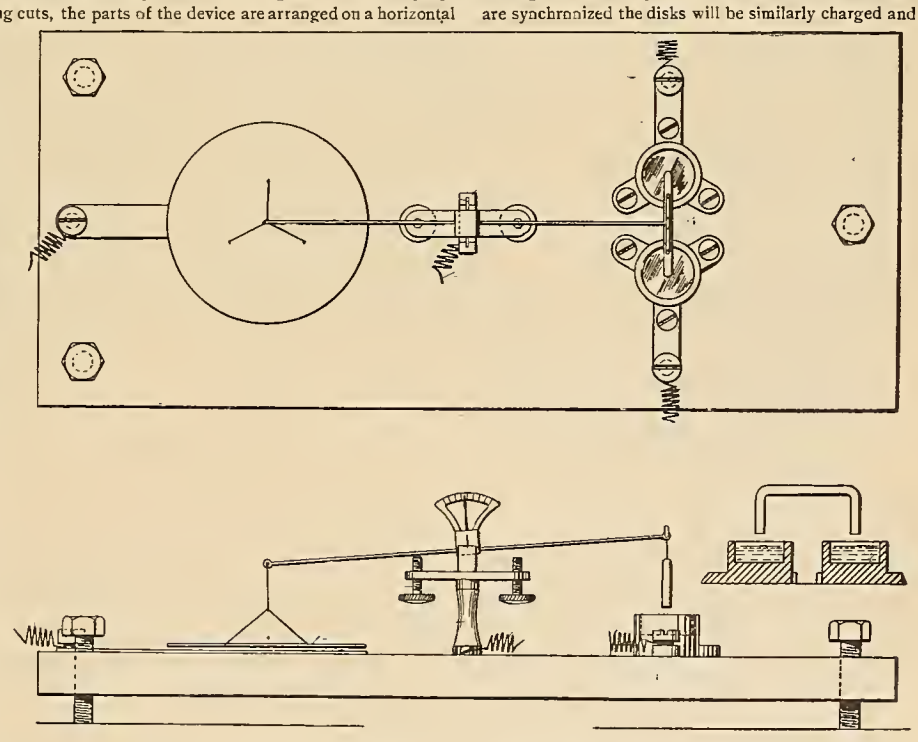


FIG. 1. ELECTROSTATIC SWITCH AND PHASE INDICATOR.

In the diagram Fig. 2 are shown two alternators and main line conductors *a b*. The alternator *d* is included in circuit with the main line through the circuit closers *f* and the plug *e*. Now let the circuit closers *f* be closed. Under the conditions already explained the charges on the plates *E'E* will cause the terminals *D' D* to be closed in the manner explained. In order to insure better connection than through the mercury, the plug, *e*, may be inserted between the terminals *g*.

This switch is an invention of Alfred W. Alcock of Melbourne, Victoria.

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CONTENTS OF THIS NUMBER.

PAGE.
The First Electric Carriage on the Streets of Chicago. Illustrated. 145, 146, 147
What Electricians mean by "Earth." By Sydney F. Walker. 147, 148
Electric Power Transmission 148
Electricity at the World's Fair. Illustrated 148
Ludwig's Combination Telegraph Key and Sounder. Illustrated 149
Electrical Standards 149
Electrostatic Switch and Phase Indicator. Illustrated 149
Editorial 150
Electrical Features of the St. Louis Illumination. Illustrated 151
A Telephone Girl's Suggestions 151
To Utilize Water Power in Ireland 151
Fire In the Postal Telegraph Company's Chicago Office 151
Painting Mouldings. Illustrated 152
American Lamp. Illustrated 152
Street Brackets for Incandescent Circuits. Illustrated 152
Smith Ventilating Fan. Illustrated 152
New Automatic Set Back Annunciator. Illustrated 152
New D. & D. Electric Machine. Illustrated 152
National Multipolar Generator. Illustrated 153
Western Union Affairs 153

DEPARTMENTS.

Correspondence 153, 154
New Incorporations 155
Electric Lighting 155
Electric Railways 155
Telephone 155
Miscellaneous 155, 156
Trade News 156
Business 156
Electrical Patents 156

THE department of electricity now claims that it has assurances that both France and England will contribute valuable exhibits. Charles Mascart who is representing the French exhibitors says his countrymen will certainly make a good showing. It is to be hoped that this will prove to be the case. American engineers invite comparison of their machines with those of foreign makers. They believe they have nothing to fear and they hope they may pick up some valuable points in studying the foreign machines in actual operation.

WHILE New York is doing all it can to check the advance of the trolley system even in the outlying districts, Chicago has quietly gone to work, considered the question, and wisely decided to permit the introduction of overhead wires. And now comes the good news that the City Railway company will commence work in the very near future. At a meeting of the directors of the railway company on last Monday it was decided to put an electric line on the South side on Thirty-fifth, Forty-seventh, Sixty-first, and Sixty-third streets. It was decided to commence this work immediately, and to push it with all possible vigor. Ordinances authorizing the company to equip these cross-town lines with electric motive power were passed by the Chicago city council March 21st, 1892. The company has since been investigating forms of motors and electrical systems. After the lines have been run on the new system for a while and when the people have had personal experience with overhead wires there will be no further opposition to the introduction of electricity on all outlying lines.

The railway company's engineers have been investigating the several systems, and while no definite conclusion has been reached, the matter is well enough in hand now so there will be no delay on that score. The company will endeavor to have at least the Sixty-first and Sixty-third street lines in operation by December, and possibly the Forty-seventh street line also. Work on all of them will commence immediately. The Sixty-first street line will be run all the way on that street from State street to Jackson Park, and will not turn at Cottage Grove avenue on Sixty-third street, as the horse-car line does now. This will give the company two independent electric lines to the park entrance.

IN the face of all that is presented elsewhere in this issue illustrating the merits of the storage battery, it will doubtless be of interest to many to learn the opinion of a scientific man who, just at present, takes a gloomy view of the situation. Regarding the use of storage batteries for street car propulsion Prof. Amos E. Dolbear of Tufts College said in a recent interview:

"I do not see how they can ever be used economically. They require constant attention, and run out so often after charging a few times that they would be very costly. I know that new ones are being heralded every day and each one is said to be a great advance on anything that has been seen before; but I do not care how the jar is painted or by what name you call it, the principle is the same, and I predict that until the time comes when the street car companies can charge 25 cent fares, the storage battery will not be used as a means of propulsion."

This is pretty strong language, and coming from a man of Prof. Dolbear's reputation will not be without weight in influencing many against the already too much maligned storage cell. The fight over what are believed to be fundamental storage battery patents has prevented the public from becoming more intimately acquainted with this class of apparatus, and there is no question but that the trolley men would prefer that the storage cell should remain in oblivion. There has been, indeed, but little encouragement to capital to invest in a field where the proper sort of encouragement would undoubtedly have worked wonders and have placed the accumulator in an entirely different light before the layman than it is in now. Commercially speaking, the storage battery has not had a fair chance in this country. But even though this last assertion be disputed, it seems that Prof. Dolbear's strictures are unnecessarily severe when he asserts that "until the time comes when the street car companies can charge 25 cent fares, the storage battery will not be used as a means of propulsion."

So much has been said and written about the application of electricity to street railways, and the manifest advantages of this means of propulsion, that it seems as though it should hardly be necessary to call further attention to this subject. Yet, with all the evidence of the success of the electric railway, and despite the fact that wherever adopted the trolley system has been received with public favor, many of the metropolitan dailies continue to oppose the introduction of this modern method of propulsion on the streets of the metropolis. It appears strange that the great dailies of the leading city of the country should so blindly oppose the electric railway when other cities are enjoying the advantages of rapid transit. The people of New York are constantly clamoring for better street railway service; the managers of the surface roads announce their willingness to extend their lines, equip them with electricity and furnish rapid transit so far as it can be obtained on surface roads, yet whenever the subject is broached in the city council the majority of the papers raise such a bowl that the aldermen are afraid to vote for the measure.

How long will the New York aldermen submit to the bullying and black-mailing tactics of these New York journals? They are satisfied in their own minds that the trolley system is safe and that it is the best possible method that could be adopted for New York. Mayor Grant is also convinced of this and he has approved the ordinance for the Huckleberry road. Why not go a step further and grant the other surface roads permission to equip their lines with electrical apparatus?

New York, the foremost city of the New World, with slow going horse cars, will be the laughing stock of visitors from Europe who will be attracted to this country next year by the Columbian Exposition, unless immediate steps are taken to improve its street railway facilites.

IN another column there is presented a description and illustrations of a very novel bit of mechanism—an electric carriage. This vehicle possesses the distinction of being the first carriage to be driven by electricity on the streets of Chicago. A great deal has been published about this carriage, but little or nothing of value has been given out relative to the details of construction. The present article, though, is most complete and will doubtless be appreciated by those who want to know something more than the fact that the carriage is driven by electricity from batteries on board.

The application is in some respects crude, but the arrangement will serve as a guide in the construction of the improvements contemplated by the present owner. The tests, also, that have been made with this novel carriage in Chicago will serve as an invaluable aid to the satisfactory solution of the question of the amount of electric power required for such service. During one of the many trips made by this carriage, current readings were taken as this vehicle passed over different street surfaces, and the curious fact was noticed during the test that more current was drawn from the battery while the carriage was running over asphalt pavement than when it was passing over what were apparently rougher surfaces.

The appearance of this vehicle is significant in that it suggests the vast possibilities in waiting for a storage cell that proves itself to be commercially suitable for carriage work. The present owner of the vehicle is introducing, and is using the carriage to illustrate the merits of, a cell for which the strongest claims are made. Should continued tests substantiate these claims, the good impression made cannot fail to revert to the interest of others exploiting similar apparatus. Chicago would be an ideal location for what might be termed an "electric livery stable," and in this one direction alone the storage battery exploiter will find a field capable of extensive development. Given a cheap cell and one that will stand such rough usage as is incidental to the operation of a street carriage and we venture to say no better place could be found than Chicago in which to inaugurate an electric carriage service With miles and miles of streets, boulevards and park roads, as smooth as a billiard table and without grades—not to mention that peculiarity of the wealthier and more progressive citizens who believe in having all improvements and luxuries and are willing to pay for them—the electric carriage builder and the "electric liveryman," it would seem, could reap a rich harvest. It is already announced that it will not be a great while before Chicagoans will see more than one electric carriage upon the streets of the city.

ACCORDING to our New York correspondent medical men are showing an increased interest in electricity. The use of electricity is now common among physicians but those who have given the subject especial attention are comparatively few. Many medical men prescribe applications of the electric current very much as the good mother prescribes Jamaica ginger, viz., because the patient "has a pain" and something must be done to relieve it. On the other hand there is the earnest and thoroughly scientific investigator who sees in the mysterious agent a possible friend and one that, if its acquaintance be properly cultivated and its nature systematically studied, may be made a most valuable aid to the profession. Many physicians will tell a patient to get "a battery" and use it himself, but there is no more reason why a patient should use electric currents of various natures without specific advice than that he should use surgical instruments. Physicians do not agree on the question of the physiological effects of the electric current. According to the quacks all one has to do is to pass the "galvanic" or the "faradic" current through the diseased part and a cure is inevitable. But the truly scientific man is not satisfied to prescribe something the nature and action of which he knows nothing beyond, perhaps, that it is harmless.

A prominent physician of Chicago was recently asked for his opinion as to the use of electricity for medicinal purposes. His answer was evidently an honest one and therefore worthy to be recorded. He expressed the belief that most physicians in applying electrical treatment worked very much in the dark. He himself, he confessed, often worked by "feeling," so to speak; that is, when he thought a patient might be "eased" by an application of the electric current he made the experiment. If the result was a lessening of pain the electricity was turned on again; if the current afforded no relief, another remedy was resorted to. From this it is reasonable to presume that with the average medical man—even among those in good standing—very little of a valuable nature is really known. The aggressiveness of the quack in playing upon the incredulous has given the "electric doctor" an unsavory reputation. If, then, the American Electro-therapeutic association, soon to hold its second annual meeting in New York, can help in the work of doing away with all fanciful ideas in relation to electro-medical applications and put this branch of medicine upon a scientific basis, the association will earn the gratitude of not only the general medical profession but that of the electrical engineer as well.

Electrical Features of the St. Louis Illumination.

The illumination of St. Louis this year for the Autumnal festivities, has been pronounced the most extensive display of this kind that has yet been made in this country. An idea of some of the set pieces may be gained from the accompanying cut, which is a reproduction of several photographs of the most prominent features of the display.

It will be noticed that these pieces include representations of the "Santa Maria," in exact imitation of that vessel, the Western hemisphere, in which the progress of civilization from the discovery of the continent is presented. There is a fine painting of Columbus, illuminated by electric lights. Perhaps the most impressive spectacle of all is a globe suspended at Broadway and Olive streets, twenty-five feet in diameter and weighing 10,000 pounds. Two sets of electric motors revolve the globe on its axis

ELECTRICAL FEATURES OF THE ST. LOUIS ILLUMINATION.

and control switches giving varied effects in turning lights on and off. The globe is a representation of the earth, the continents and islands being shown by banks of incandescent lamps, and the water by a dark background. Three thousand incandescent lights are used for this piece.

A Telephone Girl's Suggestion.

There seems to be a tendency on the part of telephone subscribers to "kick on the service" no matter how good it may be. No doubt there is cause for many complaints, but that these are largely exaggerated no one who will stop to consider the matter, will question. The "telephone girl" is the object of most of these manifestations of temper and some of the representations of this class occasionally air their opinions of the complainants. One of these girls, annoyed by the exasperating complaints of subscribers, has prepared a set of rules of which the following are a few examples:

"If you have a telephone in your office or store, ring up 'Central' and then go wait on a customer.

"Always speak in an undertone, in order to make 'Central' ask you over what you want. If she does not hear you, tell her to 'wake up.'

"Put your 'plug' in before a storm, and be sure not to take it out again, but go around to the central office and offer to lick the whole telephone company for neglect of duty.

"Take your time in answering your bell, or, what is better, do not answer it at all, but in about half an hour ring up and ask who called you, and get mad if 'Central' has forgotten who it was. She has nothing else to do but remember.

"Allow everybody who wants to, to use your telephone. Hang the receiver big end up, as in this way it gets full of dust, which makes another cause for complaint.

"Bang on the transmitter with a lead pencil as though you intended to knock it through the wall. This invariably makes it work better.

"Refuse to pay toll messages, and if you are on a line with some one always listen to their conversation and be sure to want the use of the line while they are using it. Whenever you see the manager tell him if he cannot give you a better telephone or have that one fixed, you will throw the whole thing out of the window. When the inspector comes deny that you have ever complained of the telephone, and say that it works like a charm."

To Utilize Water Power in Ireland.

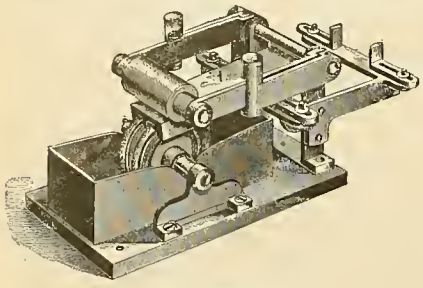
Ireland is somewhat like Switzerland with regard to its large latent resources in water power, though unlike in the little use that is made of them, and it may be worth while at the present time to draw further attention to this fact, says the London *Electrical Engineer*. Not only for electric installations, now, we are happy to say, rapidly increasing, but for many manufacturing purposes by means of electric transmission, might these waste powers in the future be usefully employed, as they have long been in Switzerland, and it would be well if electrical engineers in Ireland were to do more in trying to arouse public and private interest, by means of the papers and otherwise, in the sources of revenue that lie around waiting to be tapped. Without coal and without ports Switzerland has been able, by means of its lavish water supply, to erect and carry on fine factories and compete with other countries successfully in manufacturing products. A foreign office report just published on the condition of labor in Switzerland, brings the position out plainly in the following paragraph: "The manufacturing interests of this country mainly depend upon their rich water resources. Of the 2,322 factories which employed motive power at the close of 1888, 1,114 exclusively employed water power, and only 658 exclusively steam power, while 457 employed both water and steam; and, taken altogether, these 2,322 factories used 54,243 h. p. of water and 27,432 h. p. of steam, and only 717 h. p. of gas. The facilities which science is daily multiplying for the transmission of force by electricity, recently exemplified by the Lauffen transmission exhibited at Frankfort, are likely still further to accentuate this special feature in Swiss industry." We know that since 1888 immense strides have taken place in this department of science, and Switzerland now stands with Italy at the head of the European countries in the utilization of natural forces. In America equal progress prevails, and in this and other commercial and educational departures, American authorities are careful to have full reports from the centers where most efficiency and activity is found. Special commissions of professors, architects, and engineers are sent over from time so time to report fully upon all points that can aid progress. If a few traveling commissions could be arranged by the Irish colleges, or other authorities, to send over students and engineers to study and report upon the utilization of water power in Swiss industries, this might give rise to a development of electric transmission plants that would benefit largely the financial and commercial aspects of the sister country.

Fire in the Postal Telegraph Company's Chicago Office.

The Postal Telegraph company's main office in the Phœnix Building, Chicago, was temporarily disabled Monday, the result of a fire, which started among the cables that come in from the street, beneath the Imperial Building. The smell of burning insulating material could be distinguished in the stock exchange room about the same time the operators in the Postal's big room found trouble with their lines. The flooring of the stock exchange was torn up and the fire extinguished, but not until the ends of the main line cables had been burned. The damage to the building was slight but the delay of three hours at the busiest time of the day crippled the service for a time. Before evening, however, everything was running smoothly.

Painting Moulding.

The Standard Paint company of New York has recently placed on the market a small machine for painting moulding. As a great deal of the moulding for inside wiring is now required to be painted with a waterproof compound, the Standard company has concluded that it would be to the advantage of those who have the work to do, to employ such a machine. Through the use of such a machine, there is effected a great saving in labor, and also a considerable economy in the use of paint or compound. This painting machine is very simple, as will be seen from the cut. It can be so arranged that any size moulding can be painted by it. Any one can handle it, and with it, it



PAINTING MOULDING.

is asserted, two boys can easily paint 1,000 feet of ordinary size moulding, inside, outside, and back of capping, within an hour.

New American Lamp.

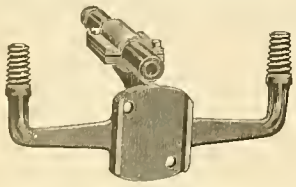
The American Electrical Manufacturing company, St. Louis, has been making for some time an incandescent lamp, illustrated herewith, which has been christened the "American," and under the title has earned a well deserved popularity. No pains have been spared by this company to put on the market a strictly high grade lamp, and from the

NEW AMERICAN LAMP.

fact that the demand through the summer months has been such that a large force of men has been kept at work night and day, it would seem that the reputation of the lamp has been well sustained. Several special lamps are made by the company, for street railway and other purposes.

Street Bracket for High Tension Incandescent Circuits.

The bracket herewith illustrated is intended to permit the use of an ordinary half-inch pipe, goose neck, to carry any kind of hood or lantern, and is suitable for use with any system of out-door incandescent lighting. As will be seen by reference to the cut, the bracket holds a long



STREET BRACKET FOR INCANDESCENT CIRCUITS.

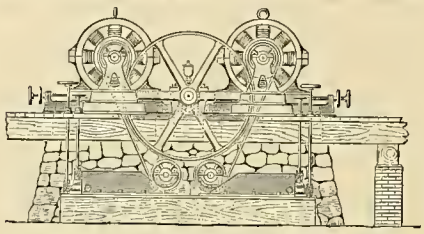
sleeve of hard rubber, enclosing a length of iron pipe which is vulcanized into the rubber. The latter projects over the iron at the end where the wires enter. The other end of the pipe projects from the rubber, and carries a regular gas pipe thread for connection to the goose neck or pipe bracket. To reduce surface leakage, the length of the exposed hard rubber is made as long as possible. It will be seen that by completely insulating the pipe and all that it supports, and leading the wires through it inside the pipe, the necessity for the insulator usually placed between the hood and the pipe is obviated, as well as the cross arm with insulators above the hood. This bracket is manufactured by the Electrical Supply company, Chicago.

The Smith Ventilating Fan.

The accompanying illustration represents the Smith ventilating fan which is handled by the Huyett & Smith Manufacturing company of Detroit, Mich. The apparatus as shown consists of the fan proper with electric motor attachment. As will be seen, the motor armature is built up on the same shaft that carries the blower blades, and hence revolves at the same speed. The whole arrangement is most compact. The fan illustrated was designed for service on a 110 volt circuit, but these equipments are supplied to suit any ordinary voltage. The fans range in sizes of from 18 inches to 54 inches in diameter and are equipped with motors of from ¾ to 3½ horse power. The weight of the different equipments range from 180 to 850 pounds.

The Evan's System of Transmitting Power.

Frictional devices for driving dynamos in close quarters are now the order of the day. The cut presented herewith shows that the Evan's Friction Cone company of

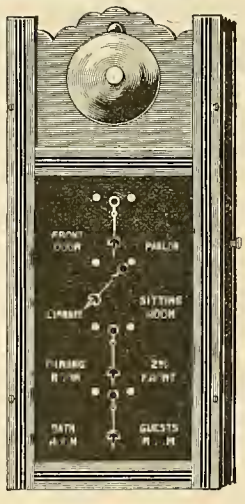


EVAN'S SYSTEM OF TRANSMITTING POWER.

Boston intends to keep itself well in line with the demands of the trade. This company states that with its system as here illustrated 150 horse power can be transmitted by the use of an auxiliary pulley. Two dynamos can be driven by one pulley, and one or both can be started and stopped while the pulley is running. The main features of the Evan's system are so clearly represented in the cut that further explanation is unnecessary.

New Automatic Set-Back Annunciator.

It is a well recognized fact that the ordinary house annunciator does not answer the purpose for which it is designed. Servants and others will not restore the drops, needles or other indicating mechanism, and hardly ever know from which room or locality the call proceeds, as there are sometimes from two to four pointers or drops registering on the dial. After several years of experiment-



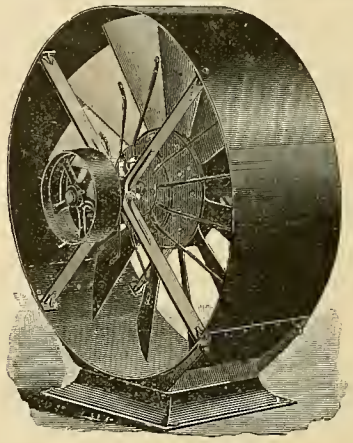
NEW AUTOMATIC SET-BACK ANNUNCIATOR.

ing, though, the Partrick & Carter company of Philadelphia, has at last perfected an automatic system in which only one indicator, and that the one for the last call, remains pointing. Each new call resets the pointer that indicated the previous call, no attention to the annunciator other than observing the dial when the call comes in, being required. The appearance of the new automatic annunciator is the same as the Partrick & Carter "King" annunciator (one needle giving two indications) except that the resetting knob is dispensed with. All those who have had any practical experience with the ordinary annunciators which have to be tripped every time a call comes in, can appreciate this.

The company thinks that, when the merits of this automatic feature in its annunciator is fully known, it will supersede many of the old style trip annunciators now in the market. The advantages claimed are: Absolute certainty of receiving the last call only, as a previous call is thrown down or tripped automatically when the last call comes in; no tripping or resetting whatsoever being required and no instructions over and over again having to be given servants; freedom from all complicated mechanism, and consequent durability.

New D. and D. Electric Machine.

Illustrated herewith is the new type D. and D. electric motor and dynamo. As will be seen from the engraving,



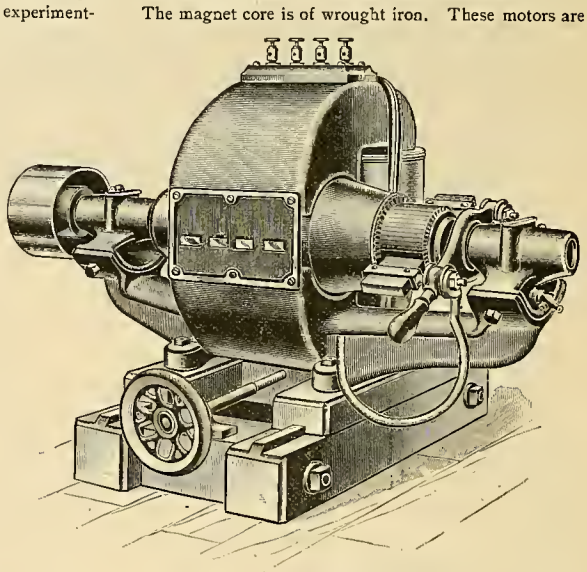
THE SMITH VENTILATING FAN.

it is a handsome and compactly built machine. The simplicity of the design attracts at once the attention of the expert.

The pole pieces are very heavy. The arms supporting the bearings are cast in one piece with the base, insuring perfect alignment. The bearings are bushed with bronze sleeves which are fitted accurately to gauge and can, in case of injury or wear, be easily and quickly inserted. The bearings are self-oiling; a loose brass ring hangs on the shaft in the center of the bearing, the lower part dipping into a reservoir of oil beneath. The ring revolving with the shaft constantly feeds it with oil, any excess being returned to the reservoir.

The armature shaft is made of the best machine steel. The commutator is of hard copper carefully insulated with mica; the bars are of sufficient width and length to insure a perfect contact and reduce the wear to a minimum. The brush holders are made for multiple carbon self-adjusting brushes, so constructed as to maintain perfect contact between each individual carbon and the commutator.

The magnet core is of wrought iron. These motors are



NEW D. & D. ELECTRIC MACHINE.

wound so as to maintain as nearly as possible a constant speed under any variation of load.

With the dynamos for lighting plants there is furnished a switch board, with a double pole switch resistance box, fuse blocks, lightning arresters, ground detectors, voltmeters and lamps.

This machine is manufactured by the D. & D. Motor company, Minneapolis, Minn.

D. D. Coaley, H. F. McGregor and G. B. Hengen have incorporated the Houston Heights Street Railway company, Houston, Tex., with a capital stock of $100,000. The company proposes to build an electrical railroad to Houston Heights, and will commence work on it at once.

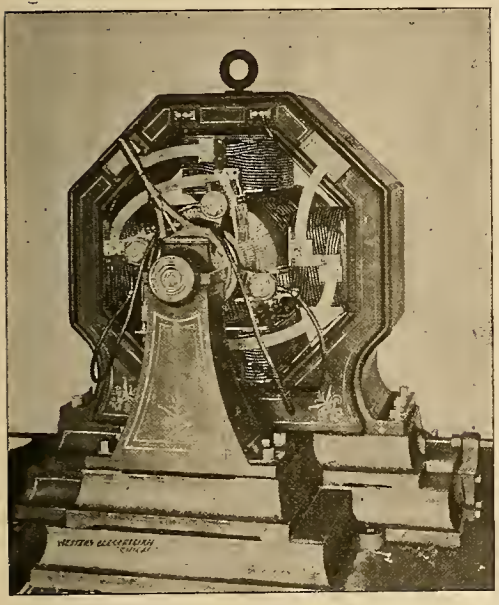
National Multipolar Generator.

Experience in building direct current generators of large output, has shown that in machines of very great capacity there is a decided gain in employing more than two poles; in fact, for very large machines the construction with only two poles involves so many difficulties, both mechanical and electrical, that it is what might be termed a very impracticable type. The National Electric Manufacturing company of Eau Claire, Wis., has just placed a new line of four pole direct current generators on the market, which the company claim not only have all the desirable features of its older apparatus, but also possess some novel points of construction not heretofore applied to electrical machinery. The accompanying illustration shows the general appearance of the new type machines. They are at present built in sizes of from 50 to 250 kilowatts, large generators being also under construction.

The field magnet frame is of the conventional octagonal shape and is cast entire in one piece making an absolutely unbroken magnetic circuit around and with the four poles. The metal employed is similar in composition to mitis metal, and its permeability is claimed to be within a few per cent. of that of wrought iron.

The armature is of the Gramme-Pacinotti type, the conductors being laid in grooves so as to be flush with the surface. This method of winding reduces the air gap between armature core and fields to a minimum; at the same time the sparking at the brushes is avoided.

The journals are large and are all made self-oiling, and



NATIONAL MULTIPOLAR GENERATOR.

in the machines of over 50 kilowatts' capacity they are provided with ball bearings.

The National machines are all over-compounded to give constant potential at the distribution point under any condition of load. In the construction of the series turns to accomplish this quite an ingenious idea has been applied, to avoid the cumbersome mass of cables or wires usually resorted to. In place of these cables solid copper rods are used, the coil or turns being built around the shunt spools by means of copper elbows at the corners; the several turns are separated by spacing pieces of hard rubber, suitable "T" or "L" shaped connectors being used to connect brush and line terminals.

Western Union Affairs.

The Western Union meeting to act on the dividend takes place next Wednesday. Mr. Gould expresses a preference to have the dividend continue at the present rate for a while longer, but says distinctly that he is willing to change his mind if it can be shown to be for the best interests of the company.

It was reported yesterday that Western Union intends to spend $1,500,000 this year for a new building at Chicago and will issue bonds to pay for it. A director of the company says this is not true. The company has been thinking of erecting a building at Chicago, large enough to accommodate its growing business there, but it is considered inexpedient to attempt to do any building in Chicago until after the World's Fair. Values there at the present time are very much inflated because of the Fair. —*Daily Financial News, September 10th.*

The Peninsula Electric Light & Power company, of Newport, Va., will hold a stockholders' meeting on September 22 to consider, among other matters, an increase of its capital stock.

CORRESPONDENCE.

New York Notes.

NEW YORK, September 10.—The daily papers, with but few exceptions, have been saying mean things about the poor besotted brute who made the mistake of his life when he attempted to "lick" Corbett. But even the extinguished "big fellow" knew when he was fairly whipped and had the decency to acknowledge that the fight had been a fair one and a better man was now in the field. In this respect "Mr." John L. Sullivan presented a pleasanter spectacle than do several of the New York dailies in their childish opposition to the much needed improvement, the maligned trolley system. "More Trolley Effrontery" and paragraphs in the editorial columns of the *Herald* to the effect that owners of real estate along Lexington avenue should bestir themselves "early and eagerly about this threatening attack on their rights and their safety"—all this reminds one that there are some people in this progressive country who do not know when they are fairly whipped and when they are progressing. But all this newspaper talk doesn't seem to worry John D. Crimmins, for his company on Tuesday last applied to the board of aldermen for permission to connect lines already built and to construct several new lines, one of which will run nearly the entire length of Lexington avenue, and to use on the new lines any kind of motive power except "locomotive steam power." Permission was asked to build new tracks in Lexington avenue above Twenty-third street to connect with the Houston, West street and Pavonia Ferry company's route, which is known as the "Avenue C" line, at East Thirty-fifth and East Thirty-sixth streets. The privilege was also asked to lay tracks in Lexington avenue above Forty-second street and to the Harlem River when the avenue shall be opened above Ninety-eighth street, and through 116th street from Morningside park to East river. In return the applicants agree to pay the city a reasonable remuneration for the privileges asked and to give passenger transfer tickets at Broadway and Forty-second street, and at West Twenty-third street and Lexington avenue for lines running to the Grand Central station. The application was referred to the railroad committee with instructions to give a public hearing in the council chamber Wednesday, September 28th.

A local theatre has made quite an attractive feature of an electrical sunrise. A curved screen, part of which is made of gauze, so that the light may shine through, extends around the stage, and behind it is an elaborate system of incandescent lamps. The controlling apparatus is so graduated that fifty different degrees of light and shade can be produced, thus causing the sunrise to grow imperceptibly. Another use of the electric current made at the same place is in representing the explosion of a bomb. A paper shell contains just enough powder to explode and make a flash. This is fired by electricity, while at the same moment another circuit controlled by the same key, sets off a gun behind the scenes, which furnishes the necessary noise.

The American Electro-therapeutic association will hold its second annual meeting at the Acadamy of Medicine on Oct. 4th, 5th and 6th. A number of important papers will be presented on the relation of electricity to medicine and surgery by Dr. William J. Morton, president of the association, and Dr. A. D. Rockwell, of this city; Dr. Horatio Bigelow, secretary of the association, and Dr. B. Massey, of Philadelphia, and Dr. Margaret A. Cleaves of the New York Post Graduate Medical School and Hospital. This association is composed of members who are especially interested in the study of electricity in medicine as applied to disease, and all the members are regular physicians in good standing with the profession. Electricity has been more abused than used in medicine. It is an agent that for many years has been mostly in the hands of charlatans, and it is only in the last few years that the profession has been alive to the fact that it presents an important field for investigation and should be dealt with as any other therapeutic measure. Twenty years ago work in this line was considered a disreputable thing for a regular physician, and the subject was never mentioned in any of the medical colleges or journals. To-day all the medical colleges deal with it more or less, and you can seldom find an issue of a medical jouanal that does not contain something in reference to it. W. F. O.

Kansas City, Mo.

KANSAS CITY, MO., September 10.—The Thomson-Houston Electric company has brought suit in the circuit court at Kansas City against the Kansas City Electric Light company for $11,600.25 which is alleged to be due for electrical apparatus furnished during the period from March 30, 1891, to May 1, 1892. This suit is said to be a counter suit against one filed by the Kansas City company about two months ago to recover $210,000 from the Thomson-Houston company, the Edison Electric Light company and the General Electric company of New York. Breaches of numerous contracts are alleged by both sides, and the court will endeavor to unravel the differences of the companies at the October term.

The board of public works of Kansas City last Tuesday awarded the contract for furnishing two dynamos of for lighting the new city hall building, to the Fort Wayne Electric company of Fort Wayne, Ind., at $2,445. Bids for furnishing the electroliers were submitted by E. D. Hornbrook & Co., the Goss Heating & Plumbing company, L. C. Bair, all of Kansas City, but all were rejected. Bids on this work will be solicited again to be opened in about ten days.

Many of the electric supply men came near being "left" on the letting of the contract for dynamos. The bids were solicited by official advertisement in a local paper of no prominence or circulation, and no one knew the city wanted dynamos. Recently an announcement of the fact was made in the WESTERN ELECTRICIAN, and almost at the last day all the bids came in. These were taken under advisement several days before the contract was awarded. The contract for wiring the new city hall building was recently let to the Kansas City Electrical company. T.

Northwestern Notations.

MINNEAPOLIS, September 10.—The event in Minneapolis electrical circles is the incorporation of the Commercial Telephone & Electric company by a number of leading business men, many of whom are already identified with large electrical enterprises. The list includes E. S. Corser, president of the Minnesota Brush Electric Light company; Thomas Lowry, president of the Twin City Rapid Transit railway system; Chas. M. Loring and H. A. Tuttle, president and general manager of the North American Telegraph company; A. B. Barton and A. M. Robertson, treasurer and general manager of the Brush Electric company, and three other moneyed men of the city. The company is to have a capital of $1,000,000 and its purpose is stated to be conducting a general telephone and telegraph business, and for the generation, storage, transmission, application and use of electricity for lighting, heating, motive and other purposes; the manufacturing, buying, using, selling, renting, leasing and otherwise disposing of and dealing in all kinds of material, conductors, conduits, apparatus, machines and mechanical contrivances which now or hereafter may be used in or about the generation, storage, transmission, use, or application of electricity. The names of the incorporators quite naturally suggested the possibility that this might be the much-talked-of electrical "combine." The parties deny this theory and insist that the company proposes to do what its articles say—conduct a telephone and telegraph business. They claim to have secured control of some new devices which will make possible better and cheaper service. It is described in a vague way as a "multiplex telegraph and telephone system." The company seeks a franchise from the council and agrees to put its wires in the old Dorsett conduits, laid years ago. The company does not propose to do any lighting.

The Western Union company took possession of its handsome new quarters the first of the week. The building itself is a landmark, having been owned and occupied for years by a leading national bank. It has been "spruced up" outside and in, and is now an excellent place for the purpose. It is a great improvement on the wretched quarters in the old city hall. The public, as well as the company, gains by the change, as the new office is far more central and satisfactory in every way. The company occupies about half the building, a three story brick with basement. The batteries and wire are kept in the basement and the general office is on the main floor. The second floor is taken up with the rooms of the general manager, local manager and their assistants; on the third floor the operators have a fine light and airy room, 100x23 feet. There are twelve operating tables, each having room for six operators. They are connected with the switch-board by wires through a false floor. The cables from outside terminate behind the switch-board and in front of the board is a row of eight quadruplex instruments. The whole outfit is new and of the most improved type.

The transfer was made Saturday night and it was remarkable that there was not the slightest interruption to business. There was not an open wire anywhere. More than 350 overhead wires were transferred from the old office to the underground circuit, 94 overhead wires from the Milwaukee and 55 from the Union depot, were put underground. The company now has a very extensive and perfect underground system.

It was something over ten years ago that the Western

Union bought the old Northwestern Telegraph company and the growth of the business has been like that of the city, phenomenal. In 1881 there were 15,523 miles of wire used; now there are 62,691. In 1881 there were 800 cells of battery, against 4,418 now. There were 35,474 messages handled in 1881 and 125,780 now.

A survey is now in progress of a route for the proposed electric railway line connecting St. Paul and Stillwater. The plan is to extend the line now running to White Bear Lake from St. Paul. Most of the route is through Washington county and the country is very sparsely settled. The line is expected to precipitate something of a boom. The line to White Bear has proved itself a very profitable little investment already. It is the intention to add attractions at the lake another year which will greatly increase travel. The line to Stillwater will be twenty miles long and the trip is to be made in about 70 minutes with a 25 cent fare one way. It is to be completed next year. The line will enter Stillwater by a street on the north hill and run into the business center. A baggage and freight service is contemplated.

A suit has been begun by E. R. Gilman, formerly president of the Thomson-Houston Electric company of St. Paul, against G. A. Mitchell to recover $9,000 claimed to be due on notes exchanged in a deal. Gilman alleges that he traded some of the company's stock for a hardware stock in Minneapolis, advising Mitchell to put in $10,000, and afterward retired from the company, helping Mitchell out with $21,000 of notes and $9,000 in the hardware business. While Gilman wants the $9,000, Mitchell says Gilman refuses to give up the bunch of $21,000 notes and wants the court to compel him to do so.

The electric illumination in the Exposition building is quite a brilliant success. The big central chandelier and surrounding festoons give a very pretty effect. The elevated electric railway makes lots of fun for the little folks and is an interesting bit of mechanism.

The Telephone company has put up new poles and wires between Minneapolis and Anoka, twenty miles up the river.

The St. Louis Park electric line is still delayed on account of the bridging of the railway tracks.

Thomas Lowry and the St. Paul aldermen haven't yet buried the hatchet, but seem to be getting a bit nearer the "hatching point."

During the State fair at Hamline this week the interurbaban electric system has been again severely tested and has stood it well.

H. C. C.

St. Louis, Mo.

ST. LOUIS, September 9.—The city council of Cape Girardeau on the 5th inst. granted a franchise for a street railway to L. S. Joseph, cashier of the First National bank, and W. A. Perry. The work of building is to commence within thirty days.

The Cass avenue line has a large force at work erecting iron poles, each being set in six feet of concrete. Contracts have just been placed with the General Electric company for three 800 horse power generators, each to be attached directly to the engine shaft.

At Washington, Ind., the city council has awarded the city lighting contract for 80 arc lights to Graham & Cox, who will at once build and equip a new station.

The owners of the Merchants' bridge, connecting North St. Louis and Madison, Ill., have submitted to the citizens of the former place proposition to alter the bridge so that an electric road can cross, and drive and footways be provided. The cost is estimated at $250,000.

Telegraphic advices from Waco, Tex., indicate that a serious accident happened on the 6th inst. to the large compound Corliss engine operated by the Electric Light & Street Railway company. A flywheel sixteen feet in diameter flew to pieces, parts of it weighing hundreds of pounds being thrown as far as three blocks away. Great damage was done to the building and machinery, but fortunately no one was hurt. W. J. Hobson & Sons of St. Joseph immediately ordered a 150 horse power, Armington & Sims engine from the Kansas City office of the Pond Engineering company, and it will be shipped from Providence at once.

The South Seventh street branch of the Broadway line will be operated by electricity from the new station of the Cass avenue lines on North Market street and Prairie avenue, three miles distant at its nearest point. A 250 horse power Ideal engine has been ordered for the owl car service of the combined line.

The village board of Madison, Ill., held a meeting on the 5th inst. at which it considered applications for electric light and railway franchises, from Mr. Niedinghaus, Robert Skeen and G. A. Niemann. The franchise for light was given to the latter, who is now operating a similar plant at the adjoining city of Venice, and will probably combine the two. The village is to be lighted within four months. Mr. Niedinghaus asks for a franchise for an electric railway to run across the Merchants Bridge from North St. Louis to Madison and Granite City. Action was deferred until the next meeting.

The incorporation is reported from Carterville, Mo., of the Southwest Missouri Electric Railway company with a capital stock of $500,000. The incorporators are given as W. M. Donaldson, E. Z. Wallower, Nadian Hamilton, A. H. Rogers, W. B. Kane, J. H. Maret and George Storey.

The Eagle Electric company, recently organized at Columbia, Ill., has made a contract with the Consolidated Engineering company of St. Louis for its complete plant. National Companies apparatus and an Ideal engine will be used.

The Municipal Electric Light & Power company, St. Louis, is now installing its sixth 3000 light battery alternator. Although it did not enter the incandescent field until nine months ago, it now has over 12,000 lights connected.

The city council at Edwardsville, Ill., met on the 6th inst. and awarded the contract for city lighting for ten years, together with the exclusive privilege of furnishing commercial and domestic lights for the same period, to the N. O. Nelson Manufacturing company of St. Louis, which operates a large manufacturing plant in the neighboring city of Le Claire. The terms were: 2000 candle power arc lights, all night, every night, $80.00 per year; commercial arcs till midnight, $80. Incandescent, one 16 candle power lamp, 60; two, 110; three, 150; each additional, 35 per month. Customers to furnish wiring and lamps; 15 cents per lamp extra if company furnishes wiring and lamps. Fifty per cent. additional for all night lights. The present plant is operated by Mudge & Cook, who bid $125 each for the city arcs, $8, $7.50 and $7 per month for one, two or three commercial arcs till midnight; incandescent, by meter, one cent per hour.

Wm. Wurdack of St. Louis, bid $85, $8.65, $8.35 and 8 15 on the arcs and one cent per hour for incandescent by meter.

B.

New England News.

BOSTON, September 10.—The Jackson Electric Engine & Telephone company, whose methods of business were thoroughly aired about fifteen months ago, has been again brought before the public, and in a very sensational way. The Rev. Dr. George S. Chadbourne of Cambridge, who was at one time president of the company, when it was known as the Jackson Electric Engine company, was arrested last week at his summer home in Wiscasset, Me., on the charge of obtaining money under false pretenses. Dr. Chadbourne is one of the best known clergymen in New England and the promoters of the Jackson enterprise made a ten strike in securing the use of his name. The writ charging deceit and false pretenses was served on Dr. Chadbourne in a suit brought by Miss Minerva M. Patten of Watertown, Mass., and Rev. Hiram L. Kelsey and W. W. LeSeur of Boston. The defendent was held in the sum of $5,000 for trial in October.

The Jackson company does not bear a very savory reputation in Massachusetts. One year ago last June there appeared in a local paper an expose of the methods of the company and since that time Boston has known it no more, at least as an active factor in the pursuit of business. C. A. Jackson ran the Boston office of the concern, The Jackson Electric Engine company was organized May 7, 1885 at Portland, Me. Its avowed objects were: "To manufacture, sell and deal in electric engines and other electric machinery and apparatus; to own and operate any patents and patent rights relating thereto; to own and hold any real and personal property, and to do any acts necessary or convenient for the prosecution of the above business."

The capital stock was fixed at $1,100,000 and the amount paid in was $300, The par value of the shares was $10 and they were taken as follows: F. P. Benner, Boston, 10; Frederick Curtis, Boston, 10; C. A. Jackson of Lawrence, 10, leaving the balance unissued. Curtis was chosen president and Jackson treasurer, of the board of directors. On May 13, 1889, the articles of incorporation were recorded, with Robert Parkin as president and Jackson treasurer, and Lorenzo Cowan, H. F. Cady and C. W. Hatch on the board of directors. Stock was sold to these gentlemen in February before the company was incorporated. In June of this year the Massachusetts commissioner of corporations sent a notice to the company for a return of their business as required by law. Jackson replied that the corporation had no office and did no business in this state.

In September, 1889, C. A Jackson, Uriah Copp, Jr., C. H. Wood and G. P. Harriogton applied to the secretary of state for Illinois for permission to open a stock book preparatory to forming a corporation to be known as the Jackson Electric Engine & Telephone company. Their objects now were: "To manufacture, buy, sell, lease and operate electric motors and engines and other electric apparatus, including telephone instruments and appliances, and to buy and sell patents issued for such purposes." The capital stock was to be placed at ten millions this time. The principal office was to be in Chicago and life of the company 50 years. The same day that a license was issued to them they filed a report in which they agreed to pay $10 apiece for the shares distributed as follows: Jackson, 999,970; Copp, 10; Harrington, 10; Wond, 10. On Dec. 11, 1889 they held their first meeting. The directors elected were C. A Jackson, Boston; C. H. Ward, Chicago; Uriah Copp, Jr., Loda, Ill.; G. P. Harrington, Edinburg Ill; G. S. Chadbourne, Cambridge, Mass.; J. P. Jackson Owensville, Ind.; H. F. Cady, Lowell, Mass.

The report of this election was filed at once, and it was stated that Dr. Chadbourne was president. The amount of stock paid in in cash was still $300 and the balance of $9,999.700 was represented by "letters patent." These documents are the telephone patents which Jackson is said to have bought for a few hundred dollars, and their use is said to be impracticable.

In March last the commissioner of corporations of Massachusetts issued a notice for the return of the business done by this new company. On the company's letter paper on which branch offices were advertised at Chicago, Denver and New Orleans, came back the answer that: "The Jackson Electric Engine & Telephone company has never done any business, and so soon as they do, I will let you know," signed, C. A. Jackson, treasurer. The commissioner wrote again saying that this reply was unsatisfactory. Jackson wrote back: "The above company has no place of business in Massachusetts." Then Uriah Copp from Loda, Ill., wrote to the commissioner: "I wish to notify you that the Jackson Electric Engine & Telephone company is doing no business in Massachuetts. It did have an office in Boston, but is doing no business there now. If any further information is wanted let me know at the above address."

That is the official record of the company in the state of Massachusetts. It has been doing no business other than the selling of stock. When first started in Boston the company had a motor in its office which, it was said, was nearly ready to be put on the street. Stock was offered at the lowest figure under the strictest assurances that the machine would be finished within three months. Rev. Mr. Kelsey's shares cost him one dollar each. He was told that only 4,000 shares were to be sold to get money to carry on the work.

It was about this time that the Rev. Dr. Chadbourne was induced to take the presidency. It is said that the doctor was to receive half of the sales of stock. No criminality is charged against him and it should be stated that he resigned a soon as the methods of the company were exposed. The suit brought against him now is for $11,500 damages. The complainants claim that $5,000 was obtained fraudulently from them by the representations of the doctor. The reverend gentleman's answer is that Kelsey and Le Seur bought their stock before he knew that it was in existence and that Miss Patten's investment was made after the fullest investigation. He admits that he may have been too enthusiastic in the promise of the invention and unwise in lending his name to the concern. All the holders of stock that can be found regard it as valueless. W. C. Chaffee who was the electrician of the company, has 200 shares, which he offers at 17 cents a share with no takers.

It is alleged that the transfer of the patents from the Maine to the Illinois corporation was not legal, and that no matter what the value of the patent may be the company that is now issuing stock has no ownership in it.

H. N. Bates & Co. of Boston, have just shipped the shafting plant of the Haverhill Electric Light company, and it will be put in place at once. The plant is fitted with Hunter friction couplings.

Steps are being taken in New London, Conn., for the completion of the electric street railroad for which a charter was granted some time ago. It is now expected that cars will be running by October.

C. H. Hotchkiss, a wealthy resident of Bridgeport, Conn., has purchased nearly the entire franchise of the Bridgeport horse railroad. He will adopt electricity as a motive power. The legislature is to be petitioned for further privileges and the road put on a first class basis at once. The purchase was made from a Rochester, N. Y., syndicate which bought the road some time ago for $400,000.

J. C. E.

PERSONAL.

Chas. M. Howell, Bessemer, Mich., president of the Illinois Electric Lamp company, was in Chicago for some days during the past week.

T. A. Pamperin, president Electrical Manufacturing company, Oconto, Wis., spent several days last week at his Chicago office, 239 La Salle street.

O. W. Meysenberg, manager for Siemens & Halske in America escaped from quarantine and arrived in Chicago on Sunday last after a six weeks' vacation in Europe.

W. C. McKinlock of the Enterprise Electric company, returned on Monday night last from a two weeks' trip to New York, Bristol, R. I., Manhattan Beach and other eastern points combining business and pleasure.

NEW INCORPORATIONS.

Socorro Electric Light company, Socorro, Mexico; capital stock, $25,000; generation of electricity.

New Gaynor Electric company, Louisville, Ky.; capital stock, $100,000; manufacturing electrical appliances,

Water & Electric Light company, Miles City, Mont.; capital stock, $50,000; furnishing water and electric light to residents of Miles City, Mont.

United Electric company, Dennison, O.; capital stock, $100,000; building and operating an electric street railway; Helea & Greene, Urichsville, Ohio.

Electric Manufacturing company, Oconto, Wis.; capital stock, $50,000; manufacturing and selling incandescent electric lamps; R. L. Gruner, Oconto, Wis.

Perry Electric Light & Power company, Perry, Ia.; capital stock, $20,000; operation of an electric light and power plant; E. A. Richards, Manson, Iowa.

Allegan Electric Light & Power company, Allegan, Mich.; capital stock $40,000; generating electricity for light and power; T. R. Harrison, Paw Paw, Mich.

Dunlap Electric company, Brownsville, Pa.; capital stock, $5,000; supplying light, heat and power to the public in Brownsville, Fayette Co., Pa.; W. Hogg, Uniontown, Pa.

Lackawanna & Old Forge Street Railway company, Lackawanna, Pa.; capital stock, $36,000; constructing and operating an electric railway in Lackawanna county, Pa.

Bellefield Street Railway company, Pittsburg, Pa.; capital stock, $12,000; constructing and operating an electric railway in Pittsburg, Pa.; Geo. C. Wilson, Pittsburg, Pa.

Economy Safety Heating company, Cleveland, Ohio; capital stock, $50,000; manufacturing and supplying steam and electric power for buildings; Foster & Lawrence, Cleveland, Ohio.

Iron River Water, Light & Power company, Iron River, Wis; capital stock $50,000; construction of water works, electric light and power plants at Iron River; W. E. McCord, Iron River, Wis.

New York Superheating & Purifying company, Jersey City, N. J.; capital stock, $25,000; to manufacture all kinds of steam and electric lighting appliances; Henry Puster, Weldon Bldg., Jersey City, N. J.

Philadelphia & Ardmore Passenger Railway company, Philadelphia, Pa.; capital stock $40,000; conducting and operating an electric railway in Philadelphia; D. S. Lindsay, S. W. corner Fortieth and Ludlow streets, Philadelphia, Pa.

Aspinwall Street Railway company, Pittsburgh, Pa.; capital stock $12,000; constructing and operating an electric railway in Ohar Township from end of Citizens line to Ross Grove; Geo. C. Wilson, 507 Times Bldg., Pittsburgh, Pa.

Peoples Electric company, of Braddock, Braddock, Pa.; capital stock $3,500; supplying light, heat and power or any of them by electricity to the public in Braddock borough, etc.; E. J. Smail, 110 Diamond street, Pittsburgh, Pa.

Declez Granite company, Los Angelos, Cal.; capital stock, $250,000; to deal in real estate, water rights, electric power; operate stone quarries, mills and manufacturing establishments, railroads, tramways, etc. T. H. Ward, Los Angelos, Cal.

Fox-Chase Electric Light, Heat & Power company, Philadelphia, Pa.; capital stock, $25,000; supplying light, heat and power by means of electricity to the public at the city of Philadelphia, Pa.; H. W. Albertson, 522 Walnut street, Philadelphia, Pa.

Virginia Light & Water company, Duluth, Minn.; capital stock, $20,000; manufacture of electricity, light, heat and power; establish and maintain waterworks in any town, village or city in Minnesota; J. A. Keyes, 205 1st Nat'l Bank Bldg., Duluth, Minn.

Bradbury-Stone Storage Battery company, East St. Louis, Ill.; capital stock, $500,000; manufacturing and dealing in electrodes for storage batteries, steam and water powers, electric light and heat plants, appliances, motors, mechanical and electrical goods of all kinds; Thos. L. Fekete, 333 Missouri avenue, East St. Louis, Ill.

ELECTRIC LIGHTING.

The Elgin, Ill., city council has decided to place 25 additional electric lights on the streets.

W. S. Fly, G. W. Dilworth, M. Eastland, R. H. Walker, T. F. Eastland, John C. Jones and W. B. Covett have incorporated the Gonzales, Tex., Electric Light & Power company with a capital of $20,000. W. S. Fly is president; R. H. Walker secretary, and G. N. Dilworth, treasurer. They expect to have a plant in operation by January 1.

Electric arc lights have been placed on the front lawn at the Columbus, O., penitentiary, for the purpose of preventing escapes at night. Under the former system of the lighting a prisoner might easily descend from the top of east or west hall in the shadows and escape, but under the glare of 2,000 candle power electric lamps this will be impossible save in the event of gross negligence on the part of the front guards.

According to the Cincinnati, O., *Times-Star*, Newport is to have two immense electric power houses—one for the electric cars and the other for electric light. This latter has recently been decided on. The estimated cost of the building and equipments is $50,000. The plant is to furnish light to Newport, Bellevue and Dayton. Sufficient power can no longer be obtained from the Crompton plant to supply the increasing demand for lights, not only in the three cities named, but from the Highland, Clifton Heights and other places outside the city.

The great progress of electrical science in connection with building interests throughout the country might well be called a wonder of the nineteenth century, says the Boston *Real Estate Record*. To those who have given little thought to this subject, a comparison of gas and electric statistics would show some cause for this "wonder." It was only a few years ago that believers in incandescent lighting for house purposes were few and far between. "Too harsh on the eyes," "too expensive," were some of the opinions expressed. To-day the uses to which the incandescent system is applied are almost as complete as is possible with the present advancement of electrical science

The Citizens Gas Light company and the Light & Power company of Warsaw, N. Y., have consolidated their interests and will be under one management The gas company was organized in 1858. The works were built in 1859. In 1870 the works were burned and in 1871 the Citizens' Light company was formed with a capital of $15,000; new works were built, and the supply of gas was continued under improved methods, larger area of mains, and greater consumption. In the fall of 1890 a local company was organized as the Warsaw Electric Light & Power company, with George C. Otis president, Edward H. Morris secretary, Elmer C. Rowe superindendent, and works of the most approved kind were built. The board of village trustees desiring to "keep up with the procession," so far as enterprise was concerned, made a contract to light the streets with electricity with the company, and the business men of the village fell into line and forthwith lighted their places of business by the same method. This seriously affected the income of the gas company, which was restricted to private house lighting and to some of the conservative business men who stood by the gas company. Ever since the electric light company has been in existence the gas company has endeavored to circumvent its plans, but these efforts came to naught. For the past two months it has become evident that a consolidation of the lighting interests of Warsaw must be arrived at to make the business fairly profitable and successful. A happy conclusion has been reached and the two companies have been merged upon the basis of nineteen for the gas stock to thirty-one for the electric light. A new board of directors will be chosen, new officers elected and then the war will have ceased.

ELECTRIC RAILWAYS.

The City & Suburban Railway company, Baltimore, Md., has commenced rebuilding its York road line preparatory to equipping with electricity.

The Cresceent Street Railroad company, of New Orleans, La., is preparing to equip its Coliseum and Upper Magazine road with electricity.

An electric railroad will be built from Atlanta, Ga., to Decatur by the Suburban City Railroad company. Work is to commence in thirty days.

The Ashland, Ky., Catlettsburgh Street Railway company has commenced work on the extension of its electric street railway from Ashland to Catlettsburgh.

The Ashland & Catlettsburg Street Railway company has let a contract for quite an extensive railway system to the Westinghouse company for electrical equipment.

At Louisville, Ky., the Kentucky & Indiana Bridge company intends to construct an electrical railroad at a cost of $80,000, and the Daisy Line Street Railway contemplates constructing an electrical railroad between Louisville and New Albany at a cost of $80,000.

The city council, Vicksburg, Miss., has granted franchise to build the electrical railroad, to R. C. McFarland, J. P. Roach and J. B. Mattingly, of Vicksburg, and E. F. Fuller, of New York. They are to build and equip four and one-half miles of road.

Work has been commenced in Baltimore, Md., on what is believed to be the first elevated roadway built especially for an electric railway. The Lake Roland Elevated Railway company is the builder, and the elevated structure is necessary in order to reach the city hall over a route which for some distance is occupied by the tracks of the Northern Central railroad.

A project is on foot to build an electric railway between Houston and Galveston, Texas. Mr. McGoldrick, of San Antonio, is interested in the matter, and Kansas City capitalists have signified their willingness to invest half a million dollars in the enterprise. Local capitalists will take an interest, and large donations of land will be made by property owners along the proposed line.

Roanoke, Va., will soon have a well equipped electrical railroad. The company, headed by S. W. Jamison, which several months ago bought out the street railway and electric light and power company, has been industriously engaged in reconstructing the lines, building extensions and equipping with electricity. It is believed that when it has carried out its plans Roanoke will have twenty miles of electrical railroad.

The General Electric company has recently secured a contract, against keen competition, to supply the Cass avenue street railway company, of St. Louis, Mo., with 85 cars, each equipped with two 25 horse power motors of the standard "W. P." type, and three 800 horse power direct coupled railway generators to run at a speed of 90 revolutions. Through this purchase by the Cass avenue company, the entire system of electrical railroads of St. Louis, is now equipped with apparatus manufactured by the General Electric company.

An important extension of the electric railway system at Rochester, N. Y., has been opened. The new line runs to the Genesee valley park and was opened last week, the following railway men comprising the party: President John N. Beckley, E. C. Foster, superintendent of the Lynn and Boston Electric railway; George M. Hoadley, superintendent of the Bemish Car Box company; Superintendent Rosborough, Electrician Green and Engineer Barnard, of the Electric railway company; Commissioner Huntington and Secretary A. R. Selden, of the Park Commission.

On the 8th of February a double track of rails had been laid almost the full length of Bryant street, from Second away out to Twenty-sixth street, San Francisco, Cal. There were two or three gaps which were expected to be filled in time to admit of running of electric cars along the route by the end of August, at the latest. That matters did not turn out as anticipated, is owing to the fact an injunction prevents for the present the operating of the road. A municipal ordinance forbids the use of electricity within a certain area of the city. The question of the validity of such legislation is to be tested in court, and a hearing is probable within a month. Should the railroad win the case, then the directors of the North Beach & Mission street railroad will at once start electric cars along Bryant street, and also make preparations for like improvements on Folsom street and other branches of its system.

TELEPHONE.

It is expected that Detroit people will be able to telephone as far as New York within a few months. The Long-Distance Telephone company had its line of wires connected up to the River Rouge three weeks ago, and has only been waiting to get its franchise through the Detroit city council before beginning the work of extension. There is a little doubt that mayor Pingree will approve the ordinance as soon as possible.

Some very interesting statistics have been presented in the *Journal Telegraphique*, the official organ of the International Bureau of Telegraph Administration. At the time the telephone was taken over by the French Government there were in existence eleven networks exploited by private telephone companies, and seventeen exploited by the Telegraph Administration. At the end of 1891 the number of networks authorized by government had increased to 119. An analogous progress had taken place in the development of the trunk lines. The number of these was eleven when service passed into the hands of the state; now there are fifty-eight, comprising lines of such importance as the Paris-Marseilles, Paris-Nantes, Paris-Brussels, Paris-London. In Germany the number of networks, which was only 200 a year ago, now amounts to 260; the number of subscribers is nearly 60,000, and 224,000,000 communications—making an average of 12½ per subscriber per day—having been exchanged.

MISCELLANEOUS.

The mayor of Baltimore, Md., announces that he is in favor of having electrical conduits built by the city.

The Crown Electrical Manufacturing company has been organized at Elgin, Ill., with a capital stock of $20,000, by Frederick J. Mosedale, James B. Horne and William S. Edwards.

At St, Louis last week the Bradbury Stone Storage Battery company was organized, with $500,000 capital. S. W. Stephens, Frank P. Hager and Thomas D. Crews will incorporate the company.

The Electric Appliance company of Burlington, Kans., has been formed with a capital stock of $2,000; directors are Warren Harrington, Benjamin Harrington and R. Wingrent, of Burlington.

The substitution of iron electric poles in Philadelphia with an arm extending over the street for the wooden poles previously in use, has been commenced under the supervision of the electrical bureau.

Bad weather interfered with the racing programme at Wheeling, W. Va., last week and it was found necessary to postpone the event. The city was thronged with visitors from the surrounding country by the novelty of racing at night by the electric light.

The Amethyst Electric Power & Light company has been incorporated at Helena, Mont., with a capital stock

of $200,000. It will operate in Hinsdale county with principal office at Creede. The directors are E. N. Magner, E. F. Kelley, J. P. Wallace and A. W. Brownell.

The Dayton, O., *Times-News* says: "Electricity has made Mrs. George Mortimer, of Memphis, twice a widow. Two years ago her first husband named McCormick, a lineman, was killed while at work. A year ago she married George Mortimer, lineman on the Memphis & Raleigh electric railway. Monday afternoon Mortimer was at work on a line wagon. He lost his balance and caught at the overhead wire to save himself. In an instant he fell to the wagon dead."

The board of public works of Detroit, Mich., is annoyed at the failure of the local company to remove the electric light poles along Woodward avenue where they stand in the way of paving operations. "I am just giving out the fortieth ukase in regard to the matter," said President McVicar last week. "The electric light people were notified two months ago to move their poles out of the way, and still the work remains unperformed. I believe that the only thing to do is to have the wires clipped and cut the poles down." There are four electric light poles in the way—one on the corner of Charlotte avenue, another at the corner of Holden avenue, one in front of 1306 Woodward, and the fourth in front of 1400.

Judge Adams has handed down an important decision in the case of the Eastman company of Rochester, N. Y., against Henry M. Reichenbach, Gus D. Milburn and S. Carl Passavant. The court finds that the plaintiff was entitled to a permanent injunction restraining the defendants from using or in any manner disclosing the secret formulæ, processes or appliances used by the plaintiffs, upon the ground that they are the exclusive property of the plaintiffs. It will be remembered that the defendants were the confidential employes of the Eastman company, Reichenbach being the head chemist and Passavant being the assistant chemist, and that on December 31st Mr. Eastman discovered that they had been engaged for some time in secret attempts to organize a company, and, as Judge Adams finds, with the intention to use the inventions and processes of the plaintiffs. They were discharged on the following morning, and proof having been procured that they intended to use the processes of the plaintiff, the action was commenced to restrain them by injunction from using or disclosing any of the processes in question. A temporary injunction was granted by Judge Rumsey at Rochester, and this has now been made permanent by Judge Adams' order.

TRADE NEWS.

The Central Electric company Chicago, has taken the agency for the machines for painting mouldings, manufactured by the Standard Paint company of New York city. These machines can be had from the Central Electric company, or any of its branches—the Southern Electrical Supply company at St. Louis, Mo., the Gate City Electric company at Kansas City, Mo., and the Western Electrical Supply company at Omaha, Neb.

Chas. M. Howell, Bessemer,, Mich., president of the Illinois Electric Lamp company, Chicago, was in the city last week with one or two other gentlemen connected with his company. The first balance sheet shows a most gratifying condition of affairs, and although the company was organized in the spring when the demand for incandescent lamps is light, a good dividend has been earned. The plant is a fine one, and with a few changes that are now contemplated, the outlook for business will be very bright.

BUSINESS.

The Electrical Manufacturing company of Oconto, Wis., has enjoyed most gratifying success in the sale of lamps since August 1st, on which date an office and salesroom were opened at 239 La Salle street, Chicago, with Wm. Hood & Co. managers. During this time fully five thousand lamps have been sold from this one agency, and the reports from customers are most satisfactory. The factory is now making 1,000 lamps per day and with a prospect that this output will be increased to 1,500 before October 1st. Further agencies have been established in Milwaukee, E. G. Muller, manager, and at Thomasville, Ga., J. B. E. Lone, manager.

One would be surprised to see the magnitude of the shipments being made by the Ries Electric Specialty company of Baltimore, Md. The Ries regulating sockets are daily becoming more in demand, and large orders are being received from almost every portion of America and the old world where alternating current is used. This company is shortly to increase its plant again so as to meet the rapidly growing demand for its specialties. John A. Blattau, special traveler of the Ries company, says the Ries socket is making thousands of new consumers for the central stations, and that enterprising construction firms are reaping a harvest particularly in fitting residences with this device.

ELECTRICAL PATENTS.

Issued Sept. 6, 1892.

481,921. Apparatus for Cutting Minerals. Llewelyn B. Atkinson and Henry W. Ravenshaw, London, and Frederick Mori, Leeds, Eng.

481,922. Compensator for Signal Wires. Samuel W. Babcock, Avon, N. Y.

481,956. Automatic Trolley Disconnector. George A. Kimball, Seattle, Wash.

A cord is attached to the trolley pole to actuate a pivoted trigger, while within a slot formed in the short arm of the trigger, is normally hung a weight.

481,959. Conduit System for Electric Railways. Reuben Lawrence, St. Joseph, Mo.

The conduit is covered by removable plates having a slot opening between them, and a space partitioned off and to one side of the slot; a double electric conductor lies in this space and a trolley makes contact with the top of the conductor and is carried by an automatically resilient support.

481,975. Meter for Alternating Electric Currents. Oliver B. Shallenberger, Rochester, Pa.

The meter embodies a coil or closed secondary conductor consisting of continuous rings or circuits of conducting material connected together in parallel circuit.

481,979. Apparatus for Electrically Purifying Water. Lucius T. Stanley, Brooklyn, N. Y.

481,989. Electric Fire and Burglar Alarm Connection. Homer T. Wilson, Louisville, Ky.

A spring contact point is normally held from a contact point and adapted to close upon it by the fusion of a composition melting at low temperature.

481,999. Electric Furnace Generator. Emile Berliner, Washington, D C.

An armature supported at the end of a permanent magnet is adapted alternately to be heated by the flames from a furnace, and to be cooled by a blast of cold air or water, whereby a current is induced in a coil surrounding the magnet.

482,012. Battery Connector. Edward R. Knowles, Brooklyn, N. Y.

482,015. Printing or Recording Telegraph. Zachary T. Lillard and Ursinus Erhard, Kansas City, Mo.

482,031. Trolley for Electric Railways. Clarence A. Adams and Thomas J. Thorp, Lincoln, Neb.

A harp adapted to support a journal for the trolley roller carries pockets for the insertion of springs which bear upon the trolley roller.

482 032. Electrostatic Switch and Phase Indicator. Alfred U. Alcock, Melbourne, Victoria.

Alternators are included in parallel circuit with the main line conductors, and circuit closers are included between the main line conductors, to which are engaged relatively movable plates charged by the alternators.

482,035. Wire Tightener. John L. Buckingham, Hermosa, S. D.

482,043 Storage Battery. Patrick Kennedy and Charles J. Diss, Brooklyn, N. Y.

The active material is held by non-conducting structures, and an electrical conductor is placed between them and in contact with the active material.

482,044. Storage Battery. Patrick Kennedy and Charles J. Diss, Brooklyn, N. Y.

The structure for holding the active material is composed of a cohesive bitumen, resin, gum, or gum resin, and a mineral non-conductor of electricity.

482,074. Electrical Heater. John V. Capek, New York, N. Y.

The heater consists of an insulated heating conductor and an inclosing sheet metal box, the lower edge of the cover being bent under the box to hold it in place and form a tight joint.

482,093. Rheostat. Harry W. Lawrence, Denver, Colo.

482,104. Ceiling Block for Incandescent Lamps. Luther Stieringer, New York, N. Y.

The ceiling block carries a perforated projecting pin, from which depend flexible lamp conductors, which are connected with contact devices on the block and threaded through holes in the pin to remove the weight from the electrical connections.

482,112. Support for Electric Lamps. Augustus Wright, Providence, R. I.

482,126. Train Signaling Apparatus. James M. Henry, Wilmerding, and Robert B. Wilson, Altoona, Pa.

The invention relates to that class of signals which are employed upon moving trains for enabling the conductor to signal to the engineer, and it consists in an improved combination whereby the agencies of electricity and compressed air, or steam, are utilized to produce a signal.

482,129. Combined Telegraph Key and Sounder. Dan J. Ludwig, New York, N. Y.

The sounding magnet depends from the upper end of a C shaped frame; the armature lever is arranged below the magnet and the key below the armature lever; all the parts being in the same plane.

482,133. Electric Alarm Clock. John McMillan and George H. Taylor, Philadelphia, Pa.

482,136. Automatic Battery Cut Off. Walter S. Richards, Natick, Mass.

The armature of the electromagnet is acted upon by a retracting spring and loosely engaged by a bell crank lever having a contact or terminal arranged to momentarily engage another contact or terminal secured to the armature.

482,137. Electrically Adjusting Relay. Walter S. Richards, Natick, Mass.

A relay and an electromagnet are included in the same circuit, and the relay is provided with an armature pivoted outside of the electromagnet and located in front of the pole piece; a spring connecting the armature.

482,139. Electric Valve Controller. Edward F. Roberts, Columbus, O.

A valve for controlling the heating fluid is provided with pistons upon its opposite sides, one of which is operated by excess of pressure and the other by an electromagnet included in an electric circuit, which also includes a thermostatic circuit closer.

482,142. Coin Controlled Vending Machine. Charles A. Shattuck, Malden, Mass.

482,148. Telltale for Electrolytic Refineries. Francis B. Badt, Chicago, Ill.

The vats are coupled in series and visual signaling devices are included, each in a normally closed local circuit including itself and one vat, an audible signaling device is adapted to be closed upon the operation of any visual device, and a meter is adapted to be successively cut into each of the local circuits.

842,149. Electrical Circuit and Cable. John A. Barrett, Brooklyn, N. Y.

An electric current consists of a pair of naked conductors, and a single mesh of cord, tape or similar insulating material woven between and about the conductors, with a greater thickness of the woven insulating material between than about them.

482,150. Electric Conductor. John A. Barrett, Brooklyn, N. Y.

A group of conductors carry a covering consisting of a strip of paper or other flexible material wound about the conductors, provided with tucks extending transversely to the lines of flexure.

482,151. Electric Conductor. John A. Barrett, Brooklyn, N. Y.

The cable embraces a plurality of independent circuits, each circuit consisting of a pair of conductors formed into a single oblong strand, the distance between conductors of the same circuit being greater than that between conductors of adjacent circuits, whereby inductive action is lessened.

482,152. Electric Circuit and Cable. John A. Barrett, Brooklyn, N. Y.

A pair of flat conductors is held in position so that the conductors are held edgewise with relation to each other by insulating material between and about the conductors.

482,153. Machine for Folding Tape. John A. Barrett, Brooklyn, N. Y.

482,157. Electric Arc Lamp. John T. Birch, Pittsburg.

Two hubs, each provided with carbon rods held in radially arranged holders, are adapted to be rotated to bring the carbons successively in position to establish arcs.

482,171. Feed Indicator for Boilers. A. Guasco and A. Chusin.

482,172. Electrical Gas Lighter. James E. Hamilton, Chicago, Ill.

A shaft is provided with a pair of arms carrying reciprocating wipers moving in a horizontal plane, and an insulated spur near the slot of a gas burner is adapted to be engaged thereby.

482,174. Telephone Exchange Apparatus. Angus S. Hibbard, New York, N. Y.

A series of telephone service circuits are combined with an order circuit, an operator's receiving telephone, and a circuit changer controlling the connection of the telephone with the service circuit, a repeating coil has one of its windings connected with the order circuit and an independent loop extends from the terminals of the receiving telephone and is formed into a closed circuit with the other winding of the repeating coil.

482,177. Electrical Conductor. P. H. Holmes.

The conductor is composed of particles of conducting carbon, such as plumbago, disposed in strata, which lie in planes parallel with the direction of the current, and are thus presented on end to the flow of the current.

482,181. Electric Connector for Hose. Charles F. Kellom, Delair, N. J.

Collars provided with tubes on their sides are attached to the hose coupling, and electrical wires lie in the tubes, and a segmental ring is adapted to make contact with the wires.

482,209. Induction Coil for Electric Meters. Elihu Thomson, Lynn, Mass.

A main circuit coil is placed in inductive relation to a meter circuit and in series with the work, and a helping high resistance circuit is placed in multiple around the work at the point of consumption, and also in inductive relation to the meter circuit.

482,221. Handle Holder for Brushes. William E. Barnett and Bennett R. Chalk, Mount Washington, Md.

482,240. Electric Arc Lamp. James E. Gaston, Sparta, Ill.

482,251. Watchman's Electric Time Recorder. Emanuel R. Heyser, Leon, Mex.

482,253. Electric Arc Lamp. Jesse F. Kester, Terre Haute, Ind.

482,263. Electric Annunciator. Erastus D. Moore, New York, N. Y.

482,265. Armature for Dynamo Electric Machines. John Nebel, Charlton.

482,270. Means for Drawing Cables into Conduits. Thomas F. O'Connor, New York, N. Y., and Joseph W. Marsh, Pittsburg, Pa.

As a means for introducing cables into conduits and preventing undue strain thereof, a series of draw wires is connected with the cable at different points along its length.

482,297. Electric Insulator. William H. Clark, Brooklyn, N. Y.

The insulator is provided with a ridge at its top for receiving the conducting wires, and a horizontal groove around the body of the insulator to receive the tie wire.

482,306. Electric Railway Signal. Charles K. Hall, New Orleans, La.

482,322. Ore Concentrator. Charles E. Seymour, Lake Geneva, Wis.

482,323. Magnetic Separator for Ore Concentrators. Charles E. Seymour, Lake Geneva, Wis.

The ore concentrator embraces a concentrator pan or bowl magnetized by an electric current, spring actuated contact points within the circuit, a pivoted key provided with an arm bearing upon one of the contact points and a vertical rod connected with the outer end of the key.

482,324. Electric Meter. Francis Teague, London, Eng.

The meter consists of a small motor actuated by current from the working circuit and adapted to indicate the energy expended in any desired units by means of an index finger moving over suitably marked dials; the working principle being that of rotation of currents by magnets as experimentally shown by Farfaday.

482,325. Trolley for Electric Railways. James M. C. Tyner and Samuel S. Irving, Minneapolis, Minn.

A trolley having an oscillatory head carries a series of insulated spring pressed fingers adapted to meet over the trolley wire.

482,328. Electric Cable. John A. Barrett, Brooklyn, N. Y.

The conductors are secured at a distance from each other to a core consisting of a hollow structure constructed to provide fixed space for dry air insulation between the conductors.

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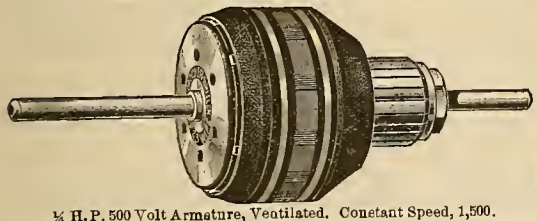

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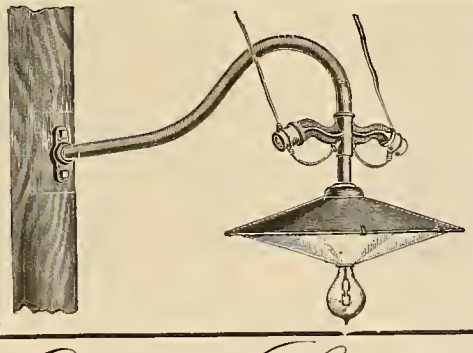

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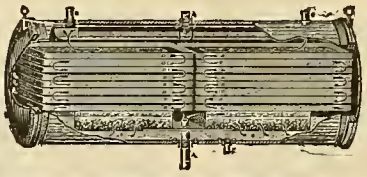

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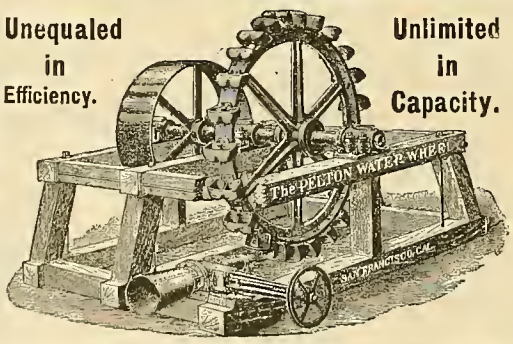

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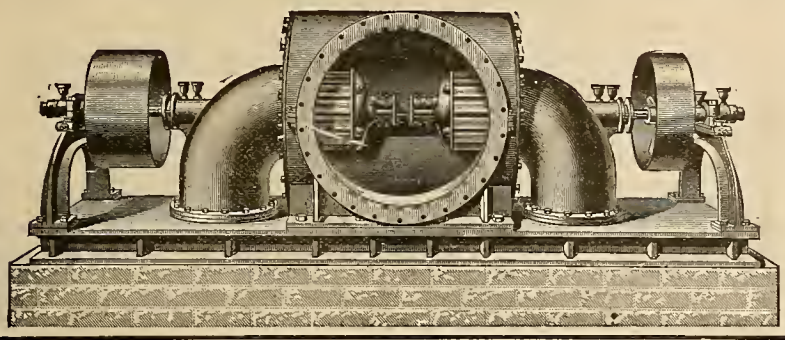

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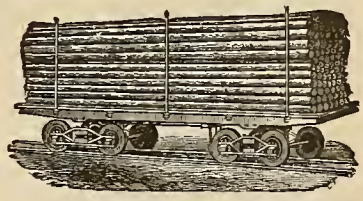

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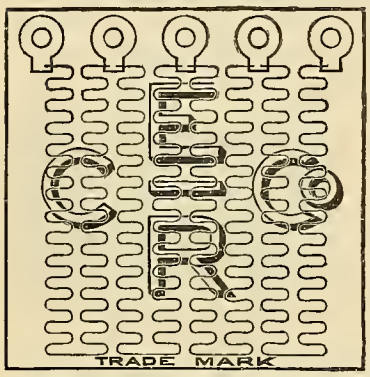

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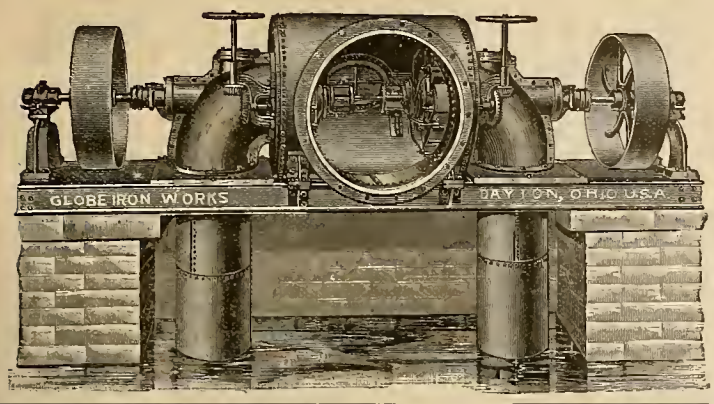

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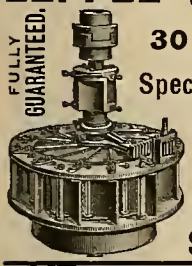

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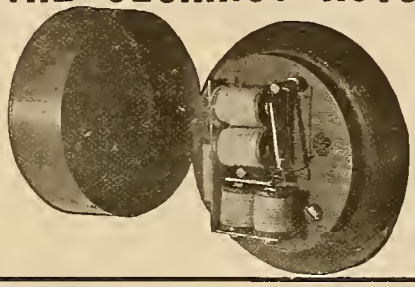

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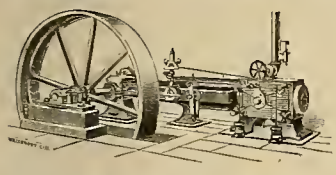

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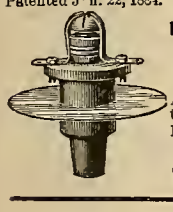

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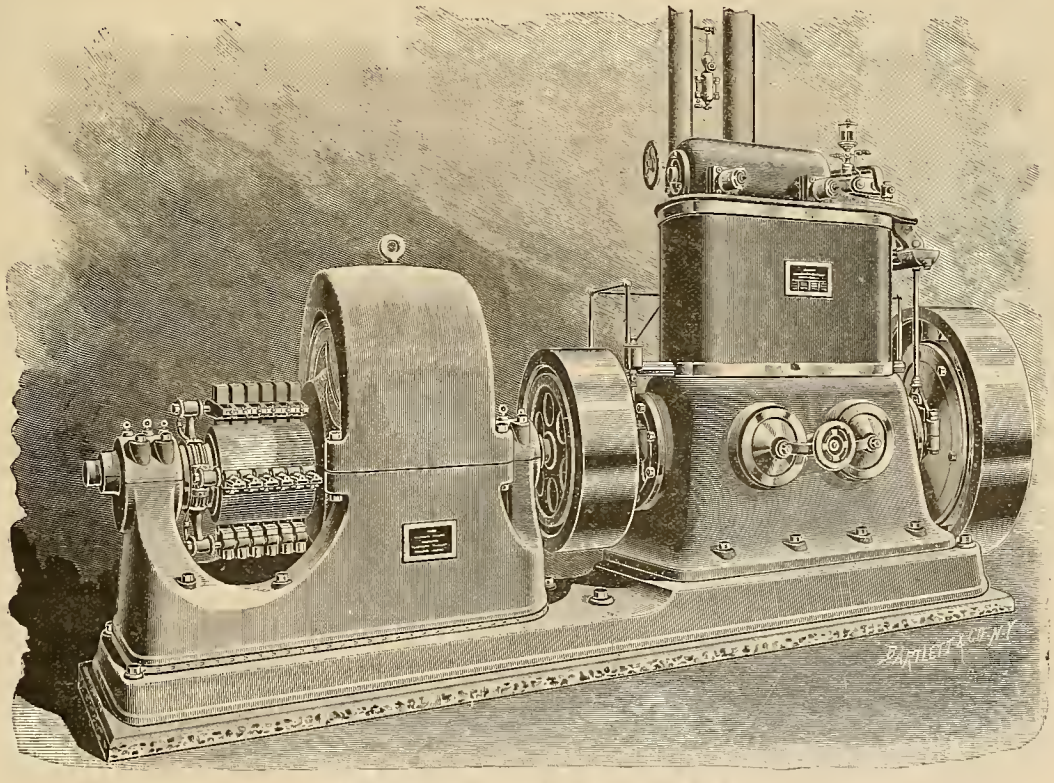

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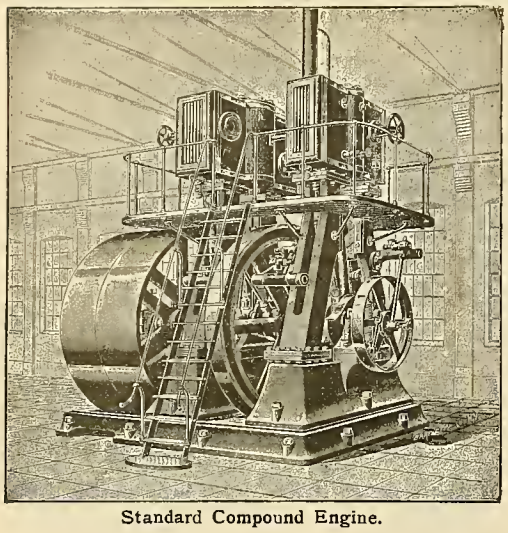

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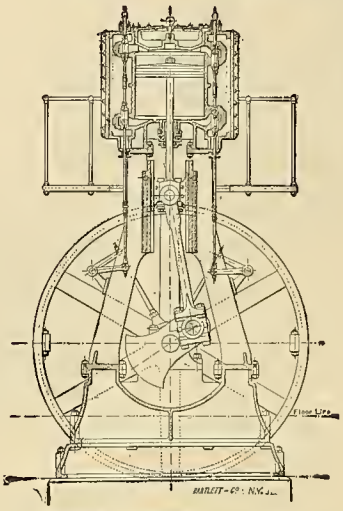

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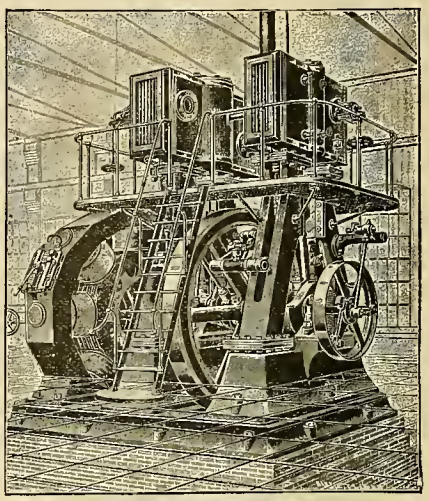

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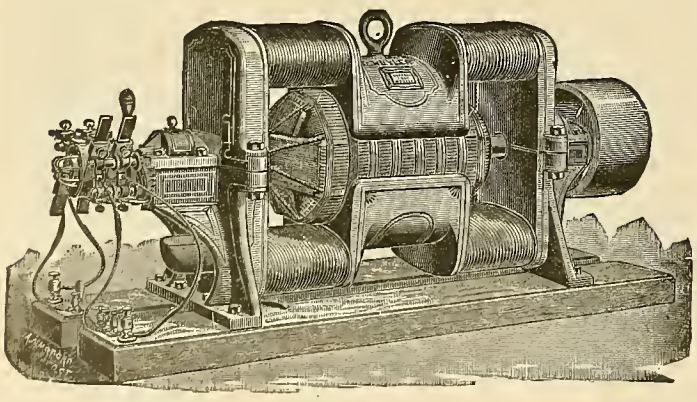

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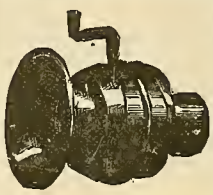

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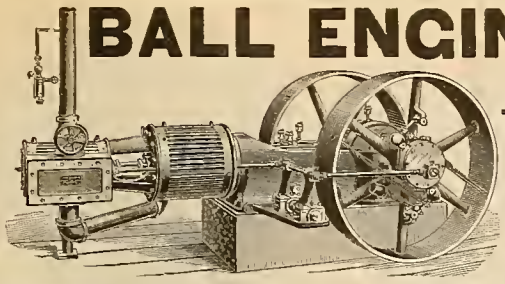

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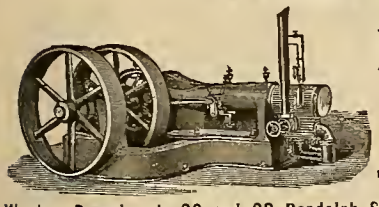

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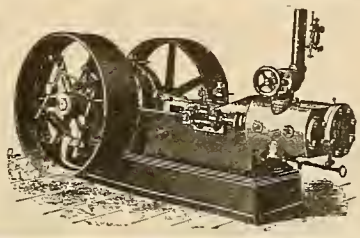

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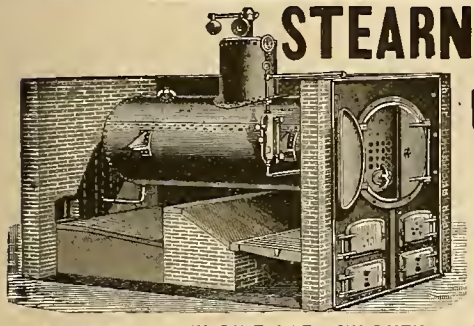

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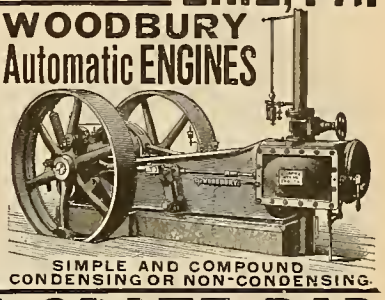

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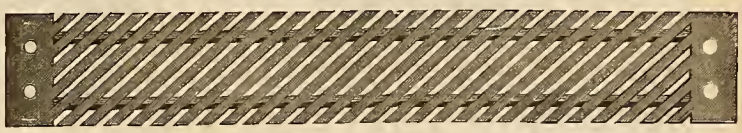

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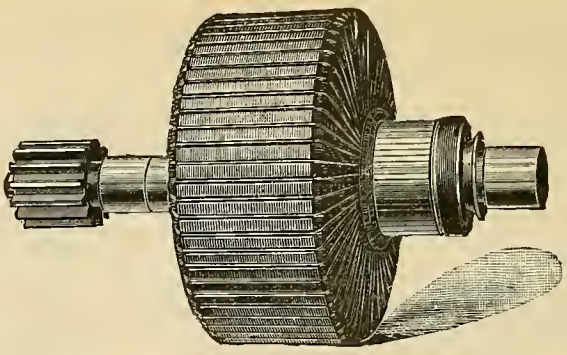

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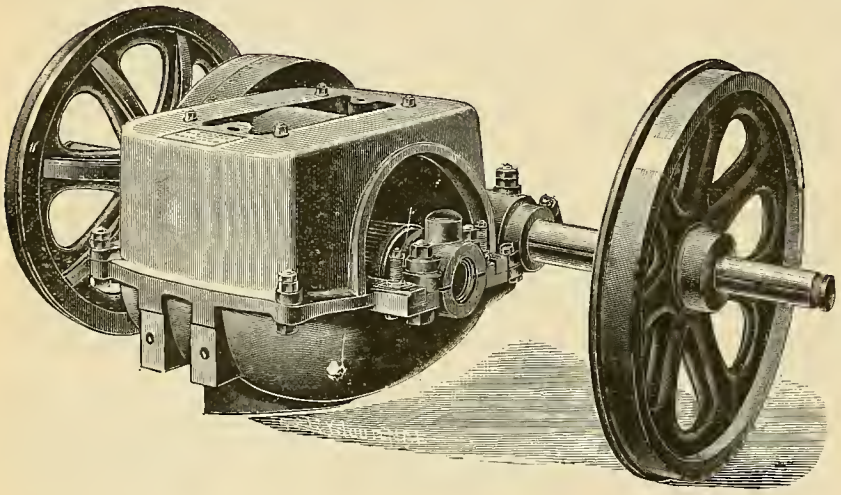

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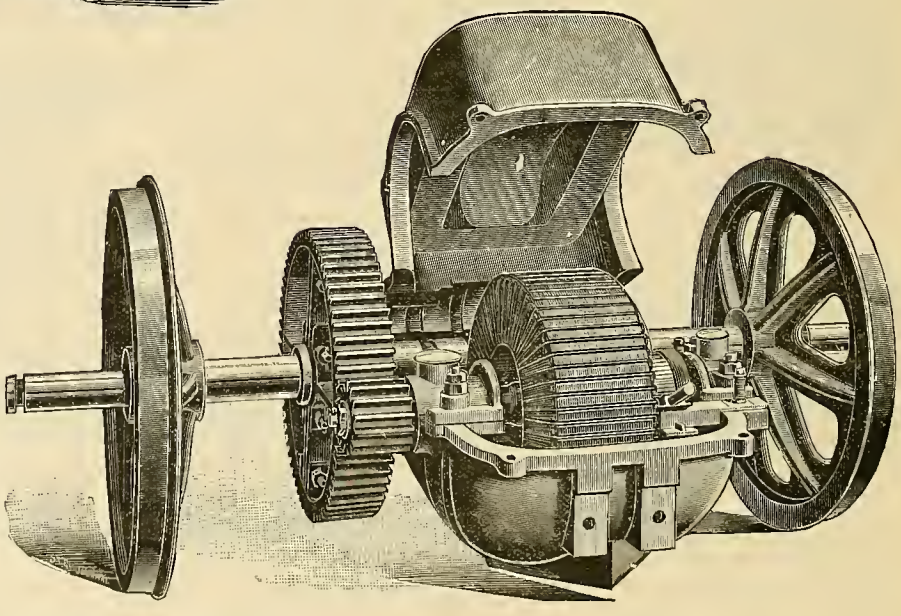

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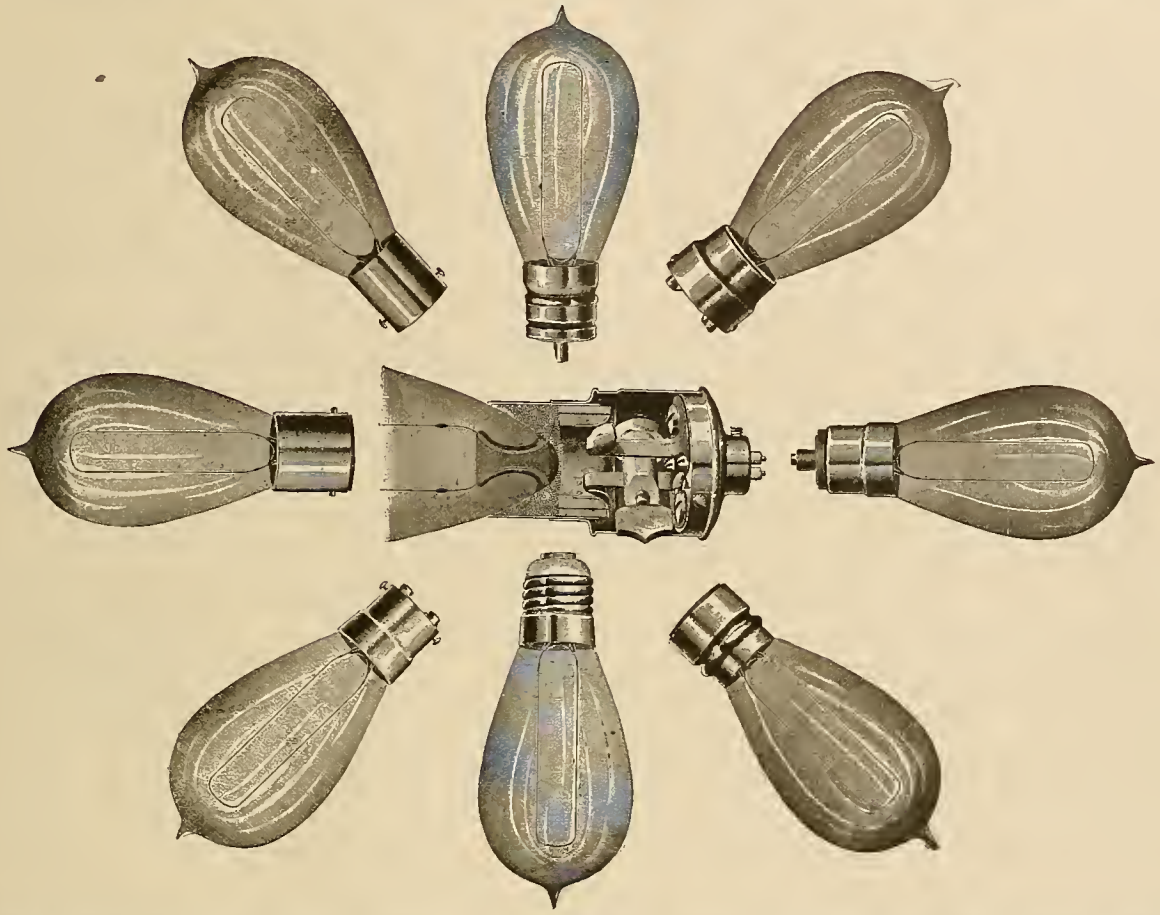

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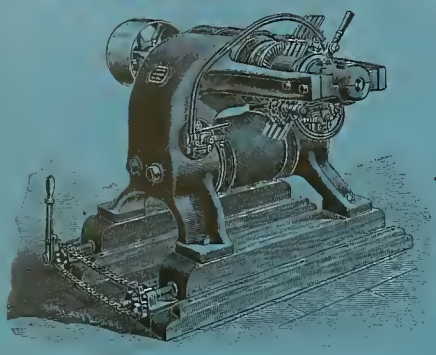

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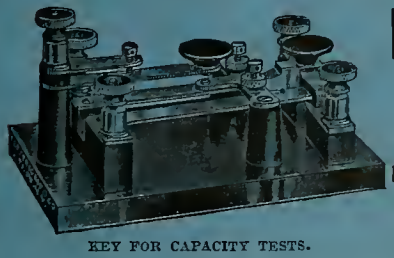

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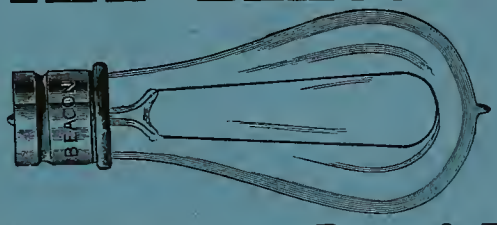

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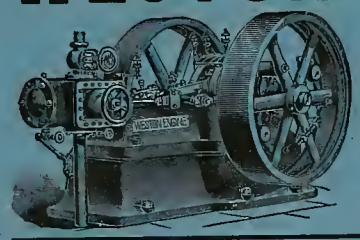

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WASHINGTON, D. C.
ST. PAUL, MINN.
PORTLAND, ORE.
SEATTLE, WASH.
HELENA, MONT.
PITTSBURGH, PA.
BALTIMORE, MD.
SPOKANE, WASH.

INDEX AND CLASSIFICATION OF ADVERTISEMENTS.

ALPHABETICAL LIST.

American Battery Co..... ix
American Desk & Seating Co..—
American District Steam Co.... x
American Electrical Mfg. Co.. iv
American Engine Co..... xii
Andrews & Co., A. H.....—
Babcock & Wilcox Co., The.... i
Baggot, E xiv
Ball Electric Light Co..... xvi
Ball Engine Co.....xix
Ball & Wood Co., The i
Beacon Vacuum Pump & Elec. Co.i
Becker Mfg. Co., John..... xiii
Beggs, J. E., Mch. & Supply Co. x
Bernstein Electric Co..... xii
Boston Braid Mfg. Co..... x
Bowers Bros..... xvi
Bridgeport Mach. Tool Wks.. —
Brookfield, Wm..... xii
Brush Electric Co viii
Bryan, W. H.. xiv
Bryant Electric Co..... xii
Buckeye Electric Co., The..... ix
Carpenter Enamel Rheostat Co. xvi
Central Electric Co..... ... v
Chicago Rawhide Mfg. Co.....—
Crescent Ins. Wire & Cable Co. xiii
Crocker-Wheeler Electric Co.. xiii
Cushing, F. W..... vii
Cutter, Geo i
Cutter Electrical & Mfg. Co...—
Dayton Globe Iron Works Co..xvii
Densmore Typewriter Co..... xii
Detroit Electrical Works..... xxiv
Diamond Electric Mfg. Co.... xii
Dixon Crucible Co., Jos..... xvii
Dudley & Co., W. W..... xvi
Duplex Electric Co., Ltd.....—
Eastern Electric Cable Co..... xiii
Eastman Kodak Co..... xiv
Edison General Electric Co.....viii
Electric Cons. & Supply Co... vi
Electric Engr'g & Supply Co.. ix
Electrical Mfg. Co., The..... xv
Electric Secret Service Co..... xix
Electrician Pub. Co..... xvi
Electrical Construction Co. The. xii
Electrical Eng. & Supply Co.The.—
Electrical Supply Co., The... xxii
Elektron Mfg. Co..... vi
Empire China Works..... x
Enterprise Electric Co..... xv
Falls Rivet & Machine Co..... ix
Ferracute Machine Co..... xiv
For Sale Advertisements. x, xii, xiii
Fort Wayne Electric Co..... xxiv
General Electric Co..... ii, iv
Gravity Purifier Co.....—
Great Western Elec. Supply Co—
Greeley & Co., The E. S.....i
Hart & Hegeman Mfg. Co.....xvii
Heisler Electric Co..... —
Hill Clutch Works..... xix
Hine Eliminator Co.....—
Holmes, Booth & Haydens.... xiv
Hood & Co., Wm.... xv
Hughes Bros. Mfg Co..... xvii
Illinois Electric Lamp Co..... xvi
India Rubber & G. P. Ins. Co. xxiii
Institute of Technology..... xiv
Interior Conduit & Insulation Co. x
International Okonite Co..... i
Jewell Belting Co..... i
Johns Mfg. Co., H. W..... xvi
Kartavert Mfg. Co..... xvi
Kelly Brothers ..... —
Klipstein, A..... xii
Knapp Electrical Works..... xxi
Lake, J. H. & D., Co ..... —
Lake Erie Engineering Works.xviii
Lane & Bodley Co.....—
La Roche Electric Works..... xvii
Leclanche Battery Co., The .. xvii
Lefmann, Julius xiv
Leffel, & Co., Jas xvii
Leonard & Co., H. W..... xvii
Link Belt Machinery Co..... xv
Loud, H. M. & Sons Lumber Co. xiv
Lovell Mfg. Co., Ltd..... xiii
Mather Electric Co..... iv
Midland Electric Wks..... xii
Moore, Alfred F..... i
Morse & Co., A. M..... xii
Munsell & Co., Eugene.....xiii
National Carbon Co..... xiv
National Electric Mfg. Co.....—
National India Rubber Co....—
New York Insulated Wire Co. xv
N. Y. Safety Steam Power Co.xvii
New York & Ohio Co..... i
Ostrander & Co., W. R..... xix
Page Belting Co..... —
Partrick & Carter Co..... —
Pearson & Co., W. B.....xviii
Pelton Water Wheel Co..... xiv
Perkins Elec. Switch Mfg. Co. ix
Phoenix Glass Co..... xix
Porter-Leavitt Elec. Motor Co. xiii
Proposals for Elec. Ltg.... xii, xv
Queen & Co..... xiii
Racine Hardware Mfg. Co.....—
Railway Equipment Co..... ix
Redding Electric Co.....x
Ries Electric Specialty Co..... x
Roebling's Sons Co., J. A. ....—
Rose Elec. Light Supply Co... xii
Royal Electric Co.....—
Samson Cordage Works..... xii
Sawyer-Man Electric Co..... xi
Schuyler Electric Co..... iv
Sechrist, Albert..... xvii
Shultz Belting Co..... x
Siebert, G.....—
Siemens & Halske Electric Co. xiii
Sioux City Elec. Supply Co...—
Sioux City Engine Works.... xix
Smith, A. T.....—
Smith, Thos. G. Jr.....—
Somoff, J. L.....—
Sperry Elec. Mining Mach. Co. xvi
Standard Electric Co..... vi
Standard Paint Co x
Stanley Electric Mfg. Co..... v
Star Electrix Co... xv
Stearns Mfg. Co..... xlx
Sterling, W. C..... xv
Stilwell & Bierce Mfg. Co. xlv, xv
Sunbeam Incand. Lamp Co...xxiii
Taylor Engine Co.....—
Thomson-Houston Elec. Co.. ii, xx
Union Hardware Co..... xii
Utica Elec. Mfg. & Supply Co. x
Van Nuis C. S..... i
Vulcanized Fibre Co..... xv
Waddell-Entz Company..... xii
Wannopee Pottery Co..... xix
Want Advertisements xiii
Washburn & Moen Mfg. Co.. iv
Western Electric Co.....xiv
Westinghouse, Church, Kerr & Co.....xviii
Westinghouse Elec. and Mfg Co. xi
Weston Engine Co..... i
Woodhouse & Rawson, Ltd....—
Worthington, Henry R..... xii

CLASSIFIED LIST.

Annunciators.
Central Electric Co.
Detroit Electrical Works.
Electrical Supply Co., The.
Knapp Electrical Works.
Ostrander & Co., W. R.
Partrick & Carter Co.

Arc Lamps.
Hall Electric Light Co.
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Batteries.
American Battery Co.
Central Electric Co.
Detroit Electrical Works.
Electrical Supply Co., The.
Greeley & Co., The E. S.
Leclanche Battery Co., The.
Partrick & Carter Co.
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American Battery Co.
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Detroit Electrical Works.
Electrical Supply Co., The.
Leclanche Battery Co., The.
Western Electric Co.

Bells, Electric.
Central Electric Co.
Detroit Electrical Works.
Electrical Supply Co., The.
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Knapp Electrical Works.
Ostrander & Co., W. R.
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Bells, Magneto.
Central Electric Co.
Detroit Electrical Works.
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Chicago Rawhide Mfg. Co.
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Babcock & Wilcox Co., The.
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(See Insulated Wires.)

Cables, Electric. (See Insulated Wires), **Copper, Sheet and Bar.**
Moore, Alfred F.
Roebling's Sons Co., J. A.
Washburn & Moen Mfg. Co.
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Electrical Supply Co., The.
Knapp Electrical Works.
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Electrical Construction Co., The.
Smith, Thos. G. Jr.
Western Electric Co.

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American Engine Co.
Babcock & Wilcox Co., The.
Ball Electric Light Co.
Ball Engine Co.
Ball & Wood Co., The.
Bryan, W. H.
Brush Electric Co.
Detroit Electrical Works.
Diamond Electric Mfg. Co.
Edison General Electric Co.
General Electric Co.
Great Western Electric Supply Co.
Heisler Electric Co.
Lake Erie Engineering Works.
Lane & Bodley Co., The.
La Roche Electric Works.
Lefmann, Julius.
Leonard & Co., H. W.
Mather Electric Co.
Morse & Co., A. M.
N. Y. Safety Steam Power Co.
Pearson & Co., W. B.
Racine Hardware Mfg. Co.
Royal Electric Co.
Siemens & Halske Electric Co.
Sioux City Engine Works.
Smith, Thos. G. Jr.
Standard Electric Co.
Thomson-Houston Electric Co.
Waddell-Entz Company.
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Western Electric Co.
Weston Engine Co.

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Central Electric Co.
Crescent Ins. Wire & Cable Co.
Cutter, Geo.
Detroit Electrical Works.
Edison General Electric Co.
Electrical Supply Co., The.
Enterprise Electric Co.
Holmes, Booth & Haydens.
International Okonite Co., The.
Knapp Electrical Works.
Moore, Alfred F.
National India Rubber Co.
Roebling's Son's Co., J. A.
Sperry Elec. Mining Machine Co.
Western Electric Co.

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Central Electric Co.
Detroit Electrical Works.
Electrical Supply Co., The.
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Cutter, Geo.
Cutter Electrical & Mfg. Co.
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Hood & Co., Wm.
Knapp Electrical Works.
Perkins Elec. Switch Mfg. Co.
Redding Electric Co.
Sechrist, A.
Utica Elec. Mfg. & Supply Co.
Van Nuis, C. S.

Dynamos.
Hall Electric Light Co.
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Detroit Electrical Works.
Diamond Electric Mfg. Co.
Duplex Electric Co., Ltd.
Electrical Eng. & Supply Co., The.
Fort Wayne Electric Co.
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Smith, A. T.

Electric Railways.
Detroit Electrical Works.
Edison General Electric Co.
Siemens & Halske Electric Co.
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Westinghouse Electric & Mfg. Co.

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Leonard & Co., H. W.

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Central Electric Co.
Electrical Supply Co., The.
Greeley & Co., The E. S.
Queen & Company.
Western Electric Co.

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Bryan W. H.
Leonard & Co., H. W.

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Cutter, Geo.
Cutter Electrical & Mfg. Co.
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Ries Electric Specialty Co., The.
Utica Elec. Mfg. & Supply Co.

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Electrical Supply Co., The.
Thomson-Houston Electric Co.

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Detroit Electrical Works.
Knapp Electrical Works.
Partrick & Carter Co.

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American Electrical Mfg. Co.
Beacon Vacuum Pump & Elec. Co.
Bryant Electric Co.
Central Electric Co.
Cutter, Geo.
Cutter Electrical & Mfg. Co.
Detroit Electrical Works.
Edison General Electric Co.
Electric Cons. & Supply Co.
Electric Eng. & Supply Co.
Electrical Eng. & Supply Co., The.
Electrical Manufacturing Co., The.
Electrical Supply Co., The.
Enterprise Electric Co.
General Electric Co.
Great Western Electric Supply Co.
Greeley & Co., The E. S.
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Klipstein, A.
Knapp Electrical Works.
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Redding Electric Co.
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Electrical Supply Co., The.
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Wannopee Pottery Co.
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American Electrical Mfg. Co.
Central Electric Co.
Crescent Ins. Wire & Cable Co.
Cushing, F. W.
Cutter, Geo.
Detroit Electrical Works.
Eastern Electric Cable Co.
Edison General Electric Co.
Electrical Supply Co., The.
Enterprise Electric Co.
Great Western Electric Supply Co.
Holmes, Booth & Haydens.
International Okonite Co., The.
India Rubber & Gutta Percha Insulating Co.
Knapp Electrical Works.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
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Sperry Elec. Mining Machine Co.
Waddell-Entz Company.
Washburn & Moen Mfg. Co.
Western Electric Co.

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American Electrical Mfg. Co.
Beacon Vacuum Pump & Elec. Co.
Bernstein Electric Co.
Buckeye Electric Co.
Central Electric Co.
Cutter Electrical & Mfg. Co.
Edison General Electric Co.
Electrical Eng. & Supply Co., The.
Electrical Manufacturing Co., The.
Electrical Supply Co., The.
Hood & Co., Wm.
Illinois Electric Lamp Co.
Knapp Electrical Works.
New York and Ohio Co.
Redding Electric Co.
Sawyer-Man Electric Co.
Somoff, J. L.
Sunbeam Incandescent Lamp Co.
Thomson-Houston Electric Co.

Lathes.
Bridgeport Machine Tool Works.

Lightning Arresters.
Van Nuis, C. S.

Magnet Wire.
(See Insulated Wires.)

Mechanical Machinery.
Ferracute Machine Co.
Bridgeport Machine Tool Works.

Medical Batteries.
Detroit Electrical Works.
Partrick & Carter Co.

Mica.
Bowers Bros.
Johns Mfg. Co., H. W.
Munsell & Co., Eugene.

Milling Machinery.
Becker Mfg. Co., John.

Mine Signals, Electric.
Detroit Electrical Works.

Mining Apparatus, Electric.
Edison General Electric Co.
Thomson-Houston Electric Co.
Sperry Elec. Mining Machine Co.
Westinghouse Electric & Mfg. Co.

Model Making.
Midland Electric Wks.

Motors.
Brush Electric Co.
Crocker-Wheeler Electric Co.
Detroit Electrical Works.
Edison General Electric Co.
Electrical Eng. & Supply Co., The.
General Electric Co.
Great Western Electric Supply Co.
La Roche Electric Works.
Lovell Mfg. Co., Ltd.
Mather Electric Co.
Porter-Leavitt Electric Motor Co.
Royal Electric Co.
Siemens & Halske Electric Co.
Thomson-Houston Electric Co.
Waddell-Entz Company.
Westinghouse Electric & Mfg Co.

Name Plates.
Becker Mfg. Co., John.

Office Furniture.
American Desk & Seating Co.
Andrews & Co., A. H.

Oil Purifiers.
Gravity Purifier Co.

Pins and Brackets.
Central Electric Co.
Electrical Supply Co., The.
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Lefmann, Julius.
Loud, H. M. & Sons Lumber Co.
Railway Equipment Co.
Western Electric Co.

Platinum.
Siebert, G.

Poles.
Electrical Supply Co., The.
Lefmann, Julius.
Loud, H. M. & Sons' Lumber Co.
Railway Equipment Co.

Porcelain.
Empire China Works.
Wannopee Pottery Co.

Publishers, Electrical.
Electrician Publishing Co.

Push Buttons.
Detroit Electrical Works.
Central Electric Co.
Electrical Supply Co., The.
Knapp Electrical Works.
Union Hardware Co.
Western Electric Co.

Railways, Electric.
(See electric railways.)

Regulating Sockets.
Ries Electric Specialty Co.

Rheostats.
Carpenter Enamel Rheostat Co.

Separators, Steam.
Hine Eliminator Co.

Silk Braid.
Boston Braid Mfg. Co.

Speaking Tubes.
Central Electric Co.
Electrical Supply Co., The.
Knapp Electrical Works.
Ostrander & Co., W. R.
Western Electric Co.

Speed Indicators.
Queen & Co.

Steam Heating Apparatus.
American District Steam Co.

Steam Pumps.
Worthington, Henry R.

Supplies, Electric Railway.
Detroit Electrical Works.
Lefmann, Julius.
Railway Equipment Co.

Tapes, Insulating.
Central Electric Co.
Cushing, F. W.
Crescent Ins. Wire & Cable Co.
Eastern Electric Cable Co.
Edison General Electric Co.
Electrical Supply Co., The.
India Rubber & Gutta Percha Insulating Co.
International Okonite Co., The.
New York Insulated Wire Co.
Standard Paint Co.
Washburn & Moen Mfg. Co.

Telegraph Apparatus.
Central Electric Co.
Electric Secret Service Co.
Electrical Supply Co., The.
Greeley & Co., The E. S.
Knapp Electrical Works.
Western Electric Co.

Telephones, Electric.
Detroit Electrical Works.
Western Electric Co.

Test Instruments.
Central Electric Co.
Electrical Supply Co., The.
Greeley & Co., The E. S.
Knapp Electrical Works.
Queen & Company.
Western Electric Co.

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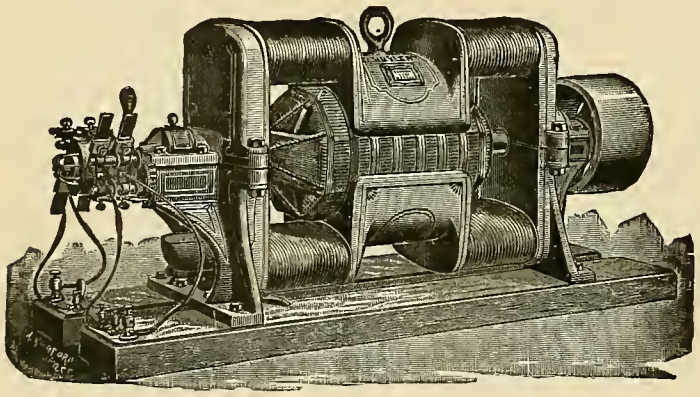

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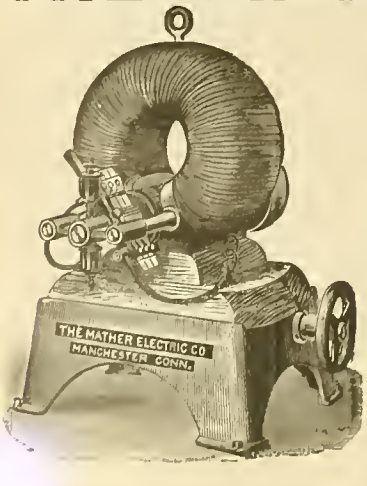

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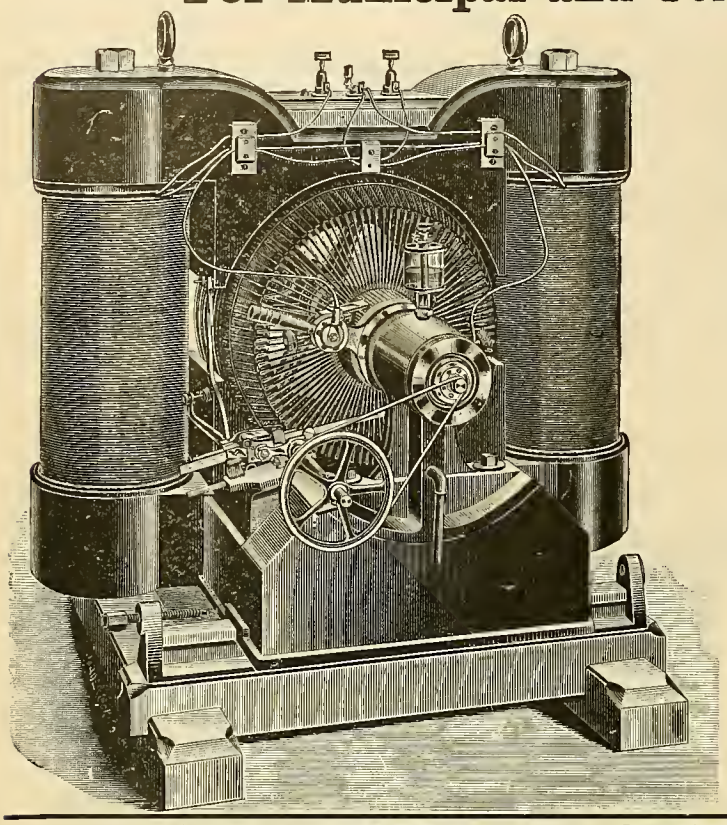

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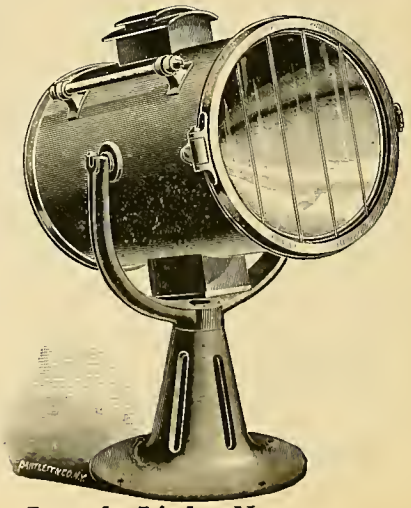

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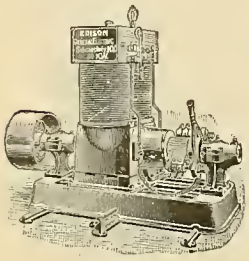

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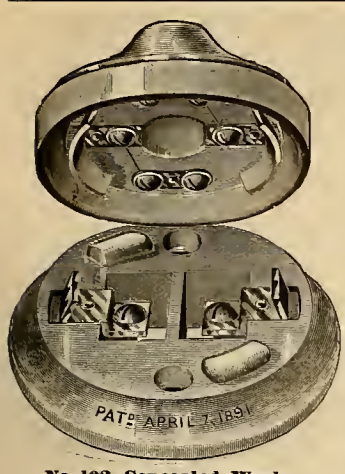

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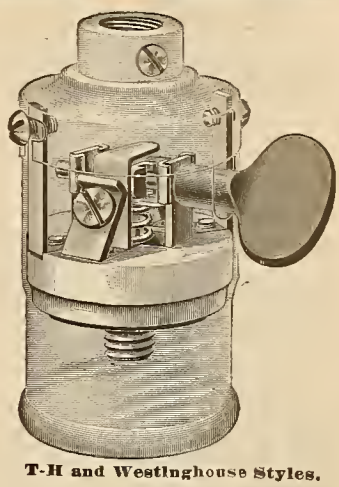
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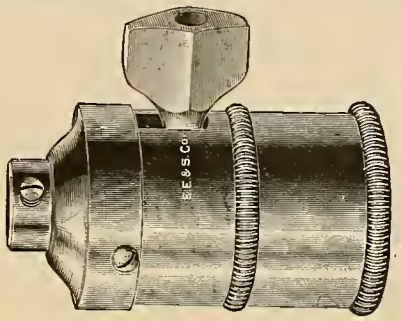

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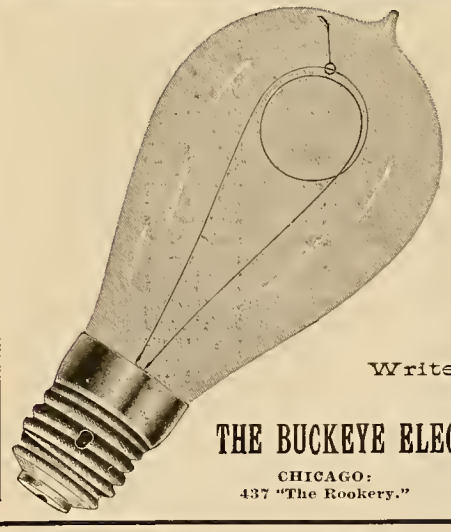

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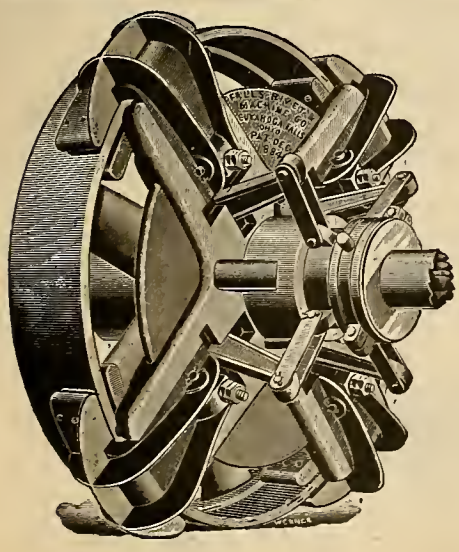

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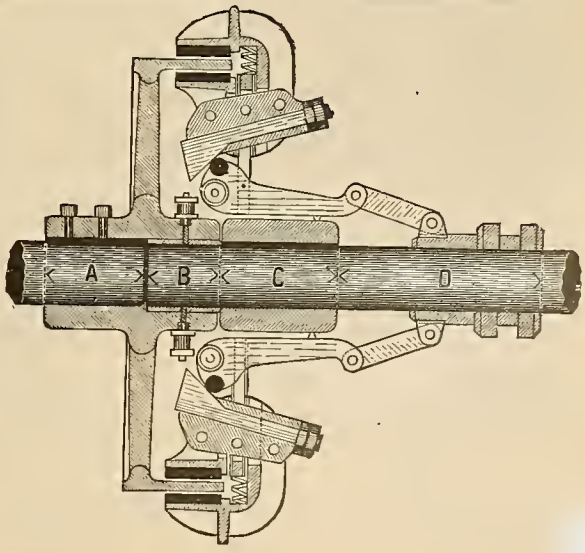

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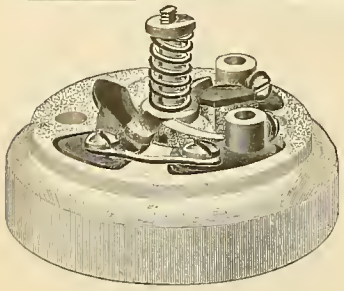

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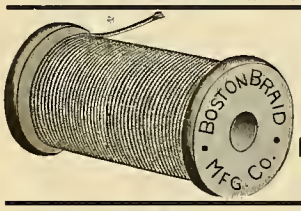

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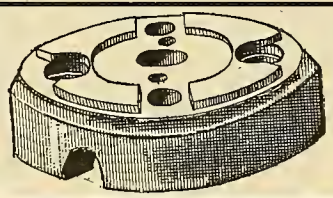

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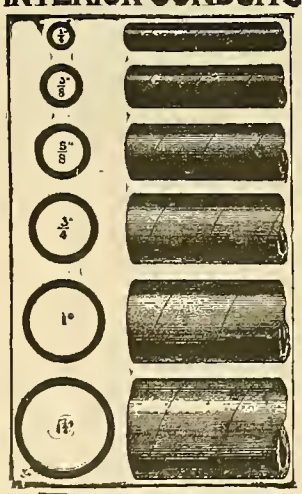

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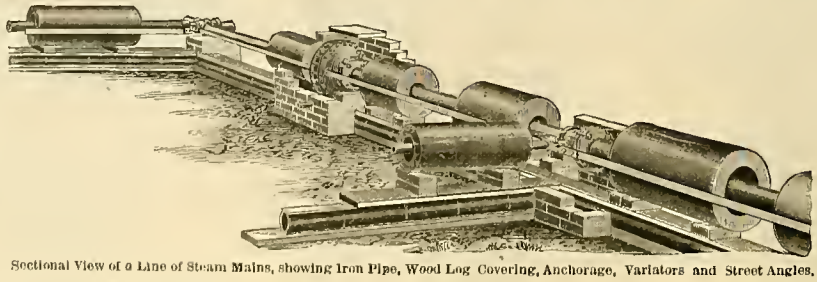

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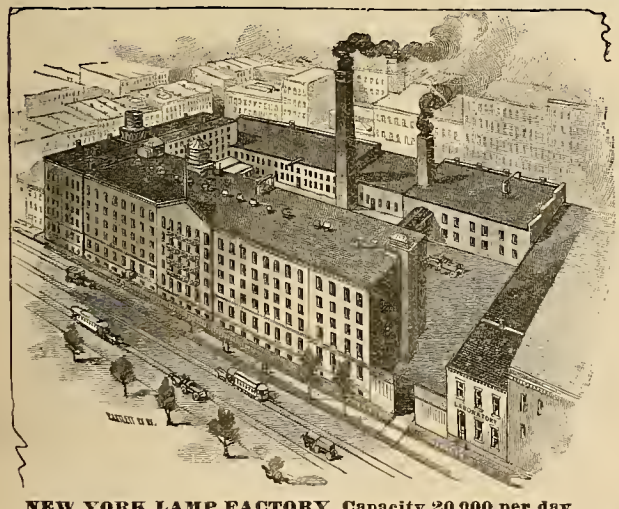

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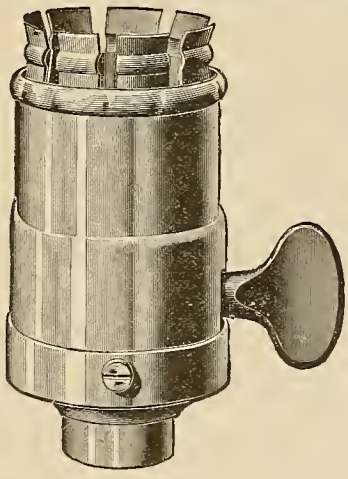

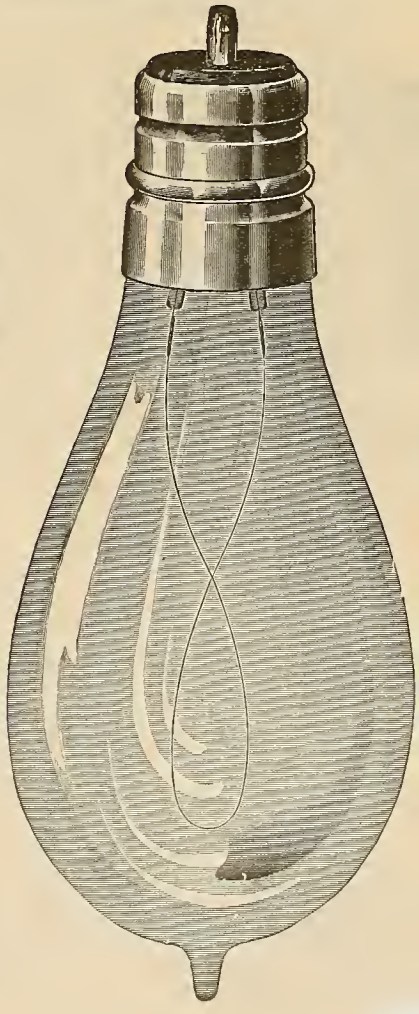

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The city reserves the right to reject any or all bids. All bids to be accompanied with a certified check of $100.00 and to be indorsed "Bids for city lighting" and addressed to

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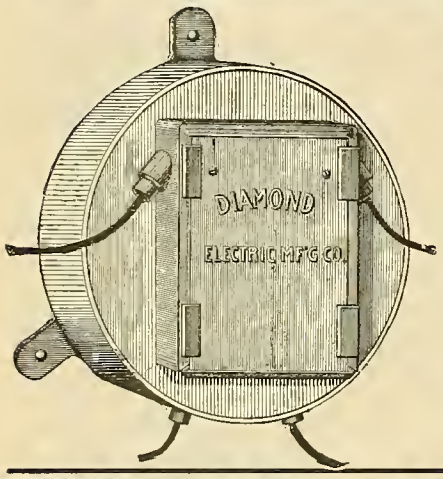

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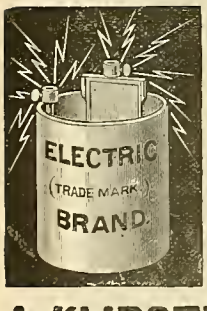

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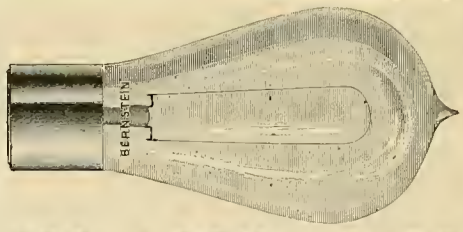

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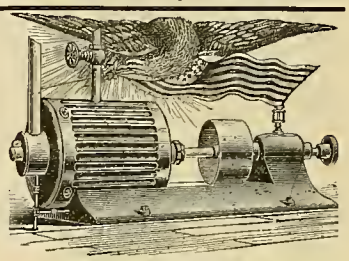

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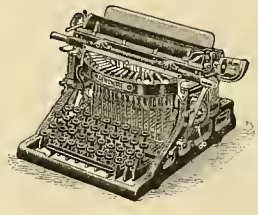

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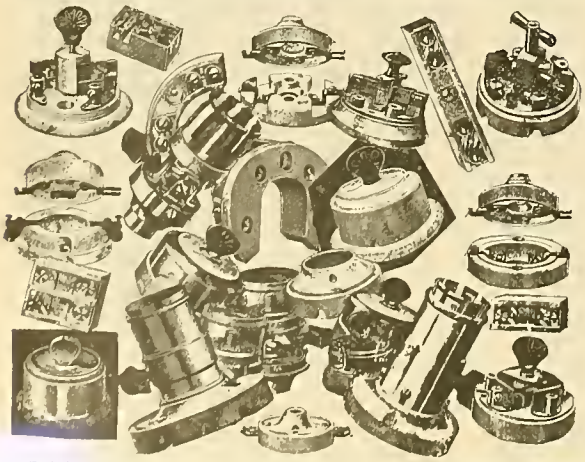

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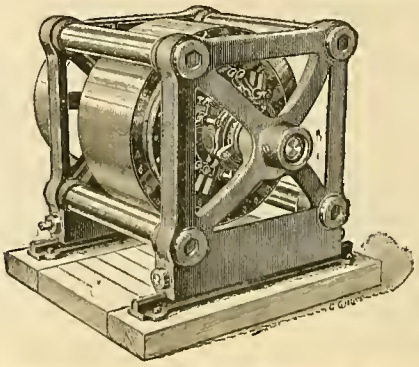

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Western Electrician.

EVERY SATURDAY.

Vol. XI. CHICAGO, SEPTEMBER 24, 1892. No. 13

Electricity at the World's Fair.

The throng of visitors to the World's Fair grounds on the occasion of the dedicatory exercises on the 21st of next month will admire the beautiful outlines of a practically completed electricity building. From a point of view northeast of the building, near the center of the western facade of the great manufactures building—the position of the observer in the illustration presented on this page—the structure has the appearance of being almost entirely finished even now. Considerable work remains to be accomplished on the southern end of the edifice, however, but another month will amply suffice to make the exterior of the building complete. The design of the building has met with general praise, and Van Brunt & Howe, the architects, of Boston and Kansas City, are entitled to warm commendation for their work. The graceful towers add much to the appearance of the structure and give it a distinctive character, beside affording excellent opportunity for electric lighting effects. The offices of the department of electricity will be located on the second floor and will be grouped about the hemicycle in the southern end of the building, overlooking the quadrangle and the administration building. They will comprise private rooms for the chief, assistant chief and secretary of the department and apartments for the clerks and stenographers. Chief Barrett and Secretary Horasby expect to be able to occupy some portion of the offices in November. The space assigned to the electrical newspapers will probably be on the ground floor of the building, in the southwestern corner, facing the mines building.

The plant at the temporary lighting and power station is soon to be increased by the addition of a 650 light Westinghouse alternator to be used for the service building, which is wired for about 1,000 lamps. Sixteen motors are now on the circuits of this station, and the average daily load is 125 amperes at 550 volts at the brush terminals. Twenty-five arc lamps are now being wired in the administration building for temporary use, as it is the intention to push the work on this building night and day in order to finish it for the dedication. The operating force at this station now comprises eight men under Manager J. H. R. Ward. Superintendent L. A. Scovil has a force of about 300 men at work on line construction for the temporary and permanent arc light wiring.

Late applications from foreign nations, which it was decided to admit, have necessitated a re-arrangement of the allotment of space in the electricity building which had been prepared by the department, and a week or so will now elapse before the plotting will have been definitely settled. The amount of space awarded foreign nations in this building is as follows:

Germany	20,000	square feet
France	16,500	"
Great Britain	8,500	"
Canada	4 000	"
Italy	2,500	"
Belgium	2,000	"
Austria	1,000	"
Spain	1,000	"
Sweden	1,000	"
Mexico	600	"
Russia	200	"
Total	57,300	"

The comparative indifference to the fair displayed by the electrical manufacturers of England is shown by the fact that they are excelled by both France and Germany in the amount of space assigned. The latter countries have evinced a lively appreciation of the advantages of exhibiting at the exposition, and their displays will far surpass that of England. Of domestic exhibitors there will be about 700, although, as in many cases several are placed together, there will be but about 150 exhibition spaces.

ELECTRICITY AT THE WORLD'S FAIR.

Owing to a misunderstanding as to the requirements of the Exposition company some of the contractors for the state buildings at the north end of the park have become imbued with the idea that the World's Fair authorities were charging them an excessive price for incandescent lighting. A meeting was held on Thursday of last week, and the *Chicago Herald* thus reports it:

Supervising Architect Sommers, of the Pennsylvania building, first related his experience. "We had to have 800 incandescent electric lights in our building," he said, "and the men here in charge of the work collect an outrageous price for it. They would not let us do it, but insisted on putting the wires in themselves. They charged $4 a lamp, when anybody could have done it for $2 a lamp and made money. They demanded the money in advance, too, just as if the state of Pennsylvania would jump the bill. But that was not the limit of their extortion. We were forced to pay $8 for each lamp for electric service. That means that it will cost us $9,600 for our electric lighting during the fair." Other contractors related similar grievances. Mr. Burnham afterward denied that overcharges were made for electric wiring. He said the rates for both wiring and service were lower than the prices charged down town. The work is being done by the Westinghouse company, which got the contract for the incandescent electric lighting after bidding $400,000 or more below the Thomson-Houston combine.

The facts do not seem to bear out the complaints of the state building people. The Exposition company charges $12 per lamp for each incandescent light used by exhibitors. This is a flat rate for the entire period of the World's Fair and covers every expense connected with the lighting service. It pays for primary and secondary wiring, the use of converters, sockets and connections, lamp renewals and operation. The price is fair but not excessive. The wiring is computed at $3, and the remaining $9 is for operation and maintenance. The exposition will be open about 180 days, which gives five cents a day as the cost of each light to the exhibitor. The latter is entitled to burn the lamp as much as he desires, and it is estimated that the average use will bring the cost down to less than one cent per lamp hour. Of the $12 one-third must be paid to the proper authorities before the work of wiring is begun and the remainder during or at the close of the fair. The Westinghouse company, which is mentioned in the *Herald* article, does extra wiring only on the order of the Exposition company, and at a rate specified in its contract. The money received for this work goes to the Exposition company. Some of the gentlemen in charge of the state buildings, in ignorance, doubtless, of the arrangements made by the electrical department of the bureau of construction, bargained to have their wiring done by Chicago firms not connected with the World's Fair. This action was not approved by the authorities, and on a recent occasion all wiremen found employed on the state buildings who could not show a Westinghouse badge were arrested and put off the grounds. The Exposition company is desirous that all the incandescent wiring shall be uniform in quality, of good material and workmanship and executed in accordance with the National rules. It is claimed that these requirements have not been met by the local companies and that much of the work must be done over again, not being of a quality to stand inspection. Hereafter, it is stated, no wiring will be done on the grounds save by the Exposition company itself or companies having contracts under it.

Some idea of the magnitude of the electrical fountains that are to embellish the grounds may be gained from the

statement that each will require a 24-inch water main. A main of similar size will also be put in for the combined electrical and emblematic fountain. The electric fountain at Lincoln Park, Chicago, has a 10-inch main. The location of the fountains at Jackson Park has not been definitely settled.

The laying of ducts for the outside incandescent wiring has been about completed. About 30 miles of duct has been put down, and it is said that 100 miles of incandescent wiring has already been placed in the buildings.

The German World's Fair commissioner has informed the local authorities that German firms will undertake the lighting of the wooded island and the choral building by incandescent lamps. The island will be lighted by 32 candle power lamps set on short posts and wired in series.

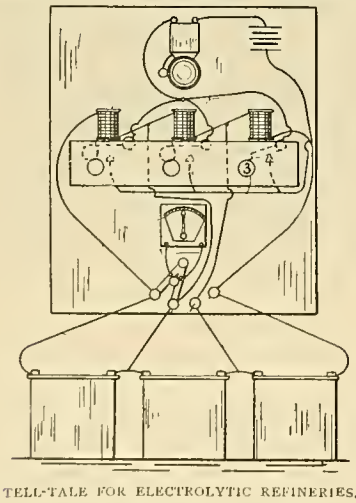
An interesting exhibit at the World's Fair will be a model of the Paris Exhibition of 1889. The reduction at present occupies a large room near the Palais de l'Industrie, Paris, where it is now being exhibited. M. Pasquier, who conceived the idea of thus enabling Americans who were unable to visit the Paris Exhibition to see what the exhibition was like, has spent over 300,000 francs on the reproduction. The electric lighting of the model is an important feature, about 350 tiny incandescent lamps being employed. Some of these lamps, used to represent the street lighting, are only $\frac{1}{4}$ of a candle power. The current is supplied from a dynamo and a battery of accumulators.

The *Petite Republique Francais* says: "A French engineer, M. Terrier de Villeneuve, who is living at present in New York and has worked for some time past in connection with Mr. Edison, is about to send to the Chicago Exposition a unique clock. The clock, which will be combined with a phonograph, will in twelve hours perform the four operas of 'Lohengrin,' 'William Tell,' 'The Huguenots,' and 'Faust.' The phonograph will reproduce the voices of the most celebrated singers who have appeared in these operas, such as Patti, Faure and others. The orchestra will be a phonographic reproduction of the Grand Opera of Paris."

Tell-tale for Electrolytic Refineries.

It is a common difficulty with electrolytic vats that their contents become short-circuited or otherwise in a defective electrical condition, and such an occurrence is a source of great injury and damage to the contents, which sometimes are of great value. It is desirable, therefore, to have means whereby each vat may be tested at will and whereby a visual or audible signal, or both, may be given to suggest the dangerous condition of any given vat without interfering with the operation of the others. The cut herewith presented illustrates diagrammatically an arrangement devised by F. B. Badt of Chicago, for this purpose.

In the cut there is represented a series of electrolytic vats adapted each to contain a number of objects to be



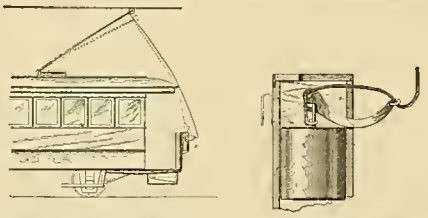
TELL-TALE FOR ELECTROLYTIC REFINERIES.

subjected to treatment. Each is provided with two terminals, from which lead the conductors connecting the several vats in series. From the terminals of each vat two wires lead each to a contact. These contacts are preferably arranged in an arc and about a center upon which swings a circuit closer, the two limbs of which are insulated from each other and adapted to engage each one of the contacts, so that any two of the contacts may be engaged at the same time, each by one arm of the circuit closer. From the two arms of the circuit closer lead two conductors to a volt meter. The condition of any vat may of course be easily ascertained by moving the circuit closer. From the contact plates conductors extend to a series of magnets, as indicated, so that each magnet is directly in circuit with each vat, and is thus energized by the current derived from the vat. Each magnet is provided with an armature carrying a signal disk, numbered so as to indicate the vat with which it is associated. Opposed to each armature is a contact, and from each of these contacts extends a conductor through a battery bell, and thus by the branches connection is made with the armatures.

If now any given vat is in a condition where less current is shunted through its local circuit, which contains an indicator magnet, the magnet will be demagnetized or weakened and its armature will fall, thus exposing the visual signal which indicates that a certain vat is out of condition. At the same time if the audible alarm is attached the circuit will be closed through the local battery and bell by the engagement of the armature with its contact and the alarm will be rung and the visual signal will point out the vat which is in disorder. If the signaling apparatus gives no indication of a change of condition of the vats, by swinging the circuit closer of the volt meter it may be ascertained whether each vat is approaching the point of danger or not.

Another Trolley Pole Catcher.

Considerable annoyance is often experienced in running electric cars by reason of the trolley jumping the wire and scraping and sliding along it. After the trolley has flown up it often becomes difficult to restore to its place on the wire. These difficulties the catcher illustrated herewith



FIGS. 1 AND 2. ANOTHER TROLLEY POLE CATCHER.

is calculated to overcome and at the same time provide means which will hold the trolley below and out of connection with the wire when it is desired to keep the trolley disconnected.

Fig. 1 represents the device as applied to the dash-board of an ordinary electric car. Fig. 2 is an enlarged view of the mechanism employed.

The car is provided with an ordinary trolley wheel on the free end of a spring pole, from which hangs the usual cord for operating the pole. The lower end of this cord is fastened to a weight, as indicated in Fig. 2, which is removably suspended from a trigger by means of a bail, and is sufficiently heavy to overcome the upward pull of the trolley pole. This bail engages over a lip formed by a downwardly sloping open slot located in the trigger below its pivotal point, and in such juxtaposition as to prevent the weight from dropping prematurely. From the pivotal point the trigger extends downward, thence outward and upward to form a handle portion, the end of which is provided with a ring, through which the cord extends. The end of the cord is attached to the weight by means of a ring, which is in turn secured to the weight. The trigger and weight are inclosed within a box attachable to the dash board. The top of the box is provided with a cover, in which there is an open slot, which is a continuation of an open slot in the vertical side of the box. The free arm of the trigger rests in the bottom of the slot, while the weight hangs on the trigger when the trap is set. The free end of the trigger projects through and plays within this vertical slot during the operation of the trigger, and the cord which actuates the trigger passes through the horizontal slot.

In using this mechanism the trolley is first placed in proper connection on the overhead wire, then the weight is hung on the trigger and its gravity will pull the free end of the trigger down on the bottom of the vertical slot, which gives the slot in the trigger sufficient slope to hold the bail in place against any possibility of jarring out while the car is in transit. When thus adjusted, the automatic disconnector or pull is set in readiness to operate. Now should the trolley jump the wire, the spring arm will fly up a short distance and jerk the cord, which in turn lifts the free arm of the trigger and inclines the open slot in such a way as to dump the weight, which descends and draws the trolley down and out of contact with the wire.

The designer of this device, Geo. A. Kimball, of Seattle, Wash., claims that it gives an important advantage in handling the car by enabling the operator to drop the weight at pleasure and hold the trolley clear of the wire when desired.

According to a press dispatch from Ottawa, Ont., the guests of the Windsor House, in that city, enjoyed a dinner cooked by electricity, on August 29th.

Maver's Relay.

In certain telegraphic systems relays possessing the quality of being quickly responsive to reversals of polarity are very desirable—for instance, in quadruplex telegraphy, in which, at certain times, it is desired that the "neutral" relay shall remain practically passive during the time of reversals of current on the line. In the neutral relays usually employed in quadruplex telegraphy various means have been employed to reduce the moment of "no magnetism" at the time of "reversals"—for instance, by shortening the cores of the relay, splitting them, forming the core of bundled iron wires, etc.; but none of these devices has been completely successful, in consequence of which a certain loss of efficiency results.

The relay illustrated in the accompanying cuts, an invention of William Maver, Jr., of New York, is one in which the moment of no magnetism between reversals is minimized. This feature secures an increased working efficiency, as will readily be understood by those familiar with the art of quadruplex telegraphy. In this arrangement any current passing in the coils of the relay always tends to move the circuit closer in one direction, however quickly the currents may succeed each other, and regardless of their direction. The device for solving this problem is very simple, and it admits of replacing the ordinary relay without extra cost.

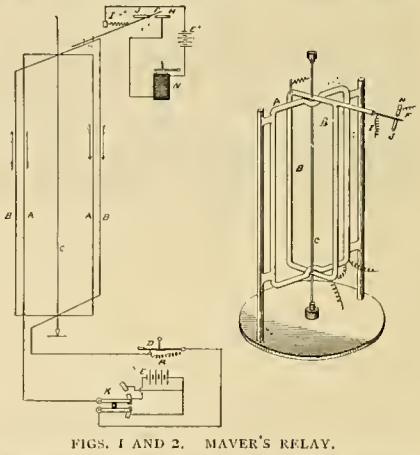
Fig. 1 is a diagram of the connections. Fig. 2 shows the relay proper.

Referring to the cuts:

A is a fixed coil, *B* is a coil rotary about the axis *C*. The coils are in series with each other and connected with the telegraph transmitters *D K* and an electric generator *E*. The coils are so connected that the current in the two coils will be parallel. The movable coil carries a circuit closer *F*, being included in circuit with the electromagnet *N* and local generator *E'*. *H* is the contact, which is touched by the circuit closer *F* for including the generator *E'*. The circuit closer *F* is retained by a retractile spring *I* against the stop *J*.

In practice the transmitter *D* may be arranged to insert or short-circuit a resistance *R*, by which means the total current strength is increased or decreased. The pull of the retractile spring *I* of the circuit closer is adjusted to withdraw the circuit closer from its contact point *H* to the stop *J* when the transmitter *D* is open, or vice versa.

The operation is as follows: When the key *D* is alternately closed and opened to send a message, the currents in the parallel coils pass in the same direction and attract each other. The local circuit closer is operated in accordance with the openings and closings of the key, and the local circuit is alternately closed and opened by the circuit closer *F* coming in contact with the terminal *H*. *K* represents typically the pole changer in circuit with the generator *E*. This may be operated as required in practice, and yet the local circuit closer *F* will remain closed or



FIGS. 1 AND 2. MAVER'S RELAY.

open or practically passive so far as the pole changer is concerned. The fixed magnet is *A*, and the movable magnet is *B*, and this carries the circuit closer *F*. In whatever direction the current passes through the series magnet, the magnet *B* will always tend to be moved in but one direction.

The instrument serves also as a sounder, since the stop *J* causes a sound when struck by the rod *F*.

This form of relay is especially adapted to respond quickly to reversals of polarity and to minimize the moment of no magnetism between reversals, because the coils are arranged in the manner of the ordinary electrical dynamometer and are free from iron cores.

The appointment of a city electrician is under discussion at Houston, Texas.

Ruins of the Victoria, B. C., Electric Plant.

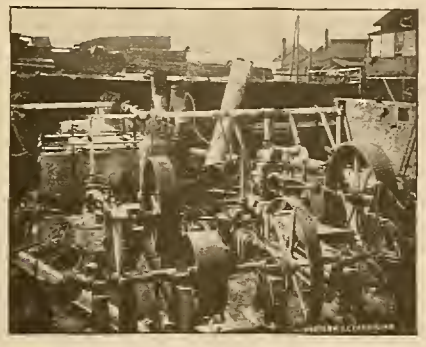
The most curious fire that has yet occurred to any electric lighting or power station on the Pacific coast transpired early on the morning of August 7th last, when the entire generating station of the National Electric Tramway & Lighting company, of Victoria, B. C., was burned to the ground. Within a year or so previous to this, two smaller stations, namely, those at Colfax, Wash., and Dayton, Wash., were burned, and at Eugene, Or., a few months ago a hot bearing, abetted by a somnolent dynamo attendant, caused a fire that destroyed an arc dynamo, but not the station. The fire at Dayton is believed to have been also due to the attendants going to sleep while on duty, though in view of a great many conflicting statements, it is impossible to definitely determine the cause of the Dayton fire. The destruction of the Colfax station is, however, directly traceable to carelessness in permitting sawdust fuel to accumulate near furnace doors. At Victoria the fire is believed to have been caused by "spontaneous combustion," or, in other words, to inexcusable carelessness. The National Electric Tramway & Lighting company commenced operations about two and a half years operating an electric railway—or electric tramway, as they call it in Victoria—of the Thomson-Houston system. This was installed and sold to the tramway people by F. H. Osgood, the agent of the Thomson-Houston company for the province of British Columbia. Gradually the tramway plant was increased until it reached almost every portion of Victoria, extending out as far as Esquimalt, four miles westward, where the British government has its drydock and shipyards for the naval vessels of the North Pacific squadron. Nothing was done in the way of lighting until about eighteen months ago when F. H. Osgood entered into a contract with the Tramway company to place and operate an electric lighting equipment in the station, he paying for all power consumed and operating the lighting plant independently, and the company holding an op-

RUINS OF THE VICTORIA, B. C., ELECTRIC PLANT.

tion on the lighting equipment for its purchase at the end of a specified time. The Tramway company, it appears, was doubtful of the success of the lighting scheme, particularly in the face of the opposition afforded by the two other companies, yet under Osgood's capable management it proved a success. As matters stood, therefore, the station contained the power plant for the street railway system, owned by the Tramway company, and the lighting plant, owned by Osgood. The loss was therefore a dual one.

At the time of the fire the steam equipment of the station consisted of one Wheelock double tandem compound condensing engine, rated at 500 horse power, one 75 horse power Corliss engine, made by the Albion Iron Works of Victoria, and one 350 horse power cross compound condensing engine, also built by the Albion Iron Works. Steam was furnished from a battery of four tubular boilers of local make. In addition to the equipment of the Tramway company, there was the usual equipment of pumps, condensers, etc. The Tramway company operated three Thomson-Houston railway generators, type D 62, while Osgood's plant consisted of three Thomson-Houston 650 light alternaters, type A 35, and one 45 light Excelsior arc dynamo. On all dynamos the insurance carried aggregated $20,000, while the total loss on the entire building and contents was about $60,000. The insurance was about $40,000. The illustrations herewith presented are reproductions of photographs taken by the correspondent of the WESTERN ELECTRICIAN and give excellent views of the ruins. The station was a frame building and was situated in a sort of a hollow, below the level of the street. When the pictures were taken, considerable rubbish had been removed in order that the appraisers of damage might prosecute their work unhindered.

Reverting to the origin of the fire, a prominent official of the Tramway company expressed the belief that the fire was due to "spontaneous combustion.' A cock loft had been constructed over the engine or dynamo rooms of the station and it appears that in this cock loft considerable litter existed, presumably paper, etc., occasioned by the unpacking of boxes or supplies. The official referred to stated that it was always very hot in this cock loft, as the ventilator in the roof of the station was not large enough to carry away the heat of the boiler and engine rooms. The fire underwriters had severely criticised this cock loft and he (the official) believing it to be a dangerous place had instructed the watchman to examine it at least once every half



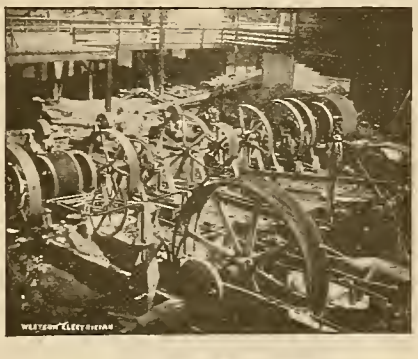
RUINS OF THE VICTORIA, B. C., ELECTRIC PLANT.

hour during the night, and in accordance with further instructions issued, the official said that each night the fire hose was unreeled and its nozzle pointed toward the door of the cock loft, ready for use should fire occur there. This condition of affairs appears extraordinary, and it is impossible to understand why a station manager should make such unusual efforts to put out a fire he believed might sometime occur when a far simpler and safer course to pursue would have been to remove the cock loft with all its tinder-like litter. This was suggested to the official in question, who replied to the effect that it doubtless would have been better to have removed the hazard, but it didn't really occur to him to do so. As a result of this carelessness, a valuable lesson has been administered. It is certain that the fire did not originate from electric wires, as the assurance was given the writers that no wires of any description passed near the point where the fire originated. No trams were burned, as the car barn is situated about 1,000 yards from the station.

The Tramway company is already at work rebuilding on the old site and will erect a substantial brick station. A 200 kilowatt Edison generator has been ordered for operating the tramway and it is hoped that the system will be again in operation by the last of September. Meanwhile the carriage and hansom cab drivers are reaping a harvest.

An Electrical Club in St. Louis.

The electrical fraternity of St. Louis is considering the advisability of forming an association. A committee consisting of C. R. Scudder, H. L. Parker, Jas. I. Ayer and H. A. Wagner issued invitations to an informal dinner to be held at the Mercantile Club at 7:30 o'clock on the evening of the 16th inst. with the object of securing a more general discussion of the matter. No attempt was made to limit the attendance to any single branch of electrical activity, nor indeed to cover the entire field—the invitations being



RUINS OF THE VICTORIA, B. C., ELECTRIC PLANT.

sent to those known to the committee and to others whose names could be had. The suggestion met with immediate and favorable response, and the following named gentlemen sat down to the dinner at the time and place named:

W. L. B. G. Allen, president of the St. Louis Engineering company; Jas. I. Ayer, general manager of the Municipal Electric Light & Power company and president of the National Electric Light association; E. J. Bagnall, electrical engineer Lindell railway; R. H. Bohle, manager Western Union Telegraph company; H. P. Broughton, Municipal Electric Light & Power company; Wm. H. Bryan, consulting electrical and mechanical engineer; F. W. Churchill, Emerson Electrical Manufacturing company; H. C. Healey, chief inspector St. Louis Board of Fire Underwriters; Chas. Higgins, superintendent St. Louis City Fire Alarm; Robert McCullough, general manager Cass avenue and Benton-Bellefontaine electrical railways; W. H. Matthews, vice president St. Louis Electrical Supply company; A. W. Merston, Emerson Electrical Manufacturing company; Ben Nahm, president American Electrical Manufacturing company; H. L. Parker, president Emerson Electrical Manufacturing company; F. G. Schlosser, superintendent Electrical Department Laclede Gas Light company; C. R. Scudder, secretary St. Louis Electric Light & Power company; R. V. Scudder, Western Electrical Supply company, C. E. Sharpe, Southern Electrical Supply company; J. A. J. Shultz, president Shultz Belting company; H. A. Wagner, superintendent Missouri Electric Light & Power company.

This was considered quite a creditable representation of the electrical fraternity of St. Louis, particularly in view of the informal nature of the call, the short time, and the impossibility of any committee counting any large proportion of those interested in electrical matters among the immediate acquaintance of its members. After the dinner Mr. Ayer read a number of letters from persons invited, but who found it impossible to attend. Among the writers were W. A. Steadman and Alex. Ross of the Laclede Gas Light company; W. O. Garrison and Jas. H. Rothamel, of the Columbia Incandescent Lamp company; James Campbell, of the Benton-Bellefontaine electric railway; James Scullin, of the Union Depot electric railway; George W. Baumhoff, superintendent Lindell electric railway; Leslie Allen, St. Louis Engineering company; C. Dougherty, Postal manager Telegraph com-

RUINS OF THE VICTORIA, B. C., ELECTRIC PLANT.

pany. In each case regret was expressed at the writer's inability to be present, and his hearty approval of the movement was given.

In an informal talk Mr. Ayer then explained the committee's ideas in calling the meeting. He felt that some expression should be given to the generally existing sentiment that there should be a closer association and wider personal acquaintance among those interested in matters electrical in St. Louis, all workers in a common field in a common direction. So great has been the development of electrical work in St. Louis that it has required the closest and most undivided attention of its workers, so much so that the benefits of mutual assistance and co-operation had been left for a more favorable opportunity. This opportunity seemed now to have presented itself and the time was ripe for the formation of an electrical club He called attention to the fact that the coming convention of the National Electric Light association would be held in St. Louis next February. As president of that association he felt the responsibility of making this meeting at least the equal in every way of any of its predecessors. He explained the objects of the association, the character of its members, and the work heretofore done at conventions. The benefits which would accrue to St. Louis by reason of the presence of such a body of men were explained, as well as the advertisement it would get by a wider knowledge of the vast progress which has been made here in electrical work in recent years.

Short talks followed by Messrs. Shultz, McCullough, Nahm, Allen, Wagner and others, all heartily in favor of the project, and enthusiastic as to its possibilities.

Mr. Ayer was made chairman and C. R. Scudder secretary, and a committee of five was appointed to correspond with other electrical clubs to secure their experience regarding organization, plan of work, etc., this committee to present a formal report at the next meeting. It was al

so decided that those present form an electrical club, and that until arrangements were made, regular meetings similar to the present be held on the second Friday of each month.

Capt. McCullough promised for the next meeting a paper on the work now in progress of changing the Cass avenue consolidated lines from horse to electricity as a motive power. The plans are in many respects novel, but are believed to be in harmony with the most recent advancements in this field.

The original committee on invitations was continued and those present were asked to submit additional names, so that invitations to the next meeting could be extended to all eligible persons who might be in sympathy with the movement.

Berliner's Thermo-electric Generator.

The construction of this generator, which was devised by Emile Berliner, of Washington, D. C., is based upon two fundamental principles, which may be stated as follows:

First. The inductive capacity of magnetic metals is reduced by heat and becomes zero at a certain critical temperature, which is dependent upon the character of the metal. If the metal is cooled below the critical temperature, its inductive capacity increases first very rapidly and then very slowly until at a certain comparatively low temperature the inductive capacity of the metal reaches its maxium. Within these limits there is a decrease of inductive capacity for every increment of temperature and

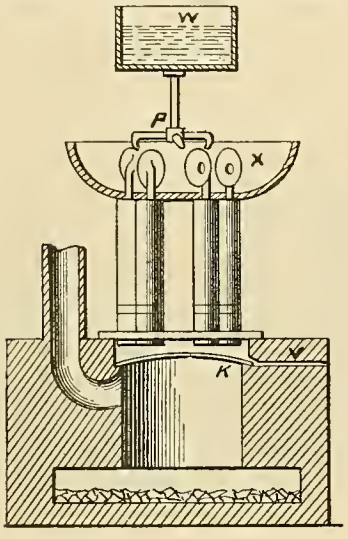


FIG 5. BERLINER'S THERMO-ELECTRIC GENERATOR.

an increase of an inductive capacity for every decrement of temperature.

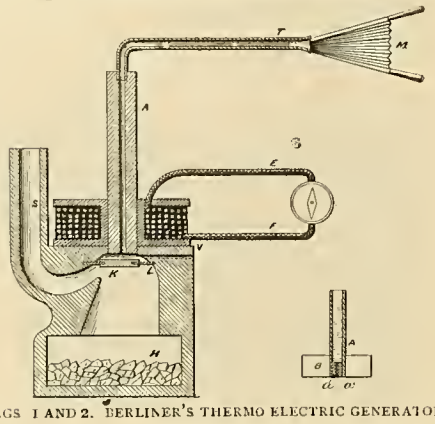
Second. If a magnet is capable of carrying an armature of a mass of iron or other magnetic metal of a certain maximum weight, it will also be capable of carrying upon an armature of much smaller weight, a mass of non-magnetic metal weighing about three fourths of the maximum armature. For instance, if a magnet is capable of holding suspended a mass of iron—*i. e.*, an iron armature—weighing not more than, say, twenty pounds, it will also be capable of holding suspended on it a mass of brass or other non-magnetic material weighing about fifteen pounds by means of an iron armature weighing only a fraction of an ounce.

Mr. Berliner makes use of the first principle by alternately heating and cooling a mass of magnetic material within a magnetic field and utilizes the variations of magneto-inductive capacity thus produced for the generation of electrical impulses. He makes use of the second principle by selecting as the armature of varying inductive capacity, a mass weighing only a small fraction of the weight of the maximum armature. By reason of the first principle he is enabled to generate electrical impulses by the direct action of heat, and by reason of the second principle to do so, it is claimed, effectively and rapidly with the expenditure of a minimum amount of heat.

In the accompanying drawings there are illustrated forms of apparatus by means of which the method can be practiced.

Fig. 1 is a vertical section of a simple form of generator; Fig. 2, a vertical section of a modified detail of the same. Fig. 3 is a perspective view, partly in section, of a number of modified elementary generators combined in a single apparatus; Fig. 4, a vertical section of an element in the last named device.

Referring to Fig. 1, there is a permanent magnet *A* with an axial bore and a coil of insulated wire around it near one end. The lower projecting end of the magnet is inserted into and closes an opening in the top of a furnace. *E F* are circuit wires proceeding from the terminals of the coil to an electrical translating device which in this instance is represented as a galvanometer. *K* is an armature of iron or other magnetic metal, circular in form and mounted in a ring *L* of brass or other non-magnetic material, and this



FIGS 1 AND 2. BERLINER'S THERMO ELECTRIC GENERATOR.

annular support of the armature is inserted with its outer edge into the brick walls of the furnace, as shown. The armature is fairly within the inductive field of the magnet *A*, but not too close to the same, and its mass is determined in accordance with the second fundamental principle of the device; that is to say, the weight of the armature is only such fraction of the maximum magnetic weight which the magnet can carry that will enable it to carry about three-fourths of such weight of non-magnetic material.

H is the fire-box of the furnace, and *S* the chimney. A fire started at *H* will heat the armature *K*, and in the operation of the apparatus care must be taken that the temperature of the armature is not increased beyond the critical point. It will now be understood that the products of combustion will strike the lower side of the armature and will then pass out through the chimney, but will never come into contact with the upper side of the armature. A tube *T* is inserted into the top of the magnet and is connected to a pair of bellows *M*, and a vent-hole *V* from the chamber formed by the armature *K*, ring *L*, the top of the furnace and magnet *A*, communicates with the open air. If now the furnace be started, the armature *K* will be heated, and if the same be made of iron it should never be heated beyond a bright red heat, which is the critical point for iron. In this condition the armature has lost the greater part of its inductive capacity, and during this process a current of electricity is generated in the coil in accordance with the well known law of magneto-electric induction. The effect of the slowly decreasing magnetic capacity of the armature upon the magnet is obviously the same as if the armature were slowly removed from the magnet. The current thus generated in the coil will be naturally very weak. If now the bellows be compressed, a puff of cold

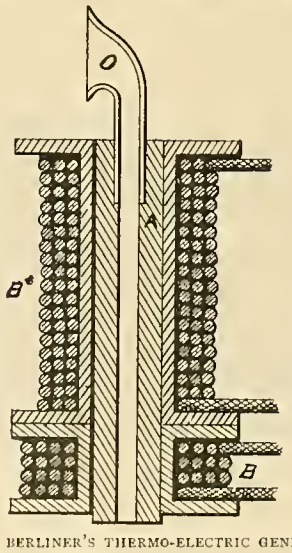


FIG 4 BERLINER'S THERMO-ELECTRIC GENERATOR.

air will be forced down through the axial bore of the magnet and will impinge upon the heated armature, cooling the same instantly, and then passing out through the vent-hole *V*. The sudden cooling of the armature has the effect to suddenly increase its inductive capacity, and the effect upon the magnet and the coil will be the same as if the armature had suddenly been brought nearer the pole of the magnet. A strong electric current will be generated in the coil and will operate the translating device *G*. As soon as the cooling agent (in this instance air) has escaped through the vent-hole, the temperature of the armature again rises and another current of electricity, but in the opposite direction, is generated in the coil. Thus it will be understood that by alternately compressing and dilating the bellows a series of alternating magneto-electrical impulses are generated. These impulses may be made to succeed each other with considerable rapidity and may be utilized.

In place of air other cooling agents may be employed, and among these water, on account of its great thermal capacity, may be used with special advantage.

In Fig. 2 an arrangement for this purpose is indicated. The axial bore of the permanent magnet is in this instance made wider, but is closed at its lower end by a plug *a*, having a small bore *a'*. The hollow of the magnet is filled, or partly filled, with water, which is maintained at the same level. The bore *a'* is so small that the water will issue from the same in drops at regular intervals, and these drops of water, falling upon the heated armature, rapidly evaporate, and abstract a considerable amount of heat from it, the vapors escaping through the vent-hole *V*.

Any number of generators of the kind described may be united for joint operation in a single apparatus, and the alternating currents generated may be commuted, and the principle of self-excitation, as in ordinary dynamos,

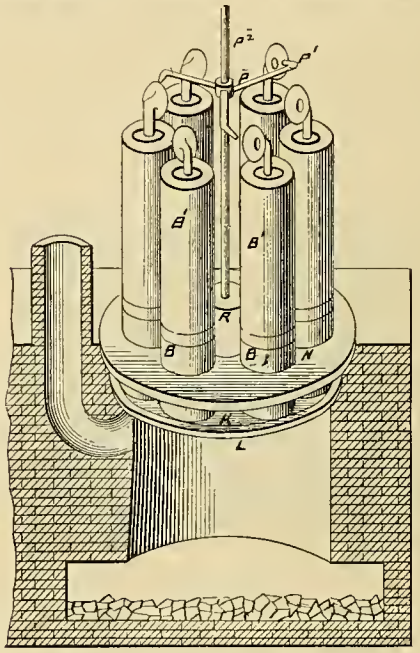


FIG. 3. BERLINER'S THERMO-ELECTRIC GENERATOR.

may be utilized. Fig. 3 represents such apparatus. The furnace in this case is constructed substantially in the manner described with reference to Fig. 1, with slight unimportant modifications. The armature *K*, mounted in the ring *L* of non-magnetic material in the brickwork of the furnace, is large enough to act upon a number of magnets, which in this instance are not permanent, but electro-magnets, the cores being of soft or cast iron. Fig. 4 shows the construction of these magnets. The cores have the same kind of axial bore as in Fig. 1, and in addition to the inducing coil *B* there is a coil *B'*, which may be called the "field-coil." A flaring funnel *O*, being in communication with the axial bore of the core, is placed upon each magnet. Six of these magnets are shown in Fig. 3; but any other number may be used. They are mounted upon a plate *N*, of non-magnetic material, which at the same time is a poor conductor of heat and which forms the top of the furnace. The magnets are arranged in a circular row at equal distances apart, and the lower pole of each projects through the plate *N* into inductive proximity to the armature. A reaction wheel *P*, having a suitable number of horizontal ejecting arms *P'*, is arranged with its hollow shaft P^2 vertically in the axial line of the group of magnets. The arms move in the horizontal plane which just clears the funnels *O*, and the ejecting nozzles are bent slightly downward, so that the fluid issuing from the same will enter the flaring opening of the funnels, and then, passing down through the bore of the cores, will exert its cooling action upon that part of the armature which is immediately below the pole of the respective magnet. The reaction wheel may be actuated either by air or by water or by any other suitable cooling agent. If actuated by air, the hollow shaft P^2 is connected with a suitable reservoir of com-

pressed air, not shown in the cuts. From the point where the reaction tubes P' branch off, a solid shaft extends downwardly in the prolongation of the line of hollow shaft P^2. This shaft carries commutator brushes and collecting disks. It will now be understood that by the action of the reaction wheel a quantity of air or water or other cooling agent will be intermittently injected into the bore of each magnet and will alternately cool and allow to be heated a portion of the armature immediately below each magnet. In the drawings there are shown six magnets, and three ejecting nozzles in the reaction wheel. Consequently the alternations of cooling and heating of successive portions of the armature will be so timed that while the part below one magnet is cooled the parts below the two adjacent magnets will be heated. From this it will now be understood that the directions of currents in the inducing coils of two adjacent magnets will always be opposed.

Where in certain types of this apparatus, for instance as in Fig. 5, the cooling agent employed is water or any other suitable fluid placed in a reservoir, it is sometimes necessary to make the armature slightly curved, to allow the water to discharge by the vent-holes, of which there is one for every magnet, before evaporation, whenever by reason of the Leidenfrost phenomenon the water should not evaporate with sufficient rapidity. A basin, placed upon the tops of the magnets, with the stems of the funnels passing through the same, may be employed for retaining the water ejected from the nozzles between the successive funnels.

Telegraph and Telephone in England.

According to the official report recently issued, by the British postmaster general it appears that the increase in the number of telegraphic messages of all kinds over that of previous years is 3,276,269, or 4.9 per cent. The London local telegrams show an increase of 335,152, or 6 per cent., the number being 6,081,276 as compared with 5,746 124 in 1890 91. An important alteration has been made in connection with the delivery of telegrams at night in the outlying portions of large provincial towns after the hour for closing the local branch office. Formerly porterage used to be charged from the head office on such telegrams, but now they are, like other telegrams, delivered free within the area of the ordinary free delivery of the local office. With regard to telephones, it is stated that the results of the working of the London-Paris telephone, which was opened on April 1, 1891, have been satisfactory. The number of conversations has increased from 1,221 during the month of April, 1891, to 2,157 in April, 1892, and it has been necessary in consequence to allocate a second circuit for the purpose. The charge is 8s. for a conversation of three minutes. As regards the acquisition of the telephones the postmaster-general says: "One of the largest companies concerned has bought up most of its rivals, and gone a long way toward constituting the monopoly which Parliament desired to prevent. The expiration of the patents and the dissatisfaction evinced by the public at the want of development of the telephone system necessarily obliged the government to examine the whole subject. Serious difficulties presented themselves, and the government decided that the postoffice alone should possess the trunk wires between towns and co operate with the companies in rendering additional services to the public. The object aimed at is to develop and cheapen the telephone service, as explained in the treasury minute which was laid before Parliament in May last. A bill founded upon the minute is under the consideration of Parliament.'

Conduit Plan in Rochester.

The proposed contract between the common council of Rochester, N. Y., and the Rochester Gas & Electric company in relation to conduits for underground electric wires, provides, among other things, that the additional ducts to be constructed by the company should be leased by the company to any corporation that may apply, with the permission of the common council; that additional ducts shall be constructed if necessary; the location of ducts shall be under the direction of the electrical committee of the council; that a fair scale of rents shall be fixed by the company for the use of ducts by other corporations, the total amount of rental not to exceed 10 per cent. per annum on the entire cost of construction, equipment and maintenance; that three citizens, as arbitrators, shall decide any dispute as to amount of rental; that the company shall keep books of record, open to the inspection of the committee, showing the number and location of ducts and electrical conductors and the rentals and payments; that on the last Thursday of March each year the company shall present to the common council a statement of its transactions respecting the conduits; that the company shall at any time upon demand of the common council sell to the city the conduits and contracts with corporations referred to.

Saratoga Springs Railway.

It was generally agreed that the selection of Saratoga Springs as the place for holding the annual convention of the New York State Street Railway association was excellent, as that resort is admirably adapted for the entertainment of visitors. Its manifold attractions have earned for it the distinction of being one of the most famous and popular summer resorts in the United States. It is estimated that five hundred thousand people visit Saratoga each summer, for whose entertainment there are over fifty hotels, large and small, and between one hundred and fifty and two hundred boarding houses; it is the Mecca of half a million pilgrims each summer, and the permanent home of thousands.

As has been the the case in so many other localities the increase in population and importance developed the necessity for a system of transit that would meet the demands of the multitude. The carriage system had grown and flourished until the autocrats of the whip absolutely ruled the resort. While conveyances were always to be had, the high prices and unsatisfactory service greatly inconvenienced the majority of the people. It soon became evident to the business men of Saratoga that they must keep up with the tide in the matter of traveling facilities. Other summer resorts had adopted electricity and found it to afford every advantage, giving the public cheap and reliable service, and earning for its promoters good dividends.

SARATOGA SPRINGS RAILWAY.

In deciding on what system it was best to adopt, it was found that the ordinary street car, though equipped with the swift and attractive electric motor, would hardly take the place of open vehicles such as the townspeople and visitors had grown familiar with. It was at this stage of the investigation that the street railway people decided to adopt the new double-decked car manufactured by the Pullman company of Chicago. If the experience of the road since it commenced operation, July 1st, is any criterion, the double-decked Pullman cars have admirably met all the requirements of the case.

This style of car is 32 feet long over the body proper, and its full length is 33 feet 7 inches. The width of the car is 7 feet 4 inches over the body. The height is 14 feet 1½ inches. Forty passengers can be seated in the lower portion of the car, and the upper deck seats an equal number. If crowded the car can carry one hundred and fifty.

In details of construction the car is very handsome. The seats in the lower part of the car are fitted with springs and handsomely upholstered. Incandescent lamps are distributed throughout the car, ten being placed under the canopy and fifteen in the lower portion.

The four stairways leading to the upper deck form the most interesting and novel feature of the entire car. They are combined into two at the bottom, but separate toward the top, leading to either end of thecar. Thus it is easy for passengers to enter at the center on either side and take the spiral stairways directly to the upper deck from within. These center entrances occupy no more room than the end platforms on ordinary street cars, the length of the central platform being only eight feet.

The car body proper consists of two compartments, each twelve feet long with circular ends, the seats being carried around the end as well as the sides to increase the seating capacity. The pilot house at either end accommodates the motor man.

A permanent canopy entirely covers the upper deck, being supported by handsomely decorated stanchion pipes, to which it is attached by means of ornamental bronze brackets.

The car being divided into two sections, each section rests on its own truck. These trucks are of the Pullman make, with the Allen steel tired wheels.

The car was designed to carry twice as many passengers as the ordinary street car of the same length, without increasing the number of employes.

A view of one of the cars at Saratoga, with a trailer, will give some idea of the people's appreciation of the new Pullman design.

There are now in operation four of these new Pullman cars, and eight trailers made by the same company. Also four single truck motor cars, and five single truck trail cars, making twenty-one cars in all. Since the road commenced operation, July 1st, these cars have carried daily to the lake 3,000 passengers; to the Geyser Spring 1,500, and about 1,000 to the race track on racing days. The rates of fare charged are ten cents to the springs and return, twenty cents to the race track and return, and twenty five cents to Saratoga Lake and return.

The electrical equipment of the road was furnished by the Thomas-Houston company. The power house is located in the rear of the Kissengen springs The main line of the road from Saratoga to Saratoga Springs is five and one-half miles long, built principally over private lands which were purchased by the company for the purpose. It is constructed after the manner of a first-class steam road with fifty-pound T rails, angle joints, 2,040 ties to the mile. A branch line runs from the village to Geyser, Kissengen and Vichy springs. There is also a branch to the race track. This cut is taken from the *Street Railway Gazette.*

In the office of the Associated Press at Washington the president's letter of acceptance was placed on two wires a little before 6 and transmitted to Baltimore, Philadelphia and New York by W. S. Daniels and E. J. Cox in one hour and fifty minutes. Complete copies of the letter, typewritten from the wires by the receiving operators, were thus placed in the hands of the printers in those cities before 8 o'clock. Simultaneously was sent over the same wires a column of synopsis of the letter for transmission from New York by cable, making a total of over 11,000 words sent on two wires between 6 and 8 o'clock, or at an average speed of forty-five words a minute for two consecutive hours.

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CORRESPONDENCE relating to electricity, or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

	PAGE.
Electricity at the World's Fair. Illustrated	157, 158
Tell-tale for Electrolytic Refineries. Illustrated	158
Another Trolley Pole Catcher. Illustrated	158
Maver's Relay. Illustrated	158
Ruins of the Victoria, B. C., Electric Plant. Illustrated	159
An Electric Club in St. Louis	159, 160
Berliner's Thermo electric Generator. Illustrated	160, 161
Telegraph and Telephone in England	161
Conduit Plan in Rochester	161
Saratoga Springs Railway. Illustrated	161
Editorial	162
Old Time Telegraphers	163
Black Copper and Blister Copper	163
Electrical Developments at Idaho Springs, Colo. By George H. Bliss. Illustrated	163
The Future of Electrical Power Transmission	164
American Institute of Electrical Engineers	164
Capturing Monkeys by Electricity	164
The Iona Snap Switch. Illustrated	164

DEPARTMENTS.

Correspondence	164, 165, 166
New Incorporations	167
Electric Lighting	167
Electric Railways	167
Telegraph	167
Telephone	167
Miscellaneous	167, 168
Trade News	168
Business	168
Electrical Patents	168

IN the proceedings of the convention of the New York State Street Railway association this week, the principal topic under discussion was the electric railway. Great advantages have been gained by the introduction of the electric system of propulsion, and the advances that have been made in the application of the electric motor have been so great as to command universal attention. Evidence of this advancement is clearly shown in the fact that street railway conventions have of late become practically electrical meetings.

A RECENT extension of the electric street railway system of Ottawa, Ont., through Ann street, is made particularly interesting by the use of steel instead of copper for the trolley wires. Sliding instead of rolling contacts are used and it is intended to ultimately use copper cross wires from the feeders instead of steel, as at present. The idea is to make use of a harder metal to withstand the friction of the trolley contact, and to make up for the loss of conductivity resulting from this substitution by the use of copper instead of steel cross wires. The line is about three quarters of a mile in length, and the experiment is reported to have given satisfactory results. Indeed, an officer of the company writes the WESTERN ELECTRICIAN that it is intended to use steel trolley wires ultimately throughout the whole system. On Ann street the cross wires are connected from the feeder to the trolley every two or three poles. Of course, on a busier line the cross wires would need to be connected at every pole.

THE problem of how to produce electricity economically from fuel without the intervention of the boiler and steam engine is a fascinating one, and one for which there are many investigators seeking a solution. Progress in this direction, though, has not been rapid; a record of the United States patents allowed on thermo-electric generators during the last few years would seem to substantiate this statement. Among those, however, who have been endeavoring to produce the much sought for thermo-electric generator is Emile Berliner. A description of a machine devised by Mr. Berliner is presented elsewhere in this issue. The principle of the device is quite simple. In the apparatus a rapidly heated and cooled armature, suspended before a coil with a permanently magnetized core, has the effect of varying the core's magnetism and thus producing alternating currents in the coil. The armature is cooled by water jets or air blasts. Although this generator can not be expected to revolutionize the electrical industry, it is quite ingenious, and from the description and illustrations presented, the readers of the WESTERN ELECTRICIAN interested in the subject will be able to obtain an idea as to what is being accomplished along this line.

IN a recent issue of the WESTERN ELECTRICIAN the precautionary measures that were being taken throughout the country to guard against the cholera were noted, and attention was called to the fact that in certain cities of Europe the crematory or "destructor" was made to burn up everything in the shape of refuse, including old shoes, rags, etc. It was also stated that these European cities had gone even further, and were experimenting with the view of utilizing the heat of the crematory furnace for municipal electric lighting. But electricity has another bearing on the case, as is very pertinently pointed out by the London *Electrical Engineer*, which says: "We are tempted to ask whether electricity has no part to play in the fight with the deadly plague. It is possible to conceive it has. In Havre, for instance, the sewage is poured into the harbor, and the surroundings are vitiated month after month till the tropical warmth of the autumn germinates the seeds of disease. Means should be taken to neutralize this plague bed in the towns. We happen to know that the authorities in Havre have already considered the application of electrical purification of their sewage. Plans were drawn out and the contract almost arranged with an influential English firm for a practical working of this method of disinfecting. Unfortunately, political elections intervened, and the scheme fell through. Possibly the execution of the project might have prevented the scores of deaths at this town."

Necessity, usually, is the means of bringing to the front the invention, and in this instance we most sincerely hope the "influential English firm" will step forward. Now is the time. If the electrical purification of sewage is a practical method it will be hailed with delight, and nowhere more enthusiastically than in Chicago. Here is a chance for our English friends. When a city is healthy it is very unwilling to invest in sanitary apparatus, but with the cholera threatening, a municipality it would welcome and help the man with credentials who feels reasonably sure of doing good.

IT is to be regretted that there should be occasion for the publication of such a document as that forwarded to Washington last week by the Society of Military Telegraph corps, in which these veterans appeal to their old comrades in the Grand Army of the Republic to assist them in securing from the government, recognition of the services which the telegraphers rendered during the civil war. That the petitioners have been neglected and the value of their services underestimated by the government is generally conceded by all who have given the matter consideration. It is certainly a reflection upon the gratitude of republics that these men, through whose efforts the great armies of the North were directed, should be to-day petitioning Congress for recognition and honorable discharge. There can be no question as to the value of their services. Their claims have been endorsed by the great generals of the union army. There is no doubt that the telegraphers suffered hardships with the fighting forces, that they braved the dangers of the campaign, and by many acts of bravery earned the recognition they are now asking from the government. The value of their services cannot be too highly estimated. In a report General Grant said of the corps: "The telegraph service was as necessary to our success as the railroad is to commerce. Nothing could be more complete than this body of brave and intelligent men. The moment the troops were put into position to go into camp all the men connected with this branch of the service would proceed to put up their wires. No orders ever had to be given to establish the telegraph."

In considering the claims of these men the character of their work and the accompanying responsibilities should be taken into account. When communication between Baltimore and Washington on the regular lines was interrupted, the secretary of war formed the American Telegraph corps. The keys to telegraph ciphers were intrusted to operators alone; staff officers were denied this privilege.

In view of the valuable services rendered it is not to be wondered that the officers of the union army unhesitatingly complimented the operators upon their work. Then why, it may be asked, has not Congress long ago recognized this service? The answer is found in the address issued from Omaha and printed elsewhere in this issue:

Yours being the larger body and having the greater number, have by your political power been able to exert upon Congress an influence which has at times enabled you to secure recognition and the enactment of just laws for your protection and deserved honor. We, on account of being a small number, have been unable to secure any recognition or an honorable discharge from the service so that we could become members of the G. A. R.

This is certainly a humilitating confession, but that it is true is shown by the fact that while politicians have cultivated the good opinion of the "old soldiers" they have entirely neglected the old time telegraphers, who were exposed to the same dangers and who rendered equally valuable services at least. While the "old soldiers" have been getting pension bills without number passed the telegraphers have been denied the distinction of honorable discharge, or any other official recognition of their connection with the army.

It is certainly time that Congress should take action in this matter.

OWING to the great excess of the demand over the supply of space for exhibition purposes in the electricity building at the World's Fair, the apportionments for foreign countries very clearly indicate the degree of interest taken by these nations in the electrical department of the exposition, as the heads of the department cannot afford to set aside space that will not be used. The table given in this week's article on "Electricity at the World's Fair," may be taken, then, as a fair indication of the relative size of the foreign electrical displays of next year. It will be observed that Great Britain is third on the list, being very largely exceeded by both Germany and France. This order does not represent the proportionate importance of these countries in electrical development, and may be accounted for by the superior commercial acuteness of the Germans and Frenchmen in recognizing the importance and value of the World's Fair to them. It is easier to take this assumption as the correct one than to believe that the British electrical manufacturers are loth to exhibit their goods side by side with similar machinery produced in the United States and on the Continent, fearing that such a comparison would result to their disadvantage. It must be admitted, however, that the latter theory is apparently borne out by the attitude of a portion of the English technical press. Thus the London *Electrician* of recent issue, in an editorial article headed "The Science of Exhibiting," begins by asking the question, "Are we not in some danger of taking the Chicago exhibition too seriously?" In answering this question in the affirmative, our contemporary says, farther on:

Take, for example, these thousands of South Americans, who will, so we are told, travel next year all the way to Chicago, and let us confine our attention solely to electrical engineering. If there is in South America a sufficient demand, actual or potential, for good electrical machinery to justify on that account alone the efforts that have been made to induce the electrical trade to exhibit at Chicago, are we not more likely to secure the trade by a display say, at Rio? We should save our South American friends the fatigue of a long journey *and we should avoid comparisons, which, as we all know, are odious.* Good samples of English engines, boilers, dynamos, motors, mains, lamps, etc., etc., arranged with an eye to the best general effect, would surely be more efficacious somewhere near the equator than on the shores of Lake Michigan.

The clause which we have designated by italics seems clearly to indicate that the possible disadvantages of a disinterested comparison by prospective customers may have had considerable weight in inducing many English electrical concerns to refrain from exhibiting at Chicago. The confession is a rather awkward one to make, and we prefer to believe that the seeming inferiority of England in the electrical department is due rather to a certain British dullness of perception than to a tacit admission of the superiority of American, French and German productions in this line. However, the regretable fact of a seeming disparity remains, and, however explained, can scarcely redound to the credit of the land that gave birth to Faraday.

As to the argument in favor of an exclusively British display in South America, a similar proposition might be advanced for Australia, Japan or Canada. Inasmuch as practically all the advantages of these segregated exhibitions could be obtained at much less cost by utilizing the great drawing power of the World's Fair, the argument does not possess much force.

Old Time Telegraphers.

The annual meeting of the Old Time and Military Telegraphers was held in Omaha last week. At the final session of the Society of Military Telegraph Corps the following address, which will be forwarded to Washington, was read:

To the Grand Army of the Republic, Washington: Comrades: Two hundred of the 1,200 telegraphers who were with you in active service during the war for the preservation of the Union still live and are enjoying a reunion at Omaha. We remember with pride our intimate relations during that trying time. You formed the great body and did the fighting, but we were with you, and bore the same relation to you that the tiller moving the rudder does to that which guides the ship. The commanding officer, like the pilot, used up our wires and instruments to guide you.

You very kindly passed favorable resolutions at Milwaukee in our behalf, but on account of the slight effort made, nothing was accomplished. We now appeal to you for your earnest help to induce Congress to consider what is due us in the way of recognition from the government. We ask for nothing more than what is just and right, and demand this in the name of patriotism. We thus send you our greeting, and hope that we can soon have the privilege of becoming members with you of your Grand Army, that we may be united with you in peace as in war.

The society decided to meet in Chicago next year, the time to be determined by the presidents of the two telegraphers' societies. The historical committee was authorized to prepare a history of the military telegraph corps in the late war for the jubilee celebration at Baltimore in 1894. The following named officers were re-elected for the ensuing year: President, William R. Plum of Chicago; vice-president, William B. Wilson of Philadelphia; secretary and treasurer, J. F. Pettit of Chicago. The president was authorized to appoint a committee on Congressional action. The society then adjourned for one year.

The Old Timers met after the military telegraphers had adjourned and completed the business of their session. The following named officers were elected for the ensuing year: President, A. H. Bliss of Chicago; vice-president, William B. West of New Orleans; secretary and treasurer, William J. Dealy of New York; historian, George C. Maynard; executive committee, R. J. Hutchinson of New York, J. M. Turner of Charleston, S. C., W. B. Wilson of Philadelphia, and T. C. Mason of Tacoma. Chicago was selected as the place for holding the meeting of next year.

Black Copper and Blister Copper.

In a recent issue of the *Engineering and Mining Journal* there appeared a communication from A. Raht, of Pueblo, Colo., in reference to the paper on "Electrolytic Refining of Copper," by F. B. Badt, which was read before the American Institute of Electrical Engineers at the recent Chicago meeting and published in the WESTERN ELECTRICIAN, June 18th. In the communication referred to Mr. Raht calls attention to the fact that Lieut. Badt in his paper refers to the treating of "black copper" where according to Mr. Raht he "surely means 'blister copper.'"

Mr. Raht says that "it seems desirable not to get technical terms mixed" and he asks the *Engineering and Mining Journal* "to clear up things." Concerning the meaning of these terms Mr. Raht says:

Black copper (translated from the German *schwarz kupfer*) shows in the break a dark appearance; hence the name, and it may contain from 75 per cent. to 92 per cent. copper. It contains, besides other impurities, such as iron, lead, etc., always several per cent. surphur; it is produced in a blast furnace, together with matte of 52 to 65 per cent. copper (German, *dunnstein* or *lech*). The English copper smelting in Wales does not produce "black copper," unless one would call the "bottoms" produced in the "best selected" method by that name. I understand that repeated attempts of refining "black copper' electrolytically, made some years ago, resulted in failure, as the electrolytic copper produced usually carried from 0.8 to 2.5 per cent. sulphur.

Blister copper shows, when broken, a true copper color. It carries from 97 to 98.5 per cent. copper and is practically free from sulphur, and it is this metal that is now nearly exclusively used as anodes in electrolytic refining. Blister copper can be made by oxidizing matte (or black copper) in a reverberatory furnace or by the Bessemer process; for the latter process I obtained in a U. S. patent in 1865 or 1866.

A copy of Mr. Raht's communication, together with the paper in which the terms criticised were used, was submitted to M. C. Ihlseng, Ph. D., Colorado State School of Mines. Prof. Ihlseng has submitted the following:

I am in accord with what you say regarding the use of "black copper" as anodes in the electrolytic process. I do this not because I desire to agree with you necessarily, but because authorities are rather of the same opinions as those expressed by you and opposed to the general criticism Mr. Raht makes. I have high regard for Mr. Raht who was superintendent of the Parrot Copper Works in Montana. If he desires to suggest a distinction of terms as defined by him, well and good; let the criticism be so announced; but if he wishes to "clear up" what he chooses to term confusing I do not think he is starting on the right track. If he intends to limit the use of the terms "black copper" and "blister copper" in the manner he defines, then he is merely endeavoring to prescribe Montana practice for that of the world.

"Black copper" is the result of a blast furnace fusion, contains over 95 per cent. of copper and is practically an ingot of copper with an admixture of some oxide of copper; the compound is perfectly homogeneous as a scratch over its surface or a fresh fracture will show. It may, and often does, contain other impurities than the oxide, as iron, etc., but it does not, as he says, "always contain several per cent. sulphur." When toughened it makes the copper of the market.

"Blister copper" is the result of a reverberatory treatment of copper matte and, as may be expected, contains some sulphur. It may carry as high as 92 per cent. of copper but rarely does. A fracture of the "blister copper" pigs will show a porous surface with pellets or globules of the metal scattered over it. The pig is not so homogeneous as in the "black copper" ingot.

Doubtless Mr. Raht, who used both blast furnaces and reverberatory furnaces at his works, employed the two terms in question to designate the separate products thereof in the manner he mentions, but I am sure the larger number of metallurgists will not agree with him. Mr. Pierce, whose ability as a metallurgist is as unquestioned as Mr. Raht's, ships "black copper" of the character I mentioned above. The Arizona smelters, those of Trinidad, Colorado and others that might be mentioned in Europe, call the impure ingots I described "black copper." I speak now of copper producers, not refiners as the Orton Works of Baltimore, Md. At Altenau, Chlausthal and Andreasberg, 600 tons are produced annually of "b'ack copper" averaging 95 per cent. copper, 2 per cent. lead and .085 per cent. silver. At Agordo the blast furnaces fuse mattes till a black copper is produced with 95 per cent. copper. See Phillips' "Elements of Metallurgy," p. 406; "Smelting of Copper," Col. Grant Frances, p. 27, Greenwood "Metallurgy of Copper." All of these refer to black copper as the result of blast furnace fusion, which same is refined to ingot copper. The operators of Siemens' electrolytic process call their metal "black copper."

"Including Ourself."

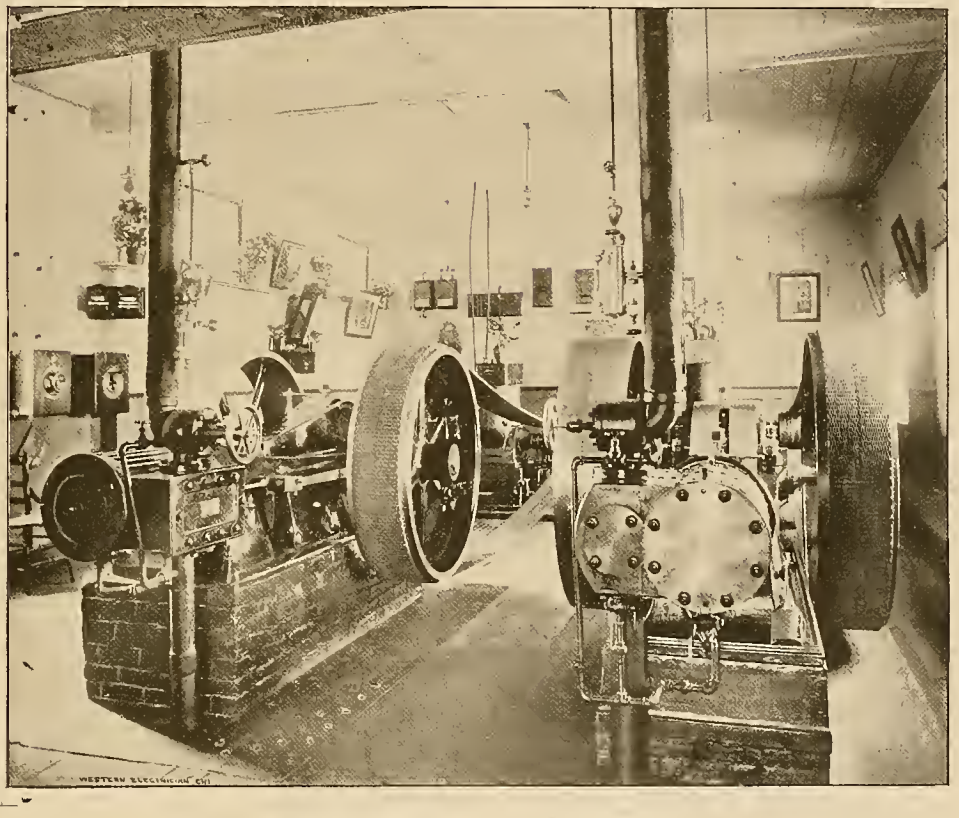
A reporter of the *Press* of Ishpeming, Mich., saw a telephone burned out recently, and this is the way he described it: "While on a visit to M. C. Quinn's this morning at 9:30 o'clock, the store telephone belched forth a blinding glare of light and for a few moments that part of the store was clouded in smoke. Dick Quinn, who was seated in the office, jumped about ten feet, while parties near by moved to a safer distance; these included ourself. In some manner the wire dropped, falling on the trolley wire. Biff, bang, chug, ting-a-ling went phones in several parts of the city that were instantly burned out. A visit to the 'Central' a few minutes afterward found Miss Lizzie Sheehan, the attendant, in a state of nervous trepidation. She had on Wednesday taken the place of Miss Kate Sullivan, who had been granted a two weeks' vacation. Miss Sheehan was in the act of calling up Marquette, when all of a sudden the little room was filled with fire and smoke, and she rushed from the place with considerable agility."

Electrical Development at Idaho Springs, Colo.

By GEORGE H. BLISS.

In your issue of May 14th a stray paragraph mentions Pontresina, which has an altitude of 6,000 feet, as probably being the highest point at which a central electric light station is operated. The writer evidently overlooked Idaho Springs, Georgetown, Leadville, and a number of other places in this section.

Idaho Springs, Colo., is a pretty mining town of 2,000 people and upward, 38 miles from Denver and 7,500 feet above the sea. It is remarkable from the fact that a central station has been in operation here since February, 1887. It was started with a small Jenney incandescent dynamo, to which a 500 light Edison dynamo was soon added. Still later, a 700 light Edison dynamo was added, and the Jenney machine was taken from service. There are a 45 horse power Ball and a 60 horse power New York safety engine, one 50 horse power and one 60 horse power tubular boilers in service. The dynamo and engine room is shown in the accompanyign cut The fire boxes under these boilers are V-shaped, 50 inches long, the full width of the boilers, at the top, and about 14 inches wide at the bottom, for grate service.



ELECTRICAL DEVELOPMENT AT IDAHO SPRINGS, COLO.

Pine wood, costing $3.50 per cord, is used for fuel, an is fed in logs three feet long. It is estimated that 25 per cent. in fuel is saved with the V fire box over the old form which was first used.

Not a single month has passed since the plant started which has not shown an increase of business. Nearly 1,000 lights are now installed. The town pays for thirty five 20 candle incandescent and for four Ward arc lamps for street illumination. The contract method is the system on which the business is transacted, and good prices are obtained. The capital stock of the company is only $10,000, and the earnings have enabled the company to increase its plant and also pay dividends. The stock is valued at $25,000, which is 150 per cent. premium. The plant is operated all night. The officers of the company are: J. J. Elliott, president; H. Plummer, vice-president; G. A. Chapman, treasurer: Robert Turner, secretary.

There is no gas plant in place, and in fact one could not exist in such a scattered community. A more striking example of the adaptability and success of the electrci light can hardly be found. The company contemplates putting in a power generator soon, to permit it to distribute current to the numerous mines in the vicinity of the town.

The Unity Electric Light & Power company has been formed at Chicago; capital stock, $50,000. The incorporators are E. H. Thompson, M. P. Alford and F. S. Donnell.

The Future of Electrical Power Transmission.[1]

There is no more attractive subject than that of the transmission of power by electrical means. In fact, there is something exceptionally engaging in being able to transmit a thousand horse power through an apparently inert and passive copper wire, and the electrical transmission of power has for many years been a pet theme, more especially of the popular electrical engineer. The transmission of a hundred thousand horse power from Niagara to New York is a splendid point for a public lecturer dealing with the wonders of electricity and the greatness of electrical engineering, but to the sober practical man it is not a question of difficulty, but of pounds, shillings and pence. He goes to the root of the matter at once, and asks "Will it pay?" The extraordinary hold high pressure transmission has upon the general public was well shown by the Lauffen-Frankfort transmission plant, and before that by the Creil experiments. The Lauffen transmission was generally considered the most important part of the recent Frankfort Exhibition, yet there was no difficulty in it. The truth is that electrical engineers can do many apparently wonderful things; the only difficulty is to get the order. When this or that engineer applies electricity in this or that new direction he deserves credit, not so much for working out new or special apparatus, as for being able to convince sceptically minded people that it will pay, and for getting the scheme carried through. Since electricity has been employed by engineers in a practical way for commercial use, a number of proposals have cropped up. It was commonly predicted, for instance, that electricity was to take the place of steam. This notion was obviously "popular," though it never gained ground in electrical circles. In fact, it did not even live in the daily press for more than ten years. Next we had schemes for utilizing the power of the tides by building large dams. Windmills were to be fixed on prominent hills. The coal and slack was to be burned at the pit's mouth, and the power transmitted to distant towns. The Great Northern railway was to be worked from a power station in the coal districts. Towns were to have electric tramways in all their streets. Steam and gas engines were to disappear from every city, and power was to be laid on electrically, as it is now in a limited way by hydraulic service. All manufacturers requiring power were to have it laid on from central stations, where it could be produced cheaply on a large scale, and even domestic cooking and heating in large towns were to be done electrically. Some of these early dreams are destined never to be fulfilled, but in many cases reality will probably be beyond the most sanguine hopes of the pioneers in these directions. It may, therefore, be well for us to review the position of electrical transmission of power, and to try and see in what directions developments are to be expected.

In the first place, windmills and tidal dams may be dismissed. The power even of a large windmill is relatively very small, and it is uncertain; and the capital outlay needed to construct tidal dams is too great. A tidal dam must be double, so that at low tide power can be obtained by emptying one dam, while at high tide it is produced by filling the other. A single dam cannot give power continuously. We may, therefore, now consider the case of distribution of power in a town, steam engines being employed. If a consumer requires a large power, such as, say, 50 or even 100 horse power, he can generally produce it as cheaply as a supply company, and thus save the cost of distribution. Trades, as, for example, that of printing, demand small powers such as two or three horse, and this power generally intermittently. At first sight it might appear that there was no comparison in economy between a small gas and a large steam engine. It is very easy to fall into a common error here. Some people continually treat the matter as if the cost of supply from central stations depends only on the coal used. This item is often a very small proportion of the cost of power. The cost of coal is swamped in the expenses of distribution, collection, interest on capital, the fees of directors and consulting engineers, and so on. The result is that it is generally cheaper to employ a gas engine than to take power from a central station. In America small motors have made much more progress. One of the chief reasons is that gas is much dearer in the United States. So is coal, but the higher price of coal increases the price of electrical power a small percentage only. The gas engine is also much more developed in England, perhaps for the same reason. It was thought for a long time that the supply of power would improve the "load factor;" unfortunately, however, the motor load overlaps the maximum lighting load, so that the plant must be large enough to meet the demands of both. Some stations, such as that of the Vestry of St. Pancras, are introducing lower rates for power taken during the day. In America there is a very large business now done in small motors for driving fans. The elevator, too, is there almost a national institution. One of the first requisites, however, is a low price for power; sevenpence or eightpence per supply unit is too much. It would certainly pay all electric light stations to supply power cheaply during the day—that is to say, when it is most wanted. To generate power during the day adds very little to the cost of running a station. In the evening, especially in winter, the motor and lamp loads overlap, and extra plant would therefore be necessary, but full price can be charged for the power supplied after sunset. The consumer thus obtains most of his power at a low figure, and, though he pays heavily during the last hour or two of the day, his average price is low. In spite of its overlapping the lighting load, the motor load not only improves the load factor to some extent, but it increases the output of the station with but little extra cost. Mr. Kapp has brought forward the plan of making meters which read less during the day, and if such meters could be introduced commercially they would be of great value in increasing the output of central stations. In short, therefore, though there are not the same opportunites in England as in America, there is every reason to suppose that the supply of power from central stations may be developed to a much greater extent than it is now.

Electrical tramways do not seem to take rapid hold in this country. It must be remembered that the enormous development in America has been largely due to the possibility of using overhead wires. If the culvert or storage battery systems had to be used, the industry would not have grown so fast. The horse car is itself very much more generally used in the United States. In this country most of the towns are old, and the streets are too narrow to admit of tramsways being worked properly, while cabs are much more generally used here, many people considering it not "quite the thing" to ride in an omnibus or tramcar. In America the cab is not used to the same extent, and cab fares are ruinously high. The hot summers induce people to jump into a tramcar even if they want to go only a few hundred yards. Electrical tramways in this country are hampered chiefly by the objections to overhead wiring. The culvert system has so far been expensive, and storage battery cars do not come within the subject with which we are at present dealing.

1. From London *Industries*.

American Institute of Electrical Engineers.

The first meeting of the season of the American Institute of Electrical Engineers will be held in New York city on September 27th. The paper of the evening will be read by Charles P. Steinmetz on the "Law of Hysteresis, and Other Phenomena of the Magnetic Circuit." It is also expected that several members will contribute short papers on their "Vacation Experiences," embodying observations of new or curious features of electrical work in this country and abroad.

The committee on rules, which has had under advisement the proposed changes regarding the election of officers, has completed its report, which is herewith presented:

During the first week in February of each year the secretary shall mail to each full and associate member of the Institute a list of members and a list of the offices to be filled at the ensuing annual election in May, giving the names of the incumbents and a copy of this rule, with the request that nominations, propositions and suggestions as to desirable candidates be made promptly and prior to March 1st.

The secretary shall submit all answers to the council, who during the month of March shall prepare a complete ticket to be headed "Council Nominees," containing the names of members whom they deem best suited, all circumstances considered, for the offices falling vacant. This ticket shall be printed on the same sheet with a "General Proposal List," containing the names of all eligible members proposed, with a memorandum stating the reason of ineligibility of all other names proposed, and with a statement that the nominations by the council are in nowise governing, but are intended only to assist members in making a choice. The voting shall be restricted to the names on this sheet. This sheet, together with an envelope, on which shall be printed the address of the secretary, with the words "Voting Envelope—Enclosing a Ballot Only," shall, not later than the 15th of April, be mailed by the secretary to every member in good standing.

Each member may cast three votes for vice-presidents and he may cast all three votes for one candidate or two for one and one for a second, or one for each of three. Each member may cast four votes for managers, which he may in like manner divide between from one to four candidates. This division shall be specified by the appropriate numeral marked opposite the desired name.

All names voted for shall be written, printed or otherwise marked on a single ticket or ballot, which shall be enclosed in a sealed, unmarked and unidentified envelope of any suitable size, to be in its turn enclosed in the voting envelope received from the secretary. On this outer envelope the member shall add his signature and the postage stamp.

At the annual meeting, these outer "Voting Envelopes" shall be opened in the meeting room by two tellers, then and there appointed by the presiding officer. After all the inner envelopes shall have been thoroughly commingled, they shall be opened and the votes shall be counted by the tellers, who shall report the results in writing. The eligible persons receiving the greatest number of votes for the respective offices shall be declared duly elected. The tellers shall reject all names that do not appear on the "Council Nominee" list or the "General Proposal" list, and they shall also reject that part of a ballot which shall name for any office or offices more candidates than there are vacancies.

This method of election shall apply to the offices of president, vice-president, treasurer and manager. No unsalaried officer except the president and treasurer shall be eligible to immediate re-election to the same office (as provided in Rule IV.) The secretary and any other salaried officer shall be chosen each year from among the members of the Institute by the council. The secretary shall be a member of council, but shall have no vote in its proceedings.

The Institute will be asked to pass upon this report next Tuesday evening. It is expected that it will be adopted.

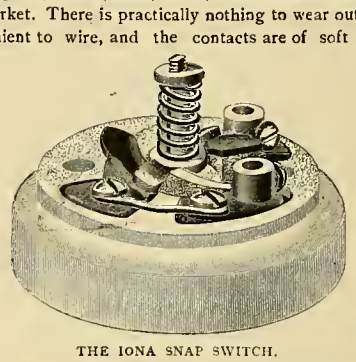
The Baltimore, East Baltimore & North Point Railway company and the Baltimore, Canton & Point Breeze Railway company will soon commence building their electrical railroads.

Capturing Monkeys by Electricity.

"I once went up the Amazon and Orinoco rivers on an animal capturing expedition for the late P. T. Barnum," said Dick Cowper, an old showman, to a *St. Louis Globe-Democrat* reporter. "I got quite a collection of snakes, birds and monkeys. I hit on a novel plan for the capture of the last named, and it worked like a charm. A monkey is a greater imitator than a Chinaman. He will do anything he sees done, and that is what gets so many of his kind into the cage. I rigged up an electric battery and attached it to an apparatus that would allow a score of the monkeys to get hold of it. I then took a party of natives and went into the forest where there were troops of monkeys. We put the apparatus down, attached the wire, and removed the battery to a considerable distance. The natives then took hold of the apparatus, danced and yelled, then retired. The monkeys made a dash for it. Half a dozen caught hold and I turned on the current. They began to shriek and squirm, but the others thought their performance a part of the programme and fairly fell over one another to get hold of the machine. I could have stuck the whole troop if they could have got hold of the concern. We then made a descent on them with sacks and soon had a score of them corraled. But it would only work once. We tried it a month afterward at a point fifty miles distant, but not a monkey came off his perch in the trees. They viewed the proceedings with evident curiosity, but without any apparent desire to imitate our war dance around the machine."

The Iona Snap Switch.

Illustrated herewith is a switch and cut-out combined with a fuse. This switch is one of the simplest, and has as few parts, it is claimed, as any other circuit breaker on the market. There is practically nothing to wear out. It is convenient to wire, and the contacts are of soft brass.



THE IONA SNAP SWITCH.

This obviates the difficulty experienced with spring clips, which lose their temper by heat, and render the switch faulty in operation. This switch is carried on a base of vitrified porcelain, with a nickel cover. It is also furnished in china, both plain and decorated. The Iona switch is being put on the market by the Redding Electric company of Boston.

CORRESPONDENCE.

New York Notes.

NEW YORK, September 17.—Whether the grumblers like the tunnel scheme for rapid transit or not, no one can gainsay the fact that the engineers are doing their part of the work expeditiously. It is now stated that the Rapid Transit commissioners are nearly ready to announce the specifications upon which bids will be invited for the franchise of the proposed underground system. Engineer John Bogart has had this matter in hand since early in the summer. In the report of the commissioners the following paragraph indicates their position in this respect:

The commission makes no recommendations as to the method of construction. These matters the commission will deem it wise to leave, so far as permitted by the act, to the judgment of the purchaser, subject always, as the act requires, to the control of this board. The particular shield, if any, to be used in excavating under the streets, the details as to materials and form of walls and other interior surface should, as far as consistent with the requirements of the act, be subject to his selection. Any attempted determination of the method of construction in advance might narrow the field of possible competition to such an extent as to endanger the success of the enterprise.

The announcement of the specifications will be made as soon as the location of the stations can be fixed. Everything else is practically settled and ready, and most of the stations have been finally located.

A dispatch from Nyack, N. Y., states that on Friday the electric launch Vashti made a successful trip, running from Nyack to Sing Sing and return inside of two hours, a round trip of eighteen to twenty miles. Current is furnished from seventy-two storage batteries underneath the floor. They practically act as so much ballast next the keel. The motor also is under the floor and placed in the stern of the boat. It is of a special type, designed by Prof. William Main for President Bradley of the Union Electric company, New York. It is a slow-speed motor connected directly with the propeller shaft. The Vashti is thirty feet over all and two feet draught. The

hull is built of oak frames, with white cedar planking, copper fastened. The cockpit is 23 feet long in the clear and has seating capacity for twenty five to thirty persons. The interior woodwork is fine quartered oak. It was built by Charles L Seabury & Co., Nyack-on-the-Hudson for S. R. Bradley. The model is a duplicate of the launch, Alva, which Seabury & Co. built last season for W. K. Vanderbilt. Every bit of the length and width of the boat is available for use of passengers, as all machinery is below the floor, giving a clear, open cockpit from stem to stern. The batteries hold a charge for a nine to ten hour run, and the speed developed is eight to teo miles per hour.

The Rip Van Winkles in Harlem have at last awakened. It will startle some when they hear it, but strange as it may seem, a petition is being circulated for the lighting of Seventh avenue by electric lights from One Hundred and Tenth street north to the Harlem river. At present gas is used for illuminating purposes but it does not give satisfaction. The lights are dim, and it is next to impossible to distinguish vehicles on the broad avenue at night. The trees throw dark shadows on the roadway, and numerous runover accidents result every week. The petition is numerously signed, and will be presented to the board of aldermen shortly Lenox avenue is lighted by arc lamps, although it is not used as much as Seventh avenue.

The Western Union Telegraph company has declared a dividend of 1¼ per cent. This is something of a disappointment to Wall street operators, as it was generally expected that the dividend rate would be raised. It was also decided to increase the capital stock of the company by $13,800,000, making the aggregate capital $100,000,000. The accumulated surplus of the company since October, 1881, is stated at $14 455,757.16. It is to represent this sum earned by the company in addition to the dividends paid since 1881 that the new stock will be issued.

W. F. O.

New England Notes.

BOSTON, Mass., September 17.—A survey by the North Shore Traction company, has just been made between Lynn and Salem, Mass., with the result that the company has determined to build an electric road between the two cities. The route will be from Essex and Boston streets, Salem, over the turnpike floating bridge to the Thomson-Houston works, when the tracks of the Belt line road will be used across the city. Trips every half hour will be made, the time consumed being twenty minutes. The fare will be five cents, ten cents lower than the Boston & Maine. Between Lynn and Salem there are now two street car lines, one via Peabody and the other via Marblehead, but the passengers are obliged to change cars on each route. The North Shore Traction company is the name assumed by the syndicate that purchased the Lynn Belt line, the Lynn & Boston and the Naumkeag street railway companies. The syndicate on Thursday took formal possession of the Lynn & Boston road. Some changes are expected on the working force of the road at once.

Work on the Haverhill and Amesbury electric road to Merrimac has been delayed from a novel cause. About sixty of the men at work on the road found themselves poisoned. In constructing the road they had to pull up a good many bushes and it is supposed they came in contact with poisonivy. Some of the cases it is feared may result fatally.

The new Bradbury-Stone Storage Battery company of Lowell, claims to be meeting with great success. Indeed this system of street car propulsion is said to have already taken its place among Lowell's prosperous industries. The Washington Park line in Sioux City was the first to adopt this system, and it has given perfect satisfaction from the start. Figures taken from its regular trips show the expense for coal per car mile to be ¾ cent. The car has been in service six months or more without renewals of any kind. The company is also meeting with success in Dover, N, H., operating cars on a 9 per cent. grade. The trolley wire is fed wholly from a battery on the hillside.

The New England Piano company of Boston has put a 250 light dynamo in its factory. The Lockwood company of Waterville, Me., manufacturers of cotton goods, has ordered a 400 light plant of the Mather Electric company. The New York Standard Watch company of Jersey City has ordered a 400 light machine from the same company. The Pacific Mills of Lawrence, Mass., which have the largest electric light plant of any mills in New England, have recently made an addition of 2,500 lights, giving them a total of 7,000 lights.

The new railroad station of the Concord & Montreal road at Laconia, N. H , has been equipped with one of the best electric light plants in northern New Hampshire. There will be 100 incandescent and 2 arc lights. From the main dome hang 2 electroliers of 30 lights each. The remainder of the incandescent lamps are arranged in groups of six to ten lights. The Concord & Montreal has granted the Concord Gas Light company permission to erect poles and string wires on its property for the purpose of transmitting power from Garvin's Fall to Concord.

S P. Wells and C. K. Strauss of the Northwest General Electric company are in Boston for the purpose of looking up the subject of long distance transmission of power for mining purposes.

The Hope Electric Appliance company, a concern recently chartered in Providence, R. I., has just opened its works in that city. A Wright is president and R. Tressenden, treasurer. The company is making an improved mast arm for arc lights, recently invented by Mr. Wright. The lamp is lowered by the use of metal tape which passes through the runway of the mast and out along the arm to the lamp at the end. The tape is connected with a small capstan on the mast, and the lamp is lowered by turning a key crank. A peculiar feature of the invention is a rocking pulley, which prevents friction and wear on the tape. There is also a marked economy of space. The company also makes a trolley arm, the lamp sliding on a trolley wire to the mast, and a simple device at the outer end cut-off the current when desired. A new cut-out, adapted for use on electric cars will be another of the specialties.

The Suburban Light & Power company of Boston has had a creditors' petition in insolvency brought against it by J Edward Addicks on a claim of $7,786.60 money loaned. The last statement of the company made in November, 1891 shows assets of $122,016.65, and liabilities of only $39,016.65. A hearing will be given October 14th.

The directors of the New Rockland, Thomaston & Camden, Me., electric road inspected the property after one month's use and found everything in a highly satisfactory state. Over 140,000 passengers were carried in the month. The reservoir at Glen Cove they decided to enlarge and they will contract at once for a heavy electrical locomotive to use in the freight and baggage service. It was decided to indefinitely postpone extending the track to Thomaston.

The Naumkeag street railway of Salem is to build a one-story power house.

Manchester, N. H , is torn up over the question of the new electric road to Lake Massabesic. Gen. Charles Williams, who owns the roads of the city, wants to bond them for $150,000 and build the electric road, which would be four miles long. Williams has control of three-fifths of the stock, but the holders of the other two-fifths object to his plan. They claim that they could not compete with the Concord & Montreal steam road, and that with a road so heavily bonded would be beyond their control. Lake Massabesic is only a summer resort and they are afraid that in order to keep their charter they would have to run cars every day in the year. They also say it is little less than criminal to make the lake, which is the source of the city's water supply, a summer resort. The real trouble probably is that the citizens want electricity introduced on the main lines of the city and Gen. Williams is not willing to do this, but is trying to create a counter diversion.

Several street car companies are negotiating with the Bradbury-Stone Storage Battery company of Lowell, regarding the adoption of their batteries if a trial prove them successful.

By the decision of Judge Colt of the United States Circuit Court the Gamewell Fire Alarm Telegraph company sustains defeat in three suits and wins in one against the Municipal Signal company. The first suit was brought by the Municipal Signal company, and related to electric signal boxes used in a municipal signal system. The Municipal rested its case on a patent issued to John C. Wilson, which was for an apparatus in which the key given to a customer removed an obstacle to the signalling crank and the signal was operated by turning the crank, whose handle projected through the side of the door. The special merit of the Wilson invention lay in controlling the locking device of the key by moving the door. In a previous invention for which a patent now expired was granted to one Hotchkiss, the citizen's key operated directly the alarm mechanism. The court says:

I do not think a transmitting mechanism controlled by a key covers a transmitting mechanism operated directly by the key. In the defendant's apparatus the key operates directly the alarm mechanism, and for this reason does not infringe the Wilson patent. Upon this ground I must direct that the bill be dismissed with costs.

In the second suit the Municipal company was plaintiff, the Gamewell company was defendant, and the suit related to patents covering devices in the municipal signal system. By this apparatus signals are conveyed by electricity to a central station from boxes located on the street. The Ennis patent relied on by the plaintiffs was for a receiving instrument which simultaneously registers a message, records the time of its reception and sounds an alarm. The court says:

The first claim of the Ennis patent is for an apparatus which accomplished a result unknown in the art up to that time, and the defendant's apparatus accomplishes the same result through the same, or well known, or equivalent instrumentalities, and therefore the machine is within the Ennis invention.

The third suit was brought by the Municipal company on a patent issued to one Noyes, March 22, 1887, on devices by means of which the reception of emergency signals to the main station is marked by the ringing of a bell, while in the case of ordinary patrol signals no alarm is sounded. The defense was that by reason of prior patents and devices there was nothing patentable in the Noyes apparatus. The court says:

I am still of the opinion that this alleged prior invention has not been established by that clear and satisfactory proof which is necessary to invalidate the Noyes patents.

The fourth suit was brought by the Gamewell company, and alleged the infringement of a patent issued to Stephen Chester in June, 1875. relating to an improved form of signal box for the transmission of fire alarm or other electric telegraphic signals. The court says:

A comparison of the defendant's signal box with the Chester box with respect to the devices by the third claim shows such dissimilarity that there can be no infringement.

The Gamewell Fire Alarm company has not given up the fight with the Municipal Signal company yet. It has filed a motion for a new trial in the patent infringement cases just referred to. The court allowed the Gamewell attorneys to file briefs but Judge Colt stated that the cases had been very carefully tried and he issued an injunction restraining the Gamewell company from further use of the apparatus involved.

The New Bedford Copper works will put in an electric plant for lighting.

Electric cars were run in Fall River for the first time last week.

There is a project on foot to develop the large water power below the Worumbo Mills, Lewiston, Me., by means of a dam and then transmit the power by means of electricity to Bath, a distance of 14 miles, to be used for manufacturing purposes. It is estimated that 5,000 horse power can be developed and that the necessary plant would cost about $150,000.

J. C. E.

St. Louis, Mo.

ST. LOUIS, September 17.—The magnificent new residence now being erected by Adolphus Busch, president of the Anheuser-Busch Brewing association, is now being wired for 800 incandescent lights.

It is reported that the town of Highland, Ill., has contracted with the Chicago office of the Fort Wayne Electric company to light the town with twenty-one arc lights at $90 each per annum.

At the last meeting of the city council of Alton, Ill., the mayor was directed to take steps towards the purchase of an electric lighting plant.

Dr. Wellington Adams, of the Adams Electric Railway company, is now in the East on business connected with his suit against the Edison company for claimed infringement of certain electric railway patents.

A train on the Union Depot electric street railway September 13th consisting of a motor car and trailer, both heavily loaded, descending the heavy grade on Russell avenue, west of Ninth street, got beyond the motor man's control and ran away. It descended the hill at a fearful speed. The motor car rounded the curve in safety, but the trailer was capsized. One man was killed outright, and some two dozen more injured—some of them seriously, it is reported. There have been a number of complaints at the speed down this hill, and there are many who attribute the present accident to reckless and careless handling of the motor. The rails were covered with mud when the accident happened, which made it impossible for the motor man to regain control of the car.

A force of electrical experts has arrived at Alton, Ill., and work is in progress on the East Second Street Electric railway. The overhead system is to be used.

The Thomson-Houston company, through its Chicago office, recently entered suit in this city against Eugene Sweeney on notes issued to it by the North Dallas Railway company of Dallas, Tex., in payment for apparatus and equipment. To secure payment of these notes Mr. Sweeney gave them the railway company's bonds to the value of $60,000, which he claimed to have owned personally. Mr. Sweeney claims the Thomson-Houston company were to release a lien it held, but having failed to do so he now enters a counter suit to recover the bonds

He was then president of the Dallas company, and is at present the projector of the City Central Railway company, which is making strenuous efforts to secure the passage through the city municipal assembly of a franchise granting it valuable rights through numerous thickly set tled districts of the city.

The municipal assembly has been called together in special session by the mayor, but will consider nothing but certain contracts. The regular session begins on the 27th inst., and it is expected that the consideration of the many bills now pending for franchises for electric railways will take up a good portion of the time.

The Chicago & St. Louis Electric Railway company, which owns a coal mine and brick making plant at Edinburg, Ill., where one of its power stations is to be located, has commenced work on a lot of 500,coo red brick, for use in its buildings. The company held open its subscription books for the sale of stock until, it is claimed, it disposed of 100,000 shares at $300 each for the purpose of completing its road bed. The capital stock of the company is $7,000,oco in 700,000 shares. Prof. Francis E. Nipher of the department of electrical engineering at Washington University is president. The preliminary surveys and location have been made, and part of the right of way secured. The route is an air line between the two cities, and is claimed to be thirty eight miles shorter than any existing road.

Northwestern Notations.

MINNEAPOLIS, September 17.—The Minneapolis Street Railway company has been rebuilding 37 16foot Jones motor cars into handsome 22 footers, and will put them in service soon.

Mr. Lowry is not yet satisfied of the feasibility of any of the electric heating devices, and the coal stove will continue in the Twin Cities another winter at least.

A general strike of telegraph operators all along the line of the Northern Pacific Railroad was averted by a conference in St. Paul. The company made many concessions, and the operators appear to have gained several important points, one of which was an increase of salary from $5 to $15 per month.

The Redwood Falls Electric Light company has been formed with $12,000 capital, and stock is being taken by citizens who will control the plant until the city is ab'e to buy it. It will be running before winter sets in.

At the top of the tower on the Minneapolis exposition building a 25,000 candle power arc light was turned on the o her night. It is 240 feet above the ground. A 9½ horse power dynamo supplies current for it.

The electric light plant at LeSueur, Minn., was damaged to the extent of about $1,000 in a recent storm. Much property was damaged about the town by balls of fire following the light wires into stores.

The Little Falls Electric & Water company has filed amended articles increasing its indebtedness limit to $75,000 and giving itself power to issue bonds not exceeding $250,000.

Henry C. Hope of St. Paul, superintendent of the Omaha telegraph system, has been notified that he has a good claim on one of the largest estates in the north of Ireland.

A. C. Russell and Francis Jewett of Lowell, Mass., directors of the Northwestern Telegraph and Telephone company, have been making a tour of inspection in the Northwest. They told the Fargo, N. D., people that their service was to be greatly improved and a line put in from Fargo to Hillsboro. They are authority for the statement that $100,000 has been spent in the Twin Cities on underground work.

They had a high old time up at South Superior the other day, celebrating the completion of the new electric line from the bay front. It is a double track, five miles long, running perfectly straight all the way.

The line work on the Sauk Rapids, Minn., electric street railway has been completed, and the line crew has gone to Ashland, where the Northwestern General Electric company is building a road. The Sauk Rapids line will not be operated till the crossings are fixed and new cars received.

Work is progressing rapidly on the new plant of the Crookston Water, Power & Light company.

The foundation is in for the new plant of the Electric Light company at Deadwood, S. D.

C. N. Parker of St. Paul has acquired the electric street railway franchise at Brainerd, Minn., granted originally to H. Spaulding and others. Mr. Parker will put in four miles of track at once, and he expects to have the line in operation November 1st. H. C. C.

Milwaukee, Wis.

MILWAUKEE, September 17.—The extension of the National avenue line past the Soldiers' Home has been in operation the entire week and in connection with the bus line between the present terminus and the grounds, carried thousands of people to the State Fair. The Wells street electric line, with the dummy line connection, was a popular route to the fair grounds.

The Cambridge avenue and Forest Home line, which extends from the corner of North and Farwell avenues to Forest Home, is now equipped with electricity.

Four Milwaukee street railway employes attended the national meeting at Indianapolis, the object of which was to form a national union.

New closed cars for the Milwaukee Street Railway company, made at Pullman, are being received, and the National avenue line is now entirely equipped with new cars.

At the Western Union Telegraph company's Milwaukee office, Augustus Wilson has been made traffic chief and assistant chief operator, Charles Warth wire chief, William Plant and A. E. Shape night chiefs, first and second halves.

The E. P. Allis company has purchased the block south of its present plant and now owns all of the property on the east side of Clinton street, between Florida street and National avenue, a distance of 1,081 feet. The offices in the near future will be located in the block just bought, and the room now occupied by the offices will be used as part of the main shop.

A few days ago the conductors on the electric line at Superior were discharged. They had contemplated joining the union and the company decided to get rid of them. Their places were at once filled with new men.

N. P. Van Slyke, a heavy stockholder in the Madison Gas company, has been elected a director and vice-president of the Four Lakes Electric company, which recently secured the franchise for furnishing heat, light and power in that city. When the new company, which is a Thomson-Houston concern, took possession of the Madison plant, it found that a St. Paul firm, which had rented two dynamos to the old company and was opposed to the Thomson Houston people, had taken both machines from the building and had them ready for shipment. New dynamos were ordered at once, but it was several days before they could be placed in position, and Madison was in almost total darkness for a few nights.

Incandescent lighting is very cheap in Wauwatosa, much cheaper than it is in Milwaukee, and a gentleman who lives in that suburb asserts that he has fifteen incandescent lights in his house, that he uses them all he wants to and that he pays only $2.50 a month for them. He would have to pay no more for them, he says, if he used all of the lights throughout every night. In the city the rate is a cent per lamp per hour. Promoters of Homewood, a new suburb west of Wauwatosa, will try to have that place supplied with light from the Wauwatosa station. C.

Detroit, Mich.

DETROIT, September 17.—Rapid transit was first introduced in Detroit August 22d. Although previously introduced in nearly all the cities and small towns of the state and in every suburb of Detroit, it was not until the date named that it made its appearance in any tangible shape in the city proper. The Detroit Citizens' Street Railway at this time placed seven of its nine new motor cars on the Jefferson avenue line, and ran them several trips in order that the motor men might get accustomed to the cars and the track. No passengers were taken except on the storage battery car, which is making five trips daily, and will endeavor to hold its own with the trolley cars. The nine cars went into actual commission on the following day. They are splendid affairs, the same that the Detroit Electrical Works are furnishing to other roads all over the country. They are solidly built, finely upholstered, and are lighted by electricity. The canopy of each platform contains the warning: "Passengers must not talk to the motor man." The trial trips were made without accident. At the power house two engines and two dynamos are in operation, the third engine not being in position. The fuel used is crude oil. As the new cars passed along Jefferson avenue they were the object of the curious gaze of hundreds who lined the sidewalks on either side, and the remarks made were almost universally in the nature of a glad welcome for the change.

The Woodward storage battery car, which has been laid up at the Jefferson avenue barns of the Detroit Street Railway company for over two months awaiting the completion of the bonding of the track, went into commission on the 22d ult., and took its place as one of the regular electric cars on that line. The services rendered were very satisfactory, and the railway company is very much interested in the work being done by this car. A fair and impartial trial will be given it, and it is expected that during the experiment this system will show that it has merits which demand serious consideration.

A movement is on foot, among local capitalists, to organize another electric street railway company. A meeting has been held and the subject discussed.

Plans for an electric lighting system on Belle Isle Park have been prepared by Frank B. Rae, providing for an illumination of every roadway and canal on the island. All wires are to be laid under ground. A low voltage will be employed and thirteen circuits of ten lights each will be provided. Portable electric pumps or wagons will be used for sprinkling the roads.

The Fuller system of electric lighting has been applied to the ferry steamers Sappho and Victoria, and electric lights will now be placed upon the other boats of the line.

The electric light muddle in Windsor is not yet settled. The Edison Electric Light company cannot get power from the street railroad owing to some unsettled accounts of the old company, and will be compelled to build a power house of its own.

The question of lighting the village of Homer, Mich., with electricity has been settled. A proposition from Cartwright & Sons has been accepted and a contract will be made with the council. The firm will run the dynamos by the water power from the Kalamazoo river and in its mills. G.

Denver, Colo.

DENVER, September 17—Negotiations are in progress fo the sale of Pueblo's three electric lighting systems and the street car line, to a New York syndidate. The amount involved is about $1,500,000.

The Durango Electric Light company will have a new plant in operation about October 1st. The capital stock of the company is to be increased from $50,000 to $100,000, the increase to be devoted to the enlargement of the present plant.

The Durango Railway & Realty company is to construct and operate an electric line in that city. The capital stock is $250,000 and the directors for the first year are C. M. Williams, T. C. Graden, John A. Porter, M. J. McClosky and Henry Arnold.

The supervisors have overruled Mayor Rogers' veto of the ordinance granting a right of way to the Tramway company for the construction of a loop in the block bounded by Fifteenth and Lawrence, Arapahoe and Fourteenth streets. This change in the system was decided upon in order to more easily handle the traffic at this point, enabling the trains to make a turn, and doing away with the present slow method of reversing the cars.

A company, organized by Joseph N. Baxter of Denver and Mr. Wrigley of Raton, New Mexico, will put in an electric plant at Blossburg, N. M., to light Raton and Blossburg, operate an electric road between the two towns, and furnish power for operating the Santa Fe mines at the latter point.

The Amethyst Electric Power & Light company of Creede, is prepared to put in a large plant, sufficient for the needs of the whole city, if a contract can be secured with the municipal authorities. This new company has no connection with the old organization. The proposed system will require seven miles of poles, and twenty-eight miles of double circuit wire, besides the service wire to individuals. The capacity of the plant will be 100 arc and 800 incandescent lamps.

Over 15,000 electric lights were used in the conclave decorations. The system required an entirely independent plant from that used for commercial business.

Oscar Reuter and Henry Lee of Denver, are among the promoters of another electric line to Golden. The Golden town council has granted a franchise for an entrance into that place. Connection with Denver will be made with the Tramway's electric lines in Highlands.

E. C. D.

PERSONAL.

General Manager A. D. Newton, of the Eddy Electric Manufacturing company, of Windsor, Conn., is taking a well earned rest for a few days in the White Mountains of New Hampshire.

W. A. Bright of Monroe, La., was in Chicago Tuesday last week. Mr. Bright was representing an electric light and power company at Monroe which is preparing to instal an extensive electrical plant.

T. A. Pamperin, general manager of the Electrical Manufacturing company, Oconto, Wis., passed through Chicago on Sunday last week en route to New York and other eastern points. Mr. Pamperin expects to be absent about two weeks.

George R. Brown, editor of the *Press*, Little Rock, Ark., was in Chicago Tuesday last week the guest of B. J. Arnold of the General Electric company. Mr. Brown is treasurer of the electric street railway system at Little Rock, recently illustrated in the WESTERN ELECTRICIAN.

NEW INCORPORATIONS.

Mosher Electric company, Chicago, Ill.; capital stock, $64,000; manufacturing electric appliances and supplies; Geo. Burry, 1605 Ashland block, Chicago, Ill.

Home Electric Light & Power company, Elkhart, Ind.; capital stock, $10,000; to erect and operate electric light, heat and power plants; E. Kuhlman, Elkhart, Ind.

Maroa Electric Light company, Maroa, Ill; capital stock, $18,000; to erect and maintain electric light, heat and power plant in Maroa, Ill.; Crocker & Co., Maroa, Ill.

California Construction company, Pasadena, Cal.; capital stock, $100,000; to construct and operate gas, electric and water works, railroads, etc.; T. H. Ward, Los Angeles, Cal.

Capital City Electric Light company, Madison, Wis; capital stock, $40,000; to establish and maintain an electric light and power plant; H. Schulkamp, Madison, Wis.

Buckley Electrical company, Buckley, Wash.; capital stock, $12,000; transmission of electric current for light, heat and other purposes; Buckley Electrical company, Buckley, Wash.

Gardiner General Electric company, San Francisco, Cal.; capital stock, $750,000; developing, applying and dealing in electricity, light, power, etc.; W. A. M. Van Bokkelen, San Francisco, Cal.

Pinckneyville Electric Light company, Pinckneyville, Ill.; capital stock, $2,850; to operate electric light, power and heat plant in Pinckneyville, Ill; Chas W. Roe, Pinckneyville, Ill.

New York Volta Electric Battery company, Jersey City, N. J.; capital stock, $100,000; to deal in electrical patents and to manufacture and sell electrical apparatus, etc.; H. O. Reed, 80 Broadway, New York, N. Y.

Hazleton & North Side Electric Railway company, Hazleton, Pa.; capital stock, $75,000; constructing and operating an electric railway from Hazleton to Drifton, Luzerne county; John F. Finney, Shenandoah, Pa.

Pottsville, Cressona, Schuylkill Haven & Orwigsburg Electric Railway company, Pottsville, Pa.; capital stock, $75,000; constructing and operating an electric railway in Schuylkill county, Pa.; L. K. Haonum, Pottsville, Pa.

Marshalltown Light, Power & Railway company, Marshalltown, Ia.; capital stock, $250,000; constructing and operating at Marshalltown a plant for electric light, power and street railway; Jones & Hovey, Marshalltown, Ia.

Hazleton & South Side Electric Railway company, Hazleton, Pa.; capital stock, $75,000; constructing and operating an electric railway from Kline township, Schuylkill county, to Hazleton, Pa.; John F. Finney, Shenandoah, Pa.

Star Electrical company (incorporated in W. Va.), New York, N. Y.; capital stock, $1,000,000; owning and operating certain patents granted to Jas. H. Mason relating to electrical apparatus; Sammis & Beerck, 96 Broadway, New York, N. Y.

Ohio River & Chartiers Valley Passenger railway company, Chartiers Pa; capital stock, $6 000; constructing and operating an electric railway in Esplen borough and Chartiers, Allegheny county; John W. Patterson, University building, Pittsburg, Pa.

Philipsburg & Houtzdale Passenger Railway company, Osceola Mills, Pa.; capital stock, $100,000; constructing and operating an electric railway in Philipsburg, Chester Hill, Osceola Mills Sterling and Houtzdale; Silas M. Patterson, Mifflintown, Pa.

Western Washington Development company, Port Angeles, Wash; capital stock, $300,000; to construct and operate railroads, steamships, telegraph and telephone lines, water works, electric light plants, etc; grade streets, erect buildings, etc.; B. F. Schwartz, Port Angeles, Wash.

ELECTRIC LIGHTING.

Weatherford, Tex., is to be lighted by electricity.

The new lighting plant for the city of Los Angeles, Cal., is 13 miles from the city.

The Kansas City Consolidated Lighting company has secured a franchise to light the city for three years.

It is expected that the new power house of the Burlington, Ia., electrical company will be ready by October 15th.

San Bernardino, Cal., is to be lighted by 40 arc lamps, which will be operated at a cost to the city of $11 per month each.

The Norwich, Conn., Croquet club is to illuminate its grounds with electricity, so that games can be played at night.

An electric light plant is being erected in Duquesne, Pa., and will be completed in October. The town is now nearly wired.

The station of the Waco, Tex, Electric Railway & Light company was recently considerably damaged by the bursting of a fly-wheel.

The boilers of the electric light station at Brandon, Vt., exploded recently, killing one man and injuring two others and doing damage to the extent of $5,000.

Milan is said to be the best lighted city on the continent of Europe. It has two large central stations equipped with American machinery. The wires, instead of being carried along the streets on poles, are suspended from brackets placed under the eaves of the houses.

There is a great demand just now for electric torch lights which can be used by campaign clubs as a substitute for the time-honored, bad smelling oil lights.

Judge Stowe has ordered the receiver of the McKeesport, Pa, Electric Light company to sell the plant within 60 days. The plant is said to be worth $75,000, with a $48,000 debt. Quarrels among the stockholders are responsible for the trouble.

Work has been begun for the buildings the Indianapolis Electric Light & Power company is to erect on Kentucky avenue north of West street. The main building is to be 200 feet in length by 85 in width, and the boiler and engine house building will be 100 feet long by 60 wide.

The Lighthouse Board is contemplating the introduction of electric lights in the lighthouses along the lake. This system of lighting has been tried at Sandy Hook, and has given complete satisfaction. It is believed that the difference in cost will be more than made up by the better service by the new light.

At a meeting of the Sumter Electric Light company of Charleston, S. C., recently, it was decided to increase the capacity of the works by putting in a ninety horse power boiler and a seventy five horse power engine. This increase of capacity has been rendered necessary by the increased demand for street and private lights

The management of the electric light company of Santa Fe, N. M., formally notified the city authorities that after a certain date no more street lights would be furnished. This action was forced upon the company as a matter of self-protection. The city is nearly five months behind in the payments for street lighting service, and no interest is allowed by the city council on the amounts due.

A dispatch from Middletown, Conn., says: The Schuyler Electric company here has just received an order from the government for the largest and most powerful search light in the world. It is destined for the statue of liberty in the harbor of New York, and will be visible for 100 miles and capable of transmitting messages that distance. It will be 50,000 candle power and will cost about $4,000.

Twenty-four employes of the Detroit Electric Light & Power company went on a strike last week. Three of the men were notified on Saturday that their services would not be needed after the 15th inst., and the men claim that the only reason given was that they had brothers in the employment of the company. The strikers demand the reinstatement of these men and the discharge of the foreman, who they claim is trying to break down their order. The company says that the trouble will easily be settled and if it is not they will have no trouble in getting new men.

The Denver Consolidated Electric Light company lately introduced a decided novelty in the way of electric illumination in the streets of that city. It consisted of a truck upon which had been erected a miniature electric light plant, with steam engine and dynamo in active operation. From the dynamo were run wires to every part of the wagon, to the spoke and tires of the wheels, uprights on the side of the platform, the seat, different places in the harness of the horses, and to the wires were attached various colored lamps, the whole producing a brilliant and unique spectacle as it moved along.

A Nebraska paper reports that H. P. Maiden, a farmer living near Ord, in that State, although near-sighted, is able to see strange sights on the planet Mars with the unaided eye. "The planet assumes to his eye," says the account, "a diameter of about twenty inches. He has made several observations and a few evenings ago saw an arc of brilliant light near the southern pole of the planet, in what, using for convenience earthly nomenclature, may be called the anarctic circle. It is at present invisible. He at present sees a large arc of equally brilliant light in the north temperate zone that stretches from verge to verge of the planet. These, he feels confident, are electric lights and as the larger arc disappeared and reappeared several times one evening he believes it is an effort of the inhabitants of Mars to communicate with us, and is therefore confident that Mars, like the earth, is inhabited by a race of intelligent beings."

ELECTRIC RAILWAYS.

The Amalgamated Association of Street Car Employes was formed in Indianapolis last week.

An ordinance has passed the city council of Nashville, Tenn., granting the Overland Railway company permission to use electricity as a motive power.

Jas. Rowan has petitioned the city council of Dubuque, Iowa, for permission to construct a belt electric railway seven miles long, principally on the bluffs of the city.

Walter H. Grigg and George L. Clayton will apply to the city council for a franchise to build an electrical or noiseless steam motor street railway at San Antonio, Tex.

The Asheville Street Railway company and the West Asheville & Sulphur Springs Railway company operating electrical railroads at Asheville, N. C., are putting in water wheels to generate electricity for the operation of their roads.

A man can now sit in a trolley car and ride through a delightful country from North Attleboro to Providence, covering over one-third of the distance from Boston to the Rhode Island metropolis. This is only the beginning of an enterprise which will yet connect Boston and Providence by electric cars over a distance of 44 miles.

The Chicago & Southwestern Electric Railway company, recently incorporated, intends to bring Oaklawn in closer connection with Evergreen Park and the South Chicago district. The road will start at State and Ninety-fifth streets and run west along Ninety fifth street to Oaklawn. The total length will be six and a half miles.

The directors of the Detroit & Suburban Street Railway company, which operates the line between Detroit and Wyandotte, have made a contract with the Westinghouse company for the equipment of their road. Work will be begun immediately, and the contract provides that the equipment shall be completed within fifty days.

The South Chicago Electric Railway company has just purchased three acres of land on Ewing avenue for $27,500 from the Calumet Canal and Dock company. The track of the road has been laid from Jackson park to South Chicago on Coles and Buffalo avenues. The track is also being laid on Commercial avenue, south of Seventy-ninth street. An extension of the road is contemplated in a line west on Seventy-ninth street to Stony Island avenue, and from there north to Sixty-fourth street, where it will connect with the Alley "L" line.

Right of way has been secured and surveys were started last week for a railway line between Marquette, Mich., and Negaunee, thirteen miles distant. The right of way is in the name of M. E. Ascire of Marquette, who is agent for outside capitalists whose identity is not yet positively known The company will use either electric power or a new steam motor. Negaunee and Ishpeming are already connected by an electric road, so that the new line will give frequent passenger service between the three cities. The new line will be in operation next summer.

TELEGRAPH.

A division of the Order of Railway Telegraphers has been organized at Augusta, Ga., with 30 members.

A new telegraph line is contemplated from Denver to Helena, Mont. It is to paralled the Western Union line and be operated in connection with the Postal Telegraph system. A company is to be formed to handle this new line with a capitalization of $475,000.

The Western Union company has moved its Augusta, Ga, office to the *Chronicle* building. It is said that the Augusta office is a deficiting station, and that the company is operating it at a loss so far as local business is concerned. All the money taken in is spent in the town in payment of salaries, and as much more has to be supplied by the company to meet office expenses every month.

A dispatch from Kansas City says: "The telegraphers' convention, which was expected to do wonders in the formation of a new union to comprise all the old brotherhoods, etc., seems to have fizzled out. The proceedings have been kept secret, but it is understood that there was an ugly fight over the constitution, which so disgusted many of the delegates that they have left the convention and the city. It has been decided to call the new organization the United Telegraphers of North America, and elect G. W. Baird of Topeka, Kan., chief officer."

TELEPHONE.

Permission has been granted the Chesapeake & Potomac Telephone company to lay underground cables in several streets in Washington.

The Telephone company of Cincinnati is now making preparations to put its wires in the conduits and it is expected will begin drawing them through in about two weeks.

Judge Pugh, of Columbus, O., recently delivered two opinions over the telephone, standing at an instrument in his residence. The decisions were taken down by two deputy clerks in the court house, one holding the receiver to his ear and repeating the words to the other, who put them in writing.

In the Circuit Court at Chicago recently Moses Cohen, a member of the firm of A. Lieberman & Co., entered suit against the Chicago Telephone company to recover $25,000 damages for personal injuries. On May 11th last Cohen was riding along Forty-second street near Ashland avenue. Employes of the company were working on the street and through their negligence, it is claimed, a heavy cross pole fell on Cohen's shoulder and seriously injured him. It is alleged that his mind has been affected.

MISCELLANEOUS.

A new laboratory for electrical study will soon be opened at Lehigh University.

Articles of incorporation have been issued to the Maroa, Ill., Electric Light company, with a capital stock of $12,000.

It is reported that the electric wiring in Dallas, Waco and other Texan towns is in a defective condition. The advisability of arranging to have the electric lighting of the state inspected by a competent man is now under discussion.

The electrical workers attracted attention in the parade in Chicago on Labor Day. Silks hats and black suits were worn by the men, each of whom carried a fancy Japanese parasol surmounted by an incandescent lamp. The truck that preceded this body was also a feature. At each end of it was an abbreviated telegraph pole with a network of wire strung from one to the other, while on the cross arms were seated four linemen apparently busily at work.

The Edison Electric Illuminating company of Spokane, Wash., has submitted a proposition to the city for furnishing the water for the city. It is proposed to transmit electric power from the city to a point on the Spokane river, to erect a station there on a block of ground which can be purchased at a nominal sum from the school trustees; filter

the water of the Spokane river through the porous gravel banks to be found there, and deliver the water by the same pumps which are now used and which are capable, under the plan proposed, of supplying a city of double the present size of Spokane, to a reservoir on an elevation 200 feet above the corner of Howard and Riverside, and lying between Division street and Spokane street and south at Ninth street, using this reservior as a distributing reservoir, and connecting it with a general distribution system. At the reservoir a small pumping plant would be run by an electric motor to elevate the water from the reservoir to a stand pipe. The company also proposes to furnish to the city of Spokane the electric motive power to run the present pumps of the city, or any pump which it may install, on the basis of $5.00 per million gallons per day, delivered at the proposed new station, the basis of measurement to be governed by the standard now in vogue in the present pumping station. When the consumption shall have reached 8,000,000 gallons per day, then the rate to be reduced to $4 50 per million gallons, and if the consumption shall ever reach 12,000,000, then the rate to be reduced to $4.00 per million gallon.

TRADE NEWS.

Mr. Richardson of the Enterprise Electric company, Chicago, has recently sold the city of St. Louis one hundred and fifty thousand feet of rubber covered wire, The Enterprise company is building up a very fine trade in St. Louis and vicinity on wire and other electric supplies.

Charles E. Lee, western manager for the Electric Gas Lighting company of Boston, returned to Chicago last week from a trip through the Northwest. Mr. Lee visited St. Paul, Minneapolis and other points and judging from his own experience he predicts an excellent season in that territory.

The Chicago Rawhide Manufacturing company has recently received an order from London, England, for 25,000 feet of rawhide belting. This company has a large amount of its belt running lighting plants on Atlantic steamships—notably the City of New York and the City of Paris—and in Europe. Among recent sales in Chicago is a full equipment for the Goodrich line of steamers, each one having a Mather installation.

The Mountain Electrical Manufacturing & Construction company, of Myersdale, Pa., has just opened its factory, and recently the plant has been inspected by a number of visitors. The building is iron, 65x100 feet, two stories and basement. At the rear is the engine and boiler house. The basement will contain the brass foundry. All the machinery will be on the first floor. The seventeen machines are nicely arranged and this floor presents a very tidy appearance. At the front of the building, first floor, are the offices. A large elevator will run from the basement to the upper story. Manager Geo. A. Smith especially deserves much credit for the business-like manner in which everything under his supervision has been done since the work was commenced. He has shown great interest, not only in the plant, but in everything pertaining to the welfare and future prosperity of the town, and doubtless it will all redound to his credit in the successful operation of the construction works.

Some months ago the Massachusetts Chemical company of Boston called the attention of its chemists to the fact that at the present time it is very difficult to buy really good shellac, the material of commerce being very much adulterated. Believing that it should be possible to produce a varnish which could be marketed at a lower price than shellac and at the same time be of uniform quality and high resistance, the company has been at work upon the problem. That its efforts have been successful in a very great degree was demonstrated by the production of an alcohol varnish of an insulation resistance nearly four times greater than that of the best grain alcohol shellacs. The Massachusetts Electrical Engineering company, of Boston, is the authority by which this superiority is established. This varnish is aptly named "Insullac" isolating gum. It is of a beautiful transparent amber color, but to suit the public taste the manufacturers will produce it in any desired color. Its appearance when applied, method of application and rapid drying qualities are identical with those of shellac. Prof. Babcock, the well known Boston chemical expert and assayer, reports that a careful analysis of the new compound shows no traces of any acids injurious to any materials to which it may be applied or any constituent in any way injurious to the health of workmen.

BUSINESS.

One of the largest stocks of switches and sockets in Chicago is carried at the local office of the Bryant Electric company. T. G. Grier is the agent, and his office is at 1522 Monadnock building.

"Some Solid Facts" about the Standard storage battery are given in a neat little pamphlet that has just been issued by the Standard Electric company of Detroit, Mich. The little book talks business in a sensible manner, and it should be interesting to those making inquiries in regard to storage cells.

Archer & Rusling have been appointed western managers of the Duplex Electric company of Corry, Pa. Mr. Archer was formerly constructing expert with the Thomson-Houston Electric company, Chicago. Mr. Rusling was also connected with the Thomson-Houston Electric company and Excelsior Electric company as salesman. The offices of Archer & Rusling are at 1325 Monadnock building, Chicago. The Duplex company is to be congratulated upon the good judgment displayed in the selection of western representatives.

Secretary C. E. Newton of the Jewell Belting company of Hartford, Conn., reports a very perceptible increase in the sales of belts to the electrical trade. A few of the recent shipments are as follows: Jamestown Electric Street Railway company, Jamestown, N. Y., two 36-in. double belts; Richmond Railway & Electric company, Richmond Va., one 56-inch and one 36-inch double; Hartford Electric Light & Power company, Hartford, Conn., one 60-inch 3-ply and one 44-inch double; Jersey City & Bergen Railroad company, Jersey City, N. J, three 27-inch doubles; North New York Electric Light company, New York city, one 48 inch double; Albany Railway company, Albany, N.Y., one 48-inch double; Elizabeth Electric Light company, Elizabeth, N. J., one 42-inch, 20-inch, two 18-inch and others; United Electric company, Springfield, Mass., one 44-inch double; Chicago, Milwaukee & St. Paul Railway company, Milwaukee, one 56-inch double; Carroll Electric Light Works, Matteawan, N. Y., one 22-inch double; Wm. Deering & Co., Chicago, Ill., one 48-inch double; Salem Wire Nail company, Findlay, O., two 40-inch double, two 30 inch double, and one 24-inch double.

In the new automatic switch which is manufactured by Albert Sechrist, Denver, Colo., each armature has magnetic connections with the opposite pole of its magnet, thereby making very powerful magnets with a small amount of current. The switch is designed to be operated by either an ordinary battery, or, with the use of a rheostat, it may be operated with a shunt off the electric light circuit. The switch is constructed on a porcelain base with a metal cover. Instead of operating the switches by hand they are controlled automatically by means of push buttons. The automatic switches controlling the various lights in the house are all located in some out-of-the-way place where they are not seen, and only the push buttons appear on the walls, from where it is desired to control the light. Any number of push buttons may be located at different points to control the same switch. For convenience two push buttons are used to control the same light, one white and the other black. The white button operates the switch which turns on the light, and the black button operates the switch which turns off the light. By having banks of buttons located at different points a person moving about the house need never be in the dark, as simply touching a button here or there turns on the light ahead or extinguishes the light no longer needed. The hall lights may be turned on or off from either the first, second or third stories and also from each chamber. A set of buttons may be located beside the bed and by simply touching this or that button it is possible to turn on or off any of the lights in the house. Although Mr. Sechrist's method was introduced less than a year ago, it has already become quite popular among architects and owners of fine residences in Denver. The system is also valuable as a burglar alarm, as the light may be automatically turned on.

The Washburn & Moen Manufacturing company, Worcester, Mass., is now manufacturing and offering to the trade what it claims is the first and only strictly fire-proof insulated wire ever produced. It is called the "Salamander" wire. The covering of this wire, it is asserted, will not burn when exposed to a flame, and the conductor can be heated to the melting point without igniting the inside insulation. This is just what is needed for the inside wiring of first-class buildings, both public and private. On the 18th of August, 1892, an exhibition test of the Salamander wire was given in New York, before a body of insurance electrical inspectors and experts, most of whom were connected with the National Board of Fire Underwriters. The tests were conducted in the following manner: Several smooth sample boards were prepared, each having arranged upon it samples of various well-known electrical wires, one sample upon each board being the Salamander wire. All samples upon the boards had the same size conductor, and were carefully wired together into a circuit, the plan being to test them in comparison, and under the same conditions. These sample boards represented sixteen leading makes of insulated wires, several of them being claimed by their makers to be fire proof. A powerful electrical current was then applied, and maintained until the conductor was first brought to a red heat, then a white heat, and in some cases, melted Under this intense heat, every one of these samples, it is stated, except the Salamander was wholly destroyed, in several instances setting fire to the board and blazing all around the Salamander, but in no case did sufficient heat escape through the Salamander covering to discolor the board beneath it. This was certainly a remarkable showing. The Massachusetts Electrical Engineering company recently made a similar test with the Salamander wire in Boston, and the results there were equally satisfactory. The *Boston Journal* gave an interesting account of the test. "The Salamander," said an expert at the exhibition, "has all the insulating qualities and the additional fire-proof quality, which makes it a safeguard against fires."

ELECTRICAL PATENTS.

Issued Sept. 3, 1892.

482,339 Electric Light Fixture. Edwin R. Crolius, Chicago, Ill.

482,343 Inclosed Conductor for Electric Railways. George A. Dupuis, Detroit, Mich.

A contact making conductor carried by the car is adapted to travel between upper and lower pulleys and to raise the upper pulleys so that they may make contact with an electrical conductor whereby current may pass through the pulley to the car. The contact making conductor is provided with insulation upon its lower surface where it bears upon the lower pulleys, thus insulating it from the ground

482,374 Automatic Electric Cut Out. Cyprien O. Mailloux, New York, N. Y.

482,379. Fire Alarm. John C. F. McGriff, Los Angeles, Cal.

482,397. Ventilating Armature for Dynamo-electric Machines. Elihu Thomson, Lynn, Mass.

The armature is hollow and the shaft upon either end is provided with encircling sleeves, one open to the air and the other connected with a blower, whereby a draft is maintained through the interior of the armature.

482,420. Adjustable Thermostat. Melvin D. compton, Newark, N. J.

Electro-magnets are combined with a thermostat in such a manner that when the initial contact is made an electro-magnet will be energized and will hold the circuit closed, thus obviating vibrating contacts.

482,421. Rudder Indicator. Charles Cory, New York, N. Y.

A pivoted core to which the indicator is attached is wound with a coil of wire connected in series with a ring coil surrounding the pivoted core, and means are provided for altering the points where the current enters and leaves the ring coil as the rudder is turned.

482,422. Railway Crossing Protector. Robert J. M. Danley, Columbus, Ohio.

Two sets of relays are adapted to operate an alarm or a gate for trains and two other relays control the first two sets to make them inoperative when a train has passed the alarm or gate.

482,423 Railway Crossing Protector. Robert J. M. Danley, Columbus, Ohio.

482,425. Galvanic Battery. Thomas T. Eckert, New York, N. Y.

When one zinc has been eaten away another zinc is superimposed by means of short screws of the same material, thus enabling the zinc element to serve until completely dissolved.

482,433. Safety Device for Electric Circuits. Llewelyn B. Atkinson, London, England.

A subsidiary circuit, insulated except at its extremities from the main conductor, is protected by a fuse or cut-out operating with less than the normal current carried by the main conductor.

482,435. Electric Arc Lamp. Henry H. Cutler, Waltham, Mass.

The lamp is provided with a feed actuator governed by a circuit controller and a thermal feed regulator, responsive to changes in length of the arc, operates the circuit controller for the feed actuator.

482,440. Telegraph Relay. William Maver, Jr, New York, N. Y.

A rectangular movable coil is pivoted with two of its sides parallel to two sides of a stationary coil while the other sides of the coils are at an angle to one another respectively; the movable coil carries an arm adapted to make contact with one of two contact points.

482,444. Voltaic Pile. William E. Washburn, Cedar Rapids, Iowa.

482,464. Burglar Alarm. Homer T. Wilson, Louisville, Ky.

482,486. Line Wire Tightening Device for Electric Lamp Support. Charles A. Pfluger, Chicago, Ill.

A rotary binding post is combined with a suspension support, and means are provided for holding the post against the strain of the tightened line wire.

482,506. Underground Trolley. Joseph Fischer, Cleveland, Ohio.

The trolley arm is circular and is surrounded by an anti-friction sleeve where it passes into the conduit to prevent wear upon the arm.

482,535. Clamp for Arc Lamp Carbons. August Weber, Schenectady, N. Y.

The opening into which the carbon is to be inserted is retained open when no carbon is in place to permit the insertion of a carbon without the necessity of manually moving the clamping member out of the way.

482,549. Means for Controlling Electric Generation. Thomas A. Edison, Menlo Park, N. J., Filed Mar 12 1881. Serial No. 28,141. Patented in England June 7, 1881, No. 2,482; in Germany July 20, 1881, No. 24,608; in Italy July 30, 1881, No. 13,198; in Belgium Aug. 16 1881, No. 55,302; in Victoria Sept. 6, 1881, No. 3,078; in India Oct. 13, 1881, No 822; in New South Wales Oct. 26, 1881; in France Oct. 28, 1881, No. 144,103; in Spain Nov. 2, 1881, No. 1,781; in Austria Hungary Nov. 13, 1881, No. 31 and No. 1,862; in Queensland Dec. 30, 1881; in New Zealand Jan. 4 1882, No. 580, and in Canada Nov. 23, 1882, No, 15,846.

One or more magneto-electric machines are combined with a main circuit and an exciting machine supplying the field circuit of the main machine, and means are provided for varying the speed of the exciting machine independently of the main machine, while a suitable electrical indicator shows the condition of the main circuit.

482,568. Electric Arc Lamp. Hubert H. Bigland and John Burns. Newcastle on-Tyne, England.

The upper carbon holder is connected with a twist rod which is adapted to be raised and with it the carbon holder, until the rod has reached a certain determinate point of its travel when a rotary motion is given to it whereby the rotation of the twist rod will offset the rise in the twist rod and maintain the carbon holder in a stationary position.

482,586. Electrical Furnace. Thomas Parker, Newbridge, England. Patented in England Oct. 29, 1889, No. 17,060; in France June 23, 1890, No. 206,566; in Germany June 27, 1890, No. 55,700, and in Italy Oct. 23, 1890, No. 431.

482,594. Electric Locomotive. William H. Soley and William W. Perkins, Philadelphia, Pa.

The shaft of a single motor is placed perpendicular to the car axles and communicates its motion thereto by means of worms and gears; the car axles are connected together by a perpendicular shaft and bevel gears, and clutches are provided upon each axle; the worms and gears upon the opposite end of the armature shaft are differential, whereby the speed of rotation may be altered by throwing into action one or the other of the clutches.

482,668. Electrical Apparatus. Leonidas G. Woolley, Grand Rapids, Mich.

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In cities where we are not already represented. Liberal discounts and exclusive territory to responcible dealers in electrical apparatus.

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A man to take charge of armature department. Must thoroughly understand every detail in connection with Edison street car and Standard armatures, also T.-H. street car and alternating armatures. Must be quick and active, and thoroughly understand the handling of men. Apply, stating experience and salary expected, to

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Peterborough, Ontario, Canada.

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A situation by a thorough business man of experience and good habits; up in electricity and electrical and mechanical devices. A good hustler. Can furnish capital, or give security. Can not consider any "Nickel-in-the-slot" or "Fire-alarm-tonch-button" opportunities. Addres, "A. F.," care WESTERN ELECTRICIAN.

THE "CLARK" WIRE.

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The rubber used in insulating our wires and cables is especially chemically prepared, and is guaranteed to be waterproof, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather and is not affected by heat. The insulation is protected from mechanical injury by one or more braids, and the whole slicked with Clark's Patent Compound, and special extra finish, which we have now adopted for all our solid wires as an extra weatherproof protection, and also preventing chafing and abrasion, which is water, acid, and to a very great extent fireproof. Our insulation will prove durable when all others fail. We are prepared to furnish Single Wires of all gauges and diameter of insulation for Telegraph and Electric Lights from stock. Cables made to order. We are now prepared to furnish our Clark Wire with a white outside finish for ceiling cleat work as well as our standard color.

Clark Joint Gum should be used for making waterproof joints. This is put up in half-pound boxes, in strips about one foot long and five-eighths inch wide, and when wrapped about a joint and pressed firmly it makes a solid mass. **FOR RAILWAY** and **MOTOR** use, we make all sizes of stranded and flexible with Clark insulation.

WE GUARANTEE OUR INSULATION WHEREVER USED, AERIAL, UNDERGROUND OR SUBMARINE, and our net prices are as low, if not lower than any other first-class Insulated Wire. We shall be pleased to mail Catalogues with terms and discounts for quantities.

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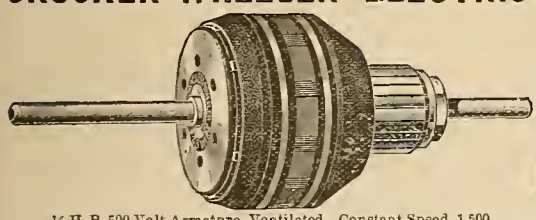

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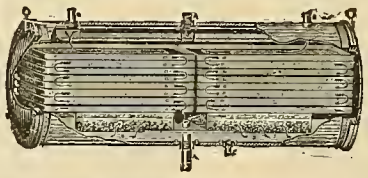

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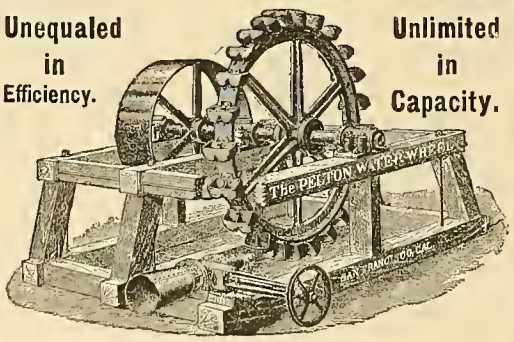

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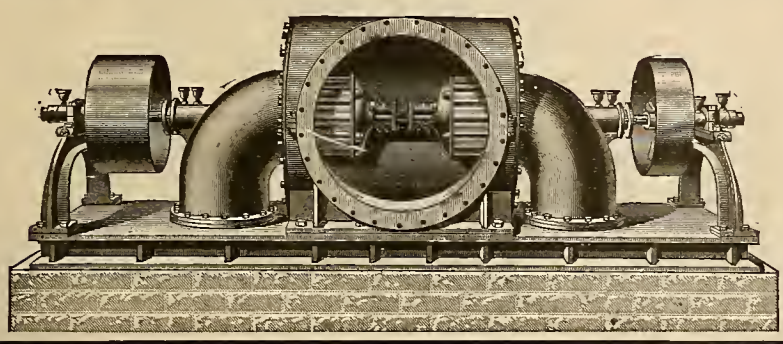

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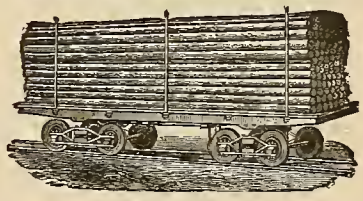

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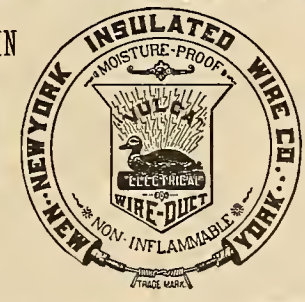

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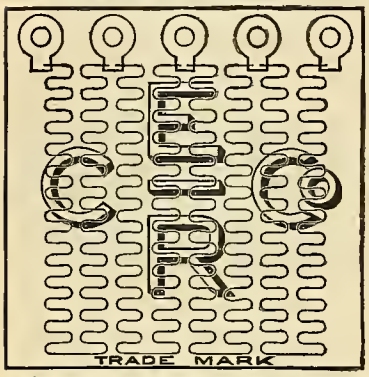

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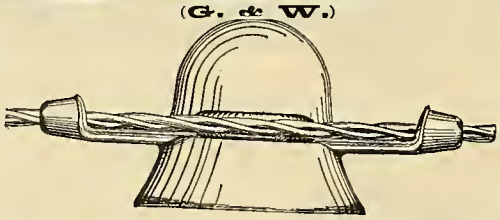

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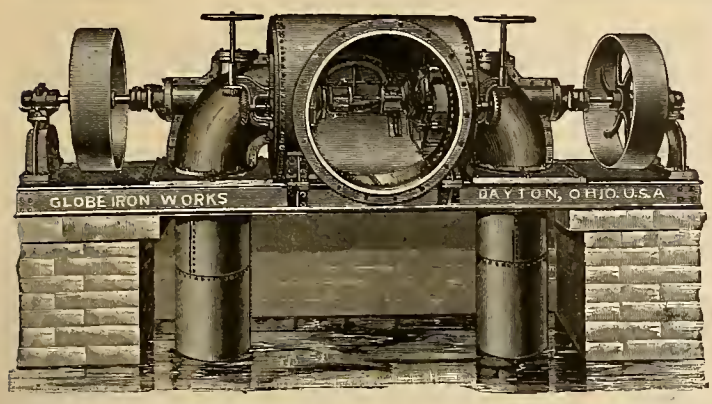

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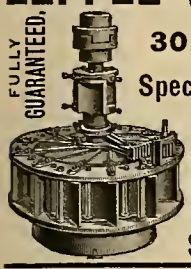

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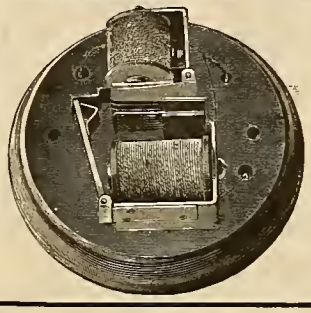

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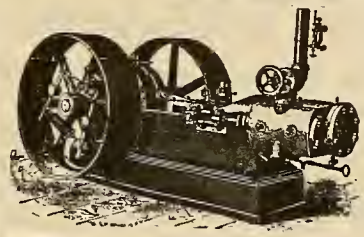

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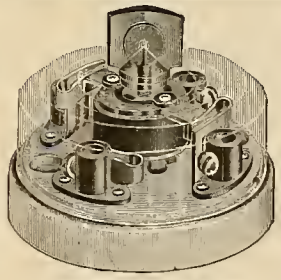

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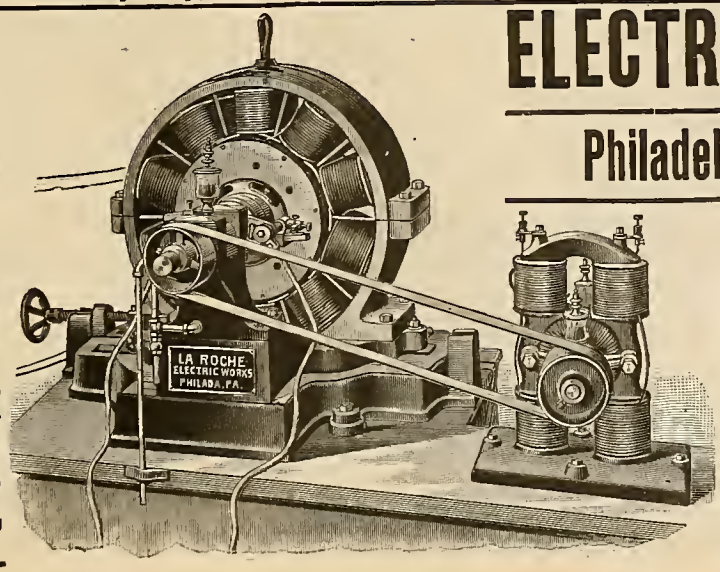

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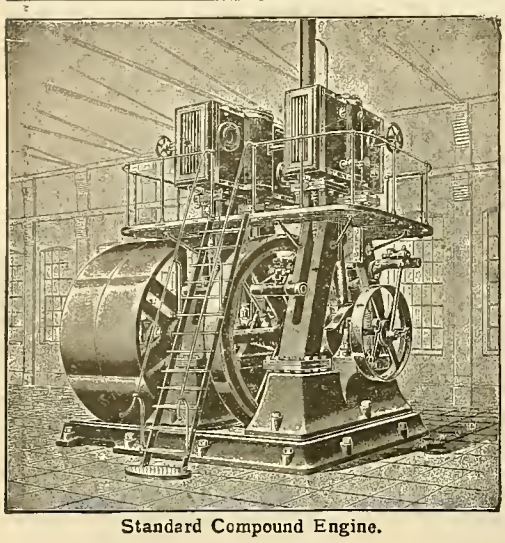

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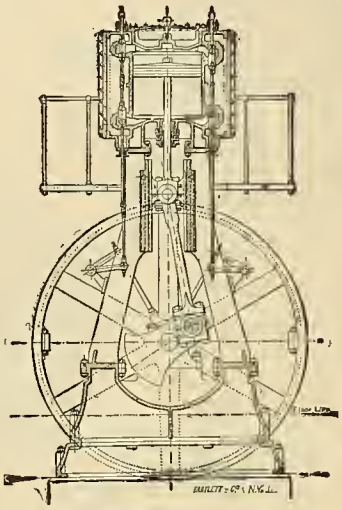

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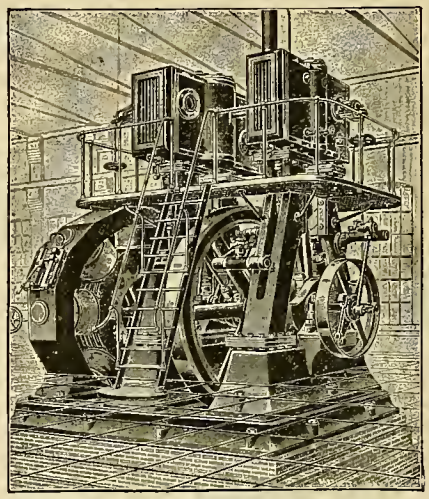

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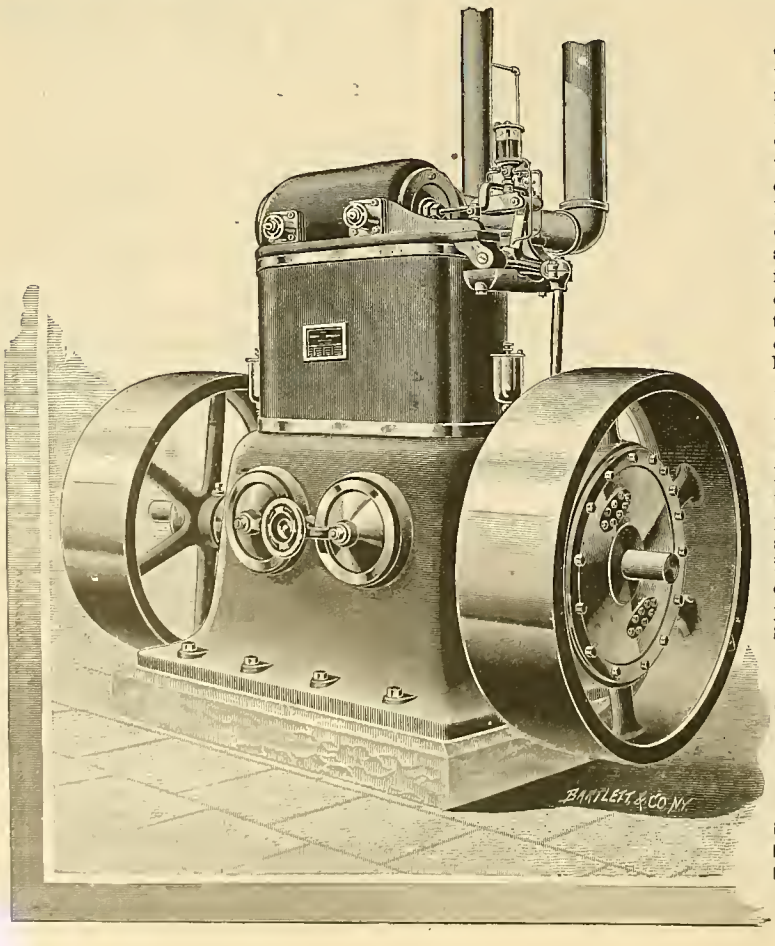

The Compound Engine, when non-condensing, so far from possessing an economy superior to the Simple Engine, has been decisively proven, "much to the disgust of the stockholder," to show normal economy only at or about its rated power, and to fall off in economy faster than a Simple Engine as the load falls off; moreover, very much faster under the extreme light loads that are common in Electrical Generation. This point is at last reluctantly admitted by the more candid builders of such engines, most of whom now advise against compounding for variable loads. The reason is in their inability to divide the load and range of temperature proportionately and automatically between the cylinders at all points of cut-off. Hence, the low-pressure cylinder expands its steam below atmosphere under a moderately early cut-off, thus converting itself into an Air Pump, and becoming a load upon the high-pressure cylinder instead of a co-laborer with it. This point was distinctly foreseen by the designers of the Westinghouse Compound Engine, and an entirely new principle was worked out, making expansion below atmosphere impossible under any load, however light. **For the first time in the history of Steam Engineering, either Simple or Compound, is built an Engine which maintains essentially uniform economy, irrespective of load,** and hence for the first time the Compound Non-condensing Engine has been made practicable. The results, demonstrated by test, show that where an ordinary Compound will range from 25 lbs. to 70 lbs. water per H. P. per hour from full to quarter load, the Westinghouse Compound, between the same limits, will range from 23 lbs. to 29 lbs. We have not deceived ourselves in this matter, and propose that the facts shall be understood. To those interested in the nicer points involved, we will be pleased to send a reprint of the paper read by Mr. F. M. Rites on this subject at the late meeting of the American Society of Mechanical Engineers, at San Francisco.

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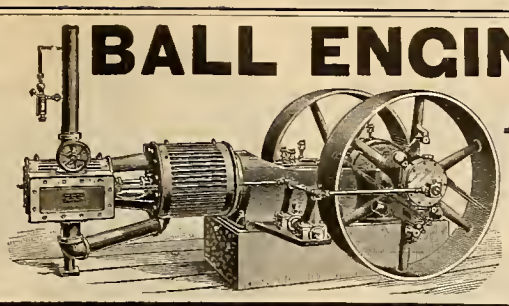

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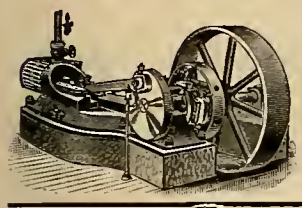

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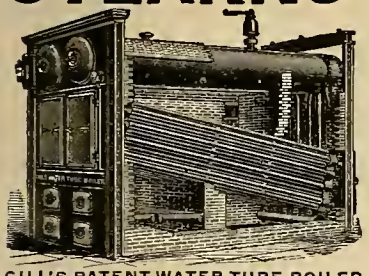

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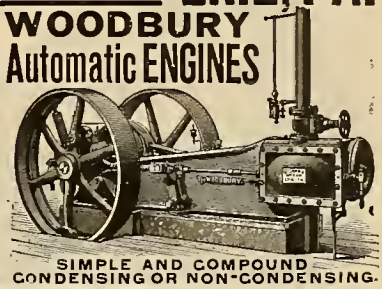

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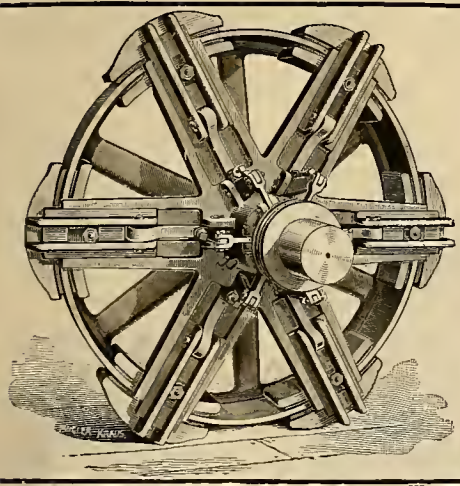

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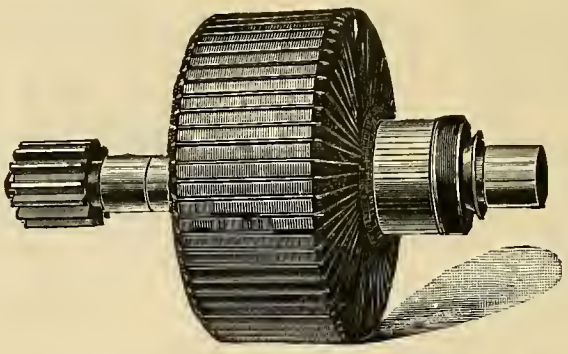

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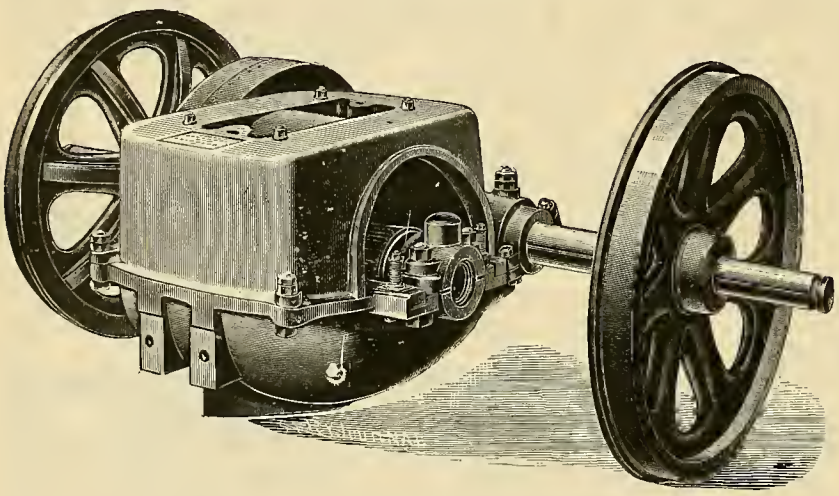

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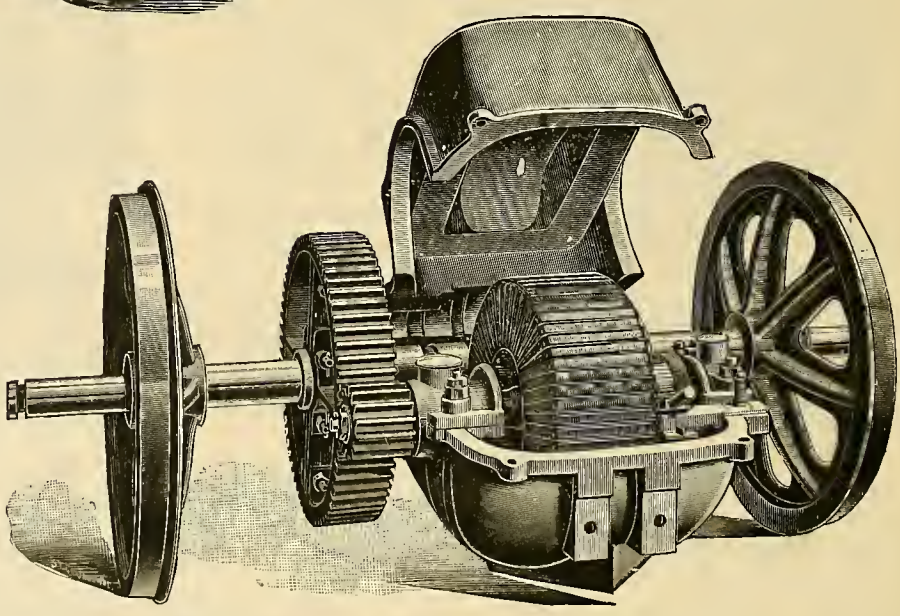

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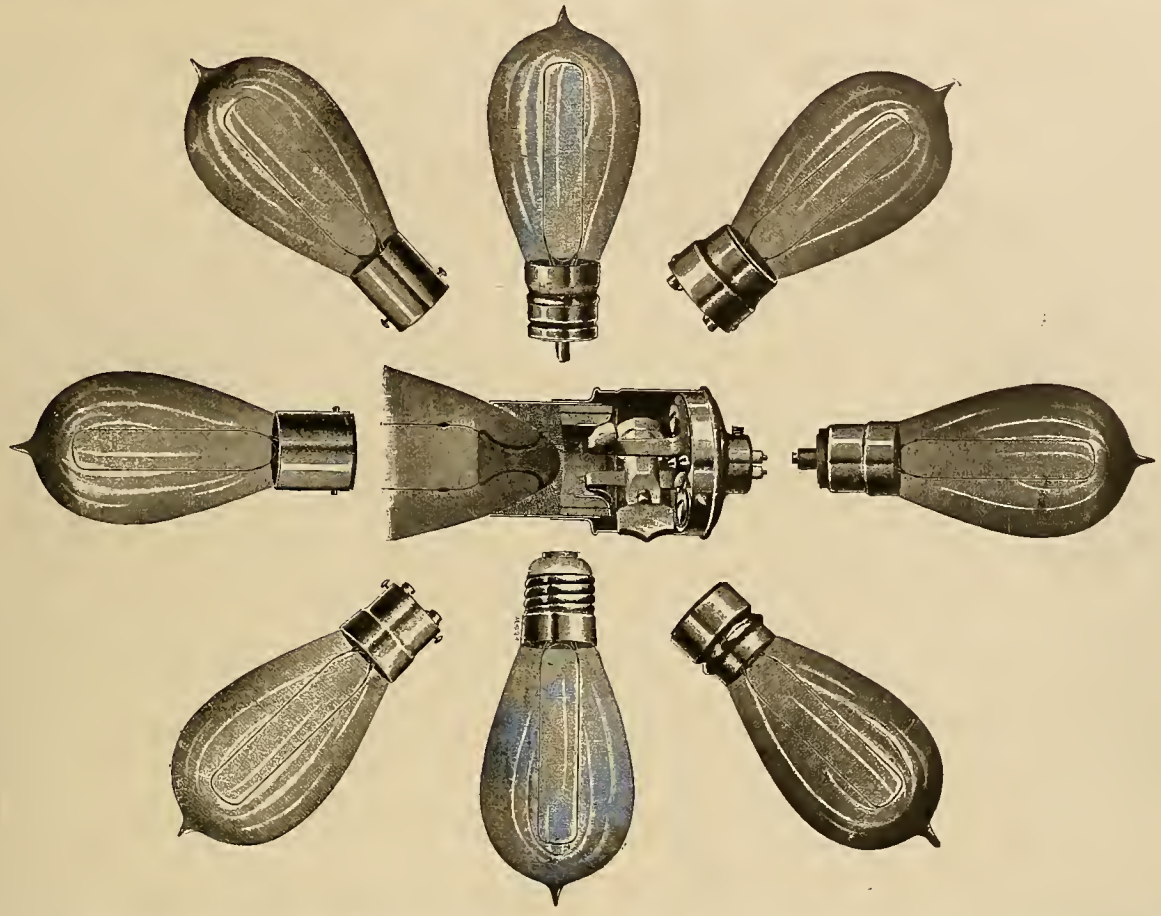

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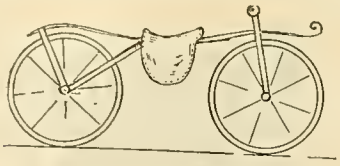

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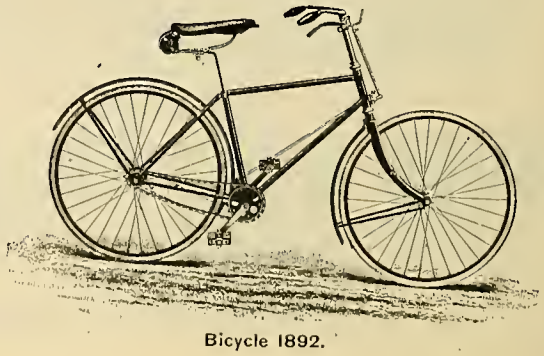

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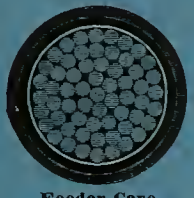
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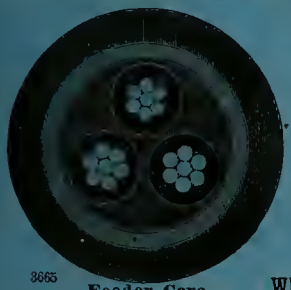
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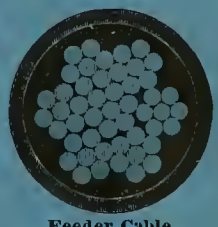
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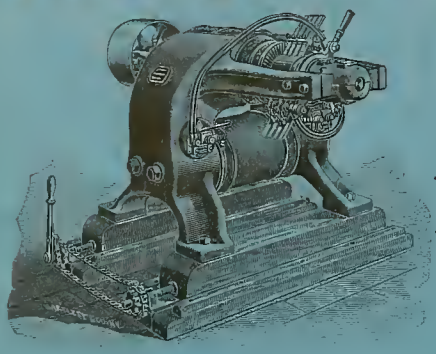

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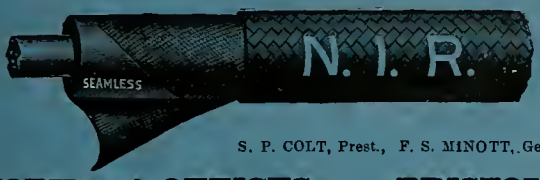

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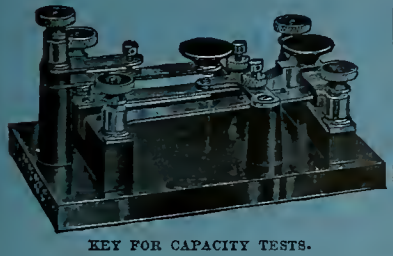

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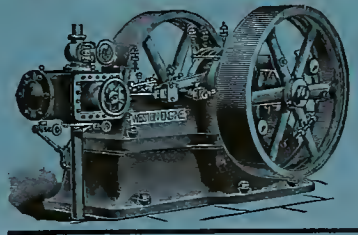

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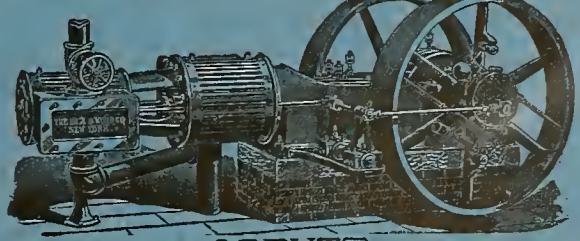

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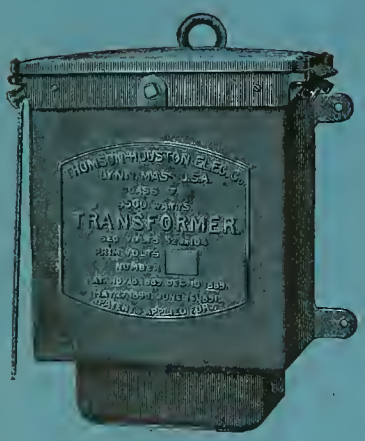

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INDEX AND CLASSIFICATION OF ADVERTISEMENTS.

ALPHABETICAL LIST.

American Battery Co..... ix
American Desk & Seating Co.. xvii
American District Steam Co.... x
American Electrical Mfg. Co..—
American Engine Co..... xii
Andrews & Co., A. H.... ... xiii
Babcock & Wilcox Co., The.... i
Baggot, E xiv
Ball Electric Light Co..... xvi
Ball Engine Co.....xix
Ball & Wood Co., The i
Beacon Vacuum Pump & Elec. Co.i
Becker Mfg. Co., John.....—
Beggs, J. E., Mch. & Supply Co. x
Bernstein Electric Co..... iv, xiii
Blanchard, Albert..... xix
Boston Braid Mfg. Co..... xiv
Bowers Bros..... xvi
Bridgeport Mach. Tool Wks.. xii
Brookfield, Wm..... xii
Brush Electric Co viii
Bryan, W. H..... xiv
Bryant Electric Co.....—
Buckeye Electric Co., The..... ix
Carpenter Enamel Rheostat Co. xvi
Central Electric Co..... ... v
Chicago Rawhide Mfg.Co..... vi
Columbia Inc. Lamp Co..... i
Crescent Ins. Wire & Cable Co. xiii
Crocker-Wheeler Electric Co.. xiii
Cushing, F. W..... vii
Cutter, Geo .....—
Cutter Electrical & Mfg. Co... ix
Dayton Globe Iron Works Co..xvii
Densmore Typewriter Co.....—
Detroit Electrical Works..... xxiv
Diamond Electric Mfg. Co.....—
Dixon Crucible Co., Jos..... xv
Dudley & Co., W. W..... xvi
Duplex Electric Co., Ltd..... xii
Eastern Electric Cable Co..... xiii
Eastman Kodak Co..... xiv
Edison General Electric Co.....viii
Electric Cons. & Supply Co... vi
Electric Engr'g & Supply Co.. iv
Electrical Mfg. Co., The..... xv
Electric Secret Service Co..... xix
Electrician Pub. Co..... —
Electrical Construction Co. The. xii
Electrical Eng. & Supply Co.The. v
Electrical Supply Co., The... xxii
Elektron Mfg. Co.....—
Empire China Works..... xiv
Enterprise Electric Co..... xv
Falls Rivet & Machine Co..... ix
Ferracute Machine Co.....—
For Sale Advertisements. x, xii, xiii
Fort Wayne Electric Co..... xxiv
General Electric Co.....ii
Gravity Purifier Co.....xviii
Great Western Elec. Supply Co ix
Greeley & Co., The E. S.....i
Hart & Hegeman Mfg. Co..... xvii
Heisler Electric Co..... iv
Hill Clutch Works.....—
Hine Eliminator Co.... xii
Holmes, Booth & Haydens.... xiv
Hood & Co., Wm.... xv
Hughes Bros. Mfg Co..... xii
Ide & Son, A. L xiii
Illinois Electric Lamp Co..... xvi
India Rubber & G. P. Ins. Co. xxiii
Institute of Technology..... xvii
Interior Conduit & Insulation Co. x
International Okonite Co..... i
Jewell Belting Co..... i
Johns Mfg. Co., H. W.....—
Kartavert Mfg. Co..... xvi
Klipstein, A..... xii
Knapp Electrical Works..... xxi
Lake, J H. & D., Co xix
Lake Erie Engineering Works.xviii
Lane & Bodley Co..... xix
La Roche Electric Works .....—
Lasell & Co., Edw..... xvii
Leclanche Battery Co., The .. xvii
Lefmann, Julius xv
Leffel, & Co., Jas xvii
Leonard & Co., H. W..... xix
Link Belt Machinery Co..... xv
Loud, H. M. & Sons Lumber Co. xiv
Lovell Mfg. Co., Ltd..... xiii
Mather Electric Co..... iv
Midland Electric Wks.....—
Moore, Alfred F..... i
Morse & Co., A. M..... xvii
Munsell & Co., Eugene.....xiii
National Carbon Co..... xiv
National Electric Mfg. Co.... v
National India Rubber Co.... i
New York Insulated Wire Co. xv
N. Y. Safety Steam Power Co. xix
New York & Ohio Co..... i
Otto Gas Engine Works..... xiii
Ostrander & Co., W. R..... xix
Page Belting Co..... —
Partrick & Carter Co..... xvi
Pearson & Co., W. B.....xviii
Pelton Water Wheel Co..... xiv
Perkins Elec. Switch Mfg. Co.—
Phoenix Glass Co..... —
Porter-Leavitt Elec. Motor Co.—
Proposals for Elec. Ltg..... xiii
Queen & Co..... xiii
Racine Hardware Mfg. Co..... xii
Railway Equipment Co..... ix
Redding Electric Co.....x
Ries Electric Specialty Co..... x
Roebling's Sons Co., J. A x
Rose Elec. Light Supply Co...—
Samson Cordage Works. xii
Sawyer-Man Electric Co..... xi
Schuyler Electric Co.....xviii
Sechrist, Albert..... xvii
Shawmut Fuse Wire Co..... xiii
Shultz Belting Co..... vi
Siebert, G..... xiii
Siemens & Halske Electric Co.—
Sioux City Elec. Supply Co...xviii
Sioux City Engine Works.... xix
Smith, A. T..... xiii
Smith, Thos. G. Jr..... xix
Somoff, J. L..... xv
Sperry Elec. Mining Mach. Co. xvi
Standard Electric Co..... vi
Standard Paint Co x
Stanley Electric Mfg. Co.....—
Stearns Mfg. Co..... xix
Sterling, W. C..... xv
Stilwell & Bierce Mfg. Co. xiv, xv
Sunbeam Incand. Lamp Co...xxiii
Taylor Engine Co.....xviii
Thomson-Houston Elec. Co.. ii, xx
Union Hardware Co..... xii
Utica Elec. Mfg. & Supply Co. x
Van Nuis C. S.....—
Vulcanized Fibre Co..... xv
Waddell-Entz Company..... xii
Wannopee Pottery Co..... x
Want Advertisements xiii
Washburn & Moen Mfg. Co.. —
Western Electric Co.....xiv
Westinghouse, Church, Kerr & Co..... xvii
Westinghouse Elec. and Mfg Co. xi
Weston Engine Co..... i
Woodhouse & Rawson, Ltd....—
Worthington, Henry R.....—

CLASSIFIED LIST.

Annunciators.
Central Electric Co.
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Electrical Supply Co., The.
Knapp Electrical Works.
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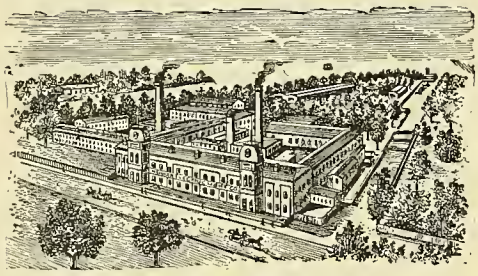

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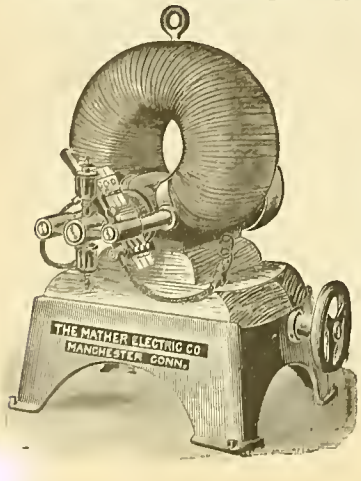

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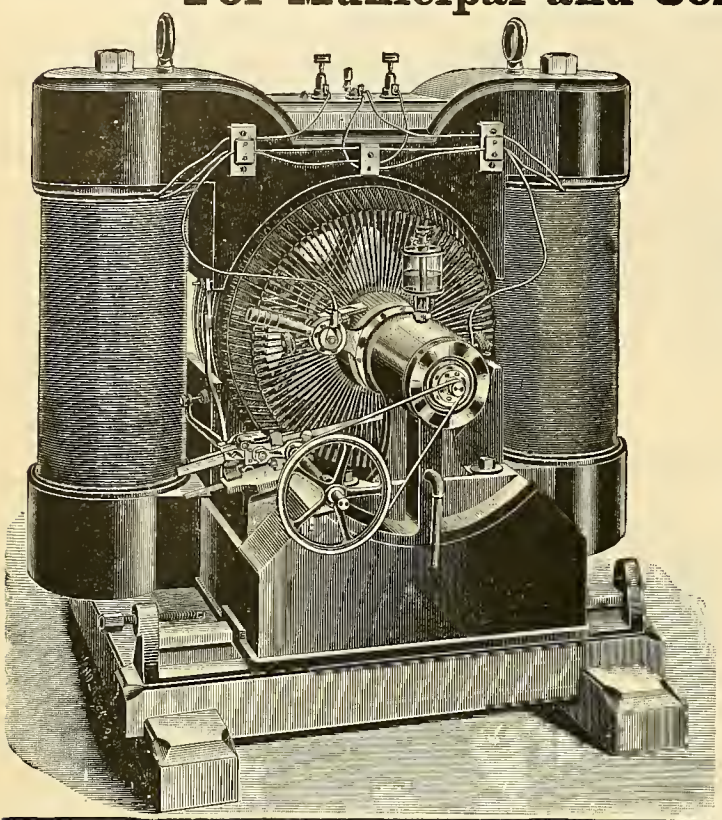

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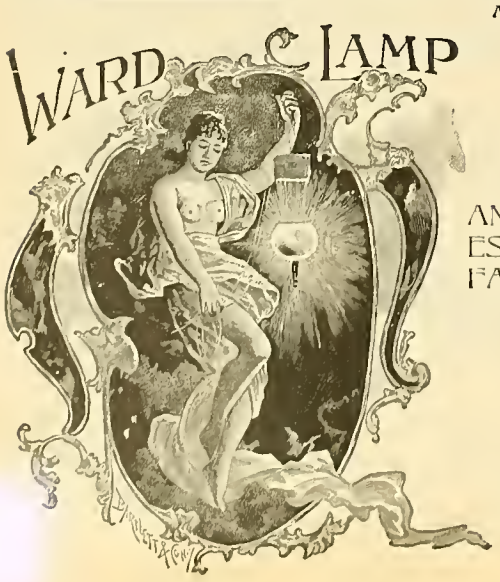

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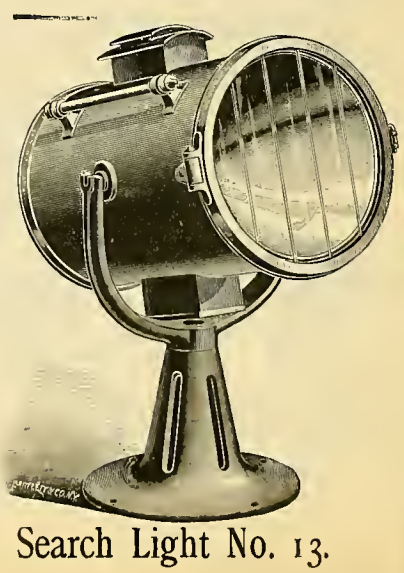

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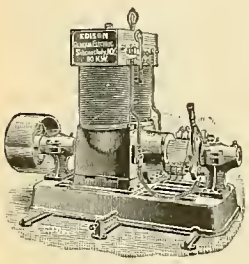

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MANUFACTURERS OF

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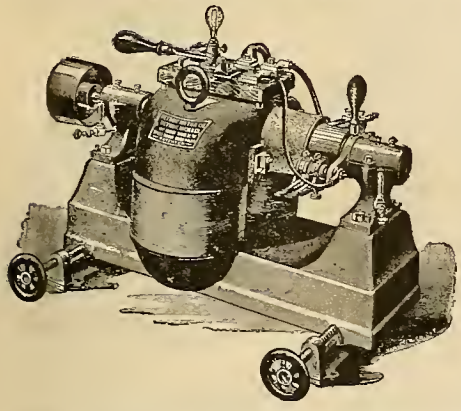

195--207 South Canal St., CHICAGO, ILL.

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INCANDESCENT LIGHTING.
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COMPLETE EQUIPMENTS
FOR CENTRAL STATIONS
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Manufacturers of { ELECTRIC SUPPLIES .. AND FIXTURES .. } of every description.

Dynamos, Motors, Lamps, Sockets, Wire, etc.

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Complete Electric Railway Station and Line Appliances.

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STORAGE BATTERY.

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Storage Batteries for Street Cars, Electric Lighting, Electric Launches, Electric Fans, Phonographic and Surgical Use, Etc., Etc.

Electromotive Force High; Life Long.

This Battery is made by the Planté process, no oxides being used, either mechanically or applied in the form of paste, paint or cement.

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C-S Double Push Flush Switch.

Single Pole. Double Pole. 3-Wire.

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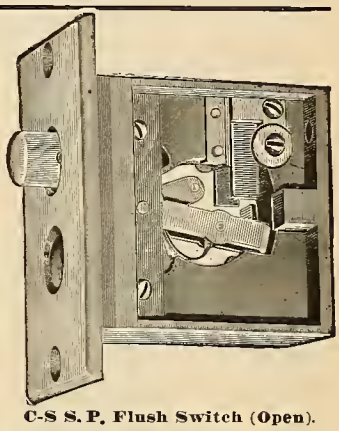

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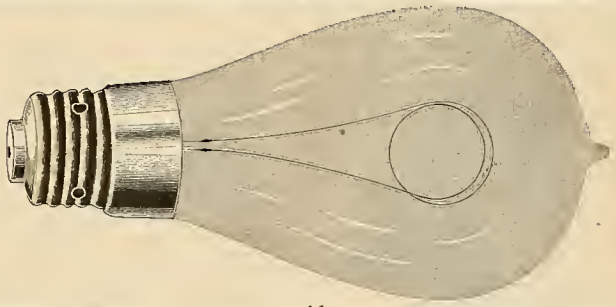

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GUARANTEES FULFILLED,
BEAUTIFUL LAMP,
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Will You Join the Procession?

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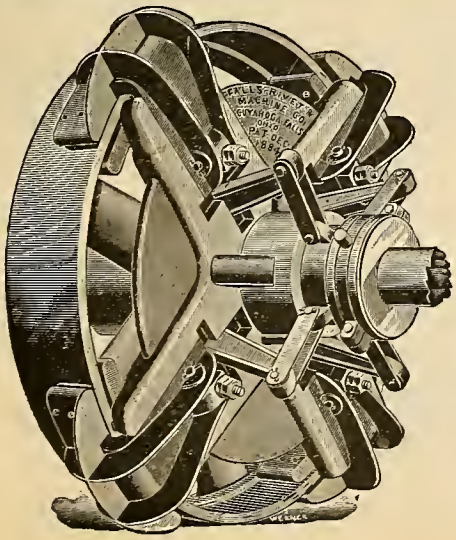

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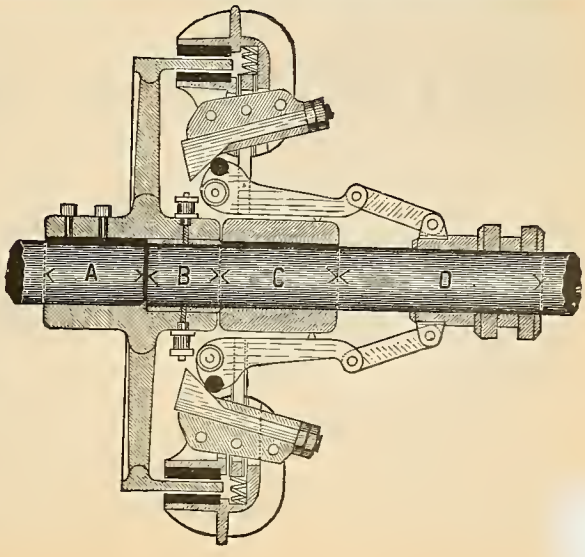

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FOR ALTERNATING CURRENT INCANDESCENT LAMPS, IS BEING UNIVERSALLY ADOPTED.

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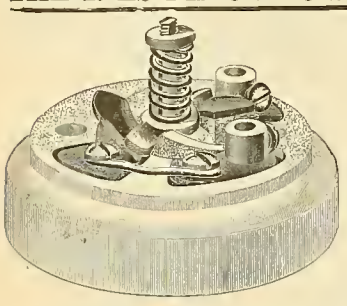

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A Switch and Cut-Out Combined.

EVERY SWITCH FITTED WITH FUSE.

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SEND FOR SAMPLE AND PRICES.

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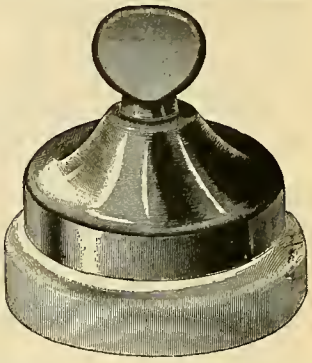

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Two 300 Amp. Shunt wound U. S. Dynamos.
Two 200 Amp. Shunt wound U. S. Dynamos.
Two 500 Lt. T. H. Dynamos, compound wound, with base, rheostat and ammeter.
Two 25 Lt. American 2,000 C. P. Arc Dynamos.
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Ten 12 Lt. Knowlee Dynamos, with lamps.
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One 15 Lt. Brush Arc, 7 amperes.
One 90 H. P. Armington & Sims Engine.
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THE JOHN E. BEGGS MACHINERY & SUPPLY CO., - 74 Cortlandt Street, NEW YORK.

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"UTICA" QUICK BREAK—ABSOLUTE LOCK—KNIFE SWITCHES for any voltage and amperes.
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When you are in need of First-Class Porcelain for Electrical Purposes, write the

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Warranted Hard Porcelain.

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Estimates Cheerfully Given.

Write Us at Once, We Can Save You Money.

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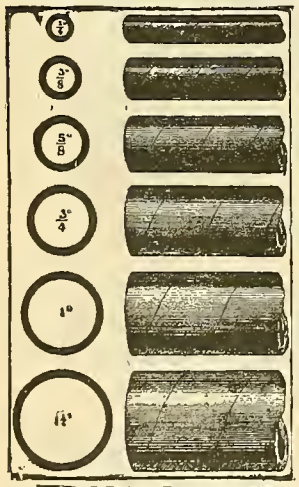

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The Solution of the Problem of Safe Guarding ELECTRIC CONDUCTORS

Wherever and for whatsoever purpose employed, is to be found in the

CONDUIT SYSTEM.

INTERIOR AND UNDERGROUND

CONDUITS

MANUFACTURED BY

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Southern Electrical Mfg. & Supply Co., 110 Baronne St., New Orleans, La.
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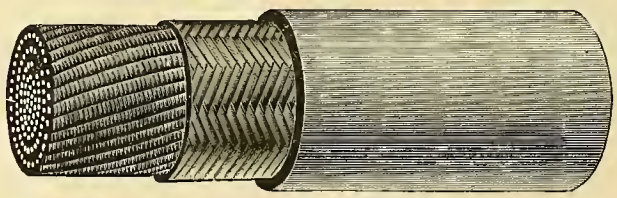
Insulated Wire

FOR ELECTRICAL PURPOSES.



Magnet Wire, Office and Annunciator Wire, Lead Covered Cables, Copper Wire, Telegraph Wire.

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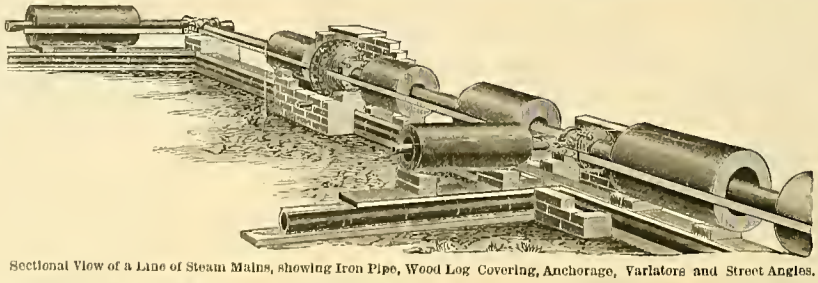
CHICAGO, 173 Lake St. **SAN FRANCISCO, 25 and 27 Fremont St.** **NEW YORK, 117 Liberty St.** **TRENTON, N. J.**

Holly System of Underground Steam Supply,

FOR THE UTILIZATION OF EXHAUST STEAM AT ELECTRICAL STATIONS.

For pamphlets and particulars regarding Electrical Companies who are using the "Holly System" and converting a waste product into money, address



Sectional View of a Line of Steam Mains, showing Iron Pipe, Wood Log Covering, Anchorage, Variators and Street Angles.

The prudent manager will not throw away his exhaust steam, which he can sell for $3,000 to $5,000 per annum for each 100 H. P., thereby materially increasing his net revenue.

AMERICAN DISTRICT STEAM COMPANY, LOCKPORT, NEW YORK.

WESTINGHOUSE ELECTRIC & MFG. CO.,

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MANUFACTURERS OF APPARATUS FOR

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LONG DISTANCE TRANSMISSION OF POWER,

Street Railway Generators, Motors and Appliances.

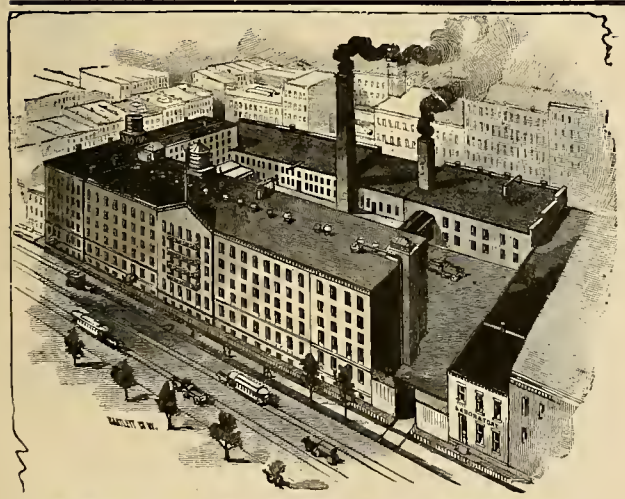
Our alternating current incandescent apparatus is in use in 430 central stations. 1,000 isolated plants. Our arc apparatus is in use all over the world.

We are now transmitting light and power various distances up to 28 miles from the source.

Our multipolar railway generators and noiseless single reduction motors have worked a revolution in the electric railway field in two years.

Orders for APPARATUS, REPAIRS and SUPPLIES formerly furnished by the United States Electric Lighting Co., Newark, N. J., should now be sent to this Company, where they will receive prompt attention.

BRANCH OFFICES IN ALL THE LEADING CITIES.
AGENTS FOR CANADA: AHERN & SOPER, OTTAWA, ONT.



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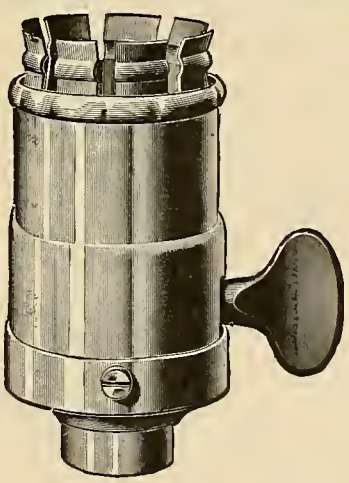

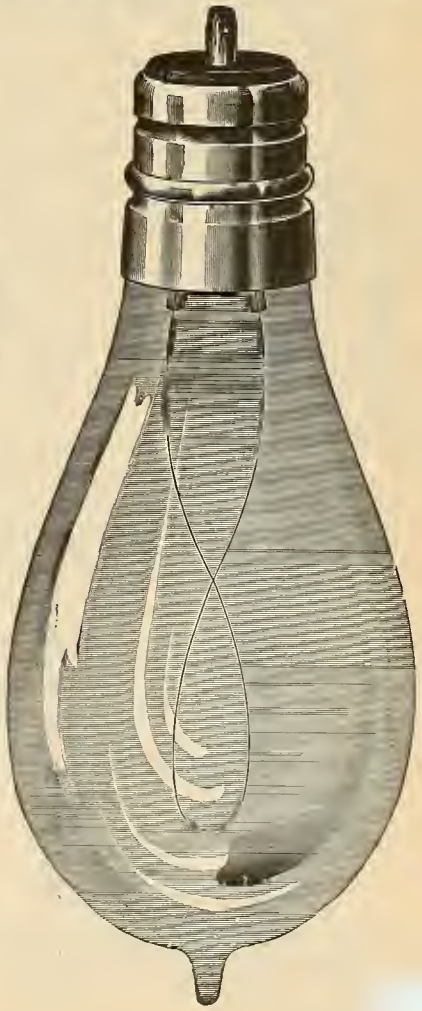

LAMPS,

8 C. P. to 150 C. P. 45 Volts to 125 Volts. To Fit Principal Sockets.

SOCKETS, SWITCHES, CUT-OUTS

AND GENERAL ELECTRICAL SUPPLIES.

WRITE FOR CATALOGUE.

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620 Atlantic Avenue, **BOSTON.**
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STANDARD SCREW GLASS INSULATORS

MANUFACTURED BY

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AUTOMATIC ENGINES

SUPERIOR REGULATION AND ECONOMY FOR ELECTRIC LIGHTING AND GENERAL PURPOSES

16 SIZES CARRIED IN STOCK

WE TEST EACH ONE OF OUR ENGINES BEFORE SHIPPING

FOR PRICES AND CATALOGUE ADDRESS ENGINE DEPT.

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HUGHES BROS. MFG. CO.,

MANUFACTURERS OF

Cross Arms, Insulator Pins and Brackets,

And Electrical Molding.

Correspondence Solicited.

CHATTANOOGA, - TENN.

Second-Hand Dynamos

FOR SALE CHEAP.

We have a number of Dynamos and Motors nearly new, which we will sell at a low price, among the number being **two 650-light, 1,000 volt Alternators.**

WANTED TO BUY:

Second-hand machine, from 50 to 200 lights, 110 volt.

G. A. HARTER,

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SAMSON BRAIDED CORD.

is the most durable for hanging Arc Lamps, Trolley Cord, Covering Field Magnets, Sash Cord, etc., etc.

Send for Samples and Prices.

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LATHES

E. P. Bullard, Propr. Bridgeport, Conn.

SAL AMMONIAC

(ELECTRIC BRAND)

For Electrical Purposes

Guaranteed 98/99% and free of lead and iron. If you want the best quality ask your dealer for this brand. Imported by

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THE LATEST AND BEST

SLOW SPEED, MULTIPOLAR DYNAMO.

ADVANTAGES: Slow speed, small floor space, direct driven, self-oiling bearings, little external magnetism, etc.

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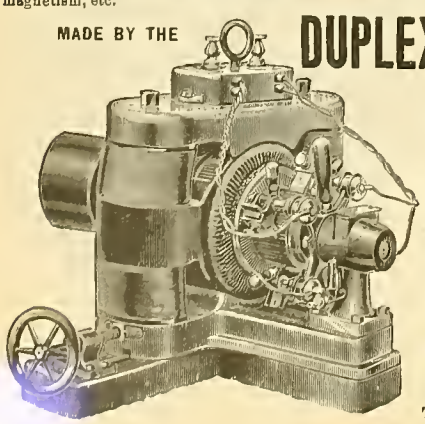

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Limited,

CORRY, PA.

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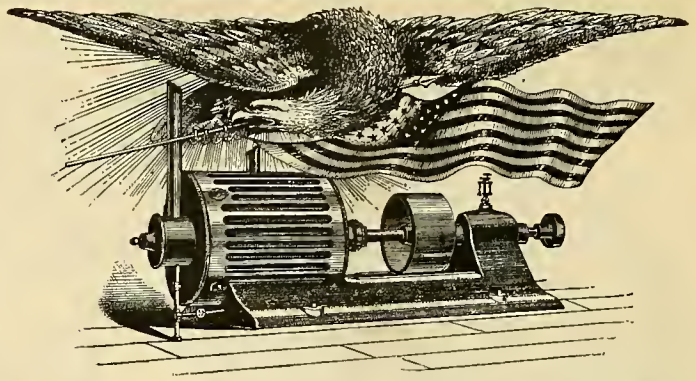
Providence, R. I.—Drake, Payson & Whittier, Cor. Washington & Eddy Sts.
Tarpon Springs, Fla.—W. D. Wilson.



AMERICAN HIGH SPEED ENGINE.

This Engine revolutionizes the manner of applying steam in generating power. It can be regulated so as to run at any speed desired, up to

1000 OR MORE REVOLUTIONS PER MINUTE !

It is not a rotary Engine, yet the motion of its parts is such that there are no "dead centers." It takes steam and exhausts four times at each revolution. For

SPEED, SIMPLICITY AND ECONOMY,

this Engine has no equal. It possesses many striking advantages over all other Engines, either slow speed or so-called high speed. Its speed is closely regulated by a sensitive and reliable automatic governor. Built of any required size,

FOR ALL STATIONARY AND MARINE PURPOSES.

It can be **coupled directly** to dynamos, fans, blowers, fire engine and other rotary pumps; in fact, to **any** machine requiring great velocity. It is smooth running and **noiseless.** Being light and compactly built, it takes up less room than any other Engine of equal power. No heavy foundations are required. This Engine is

THE ACME OF SIMPLICITY.

No skilled engineer is required.

For further particulars and Illustrated Catalogue, call upon, or address

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HINE'S ELIMINATOR.

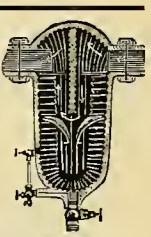
THE ACKNOWLEDGED SUPERIOR OF ALL

Steam Separators and Oil Extractors.

VERTICAL.

In twelve trials in the "Cornell" Separator test, it averaged 98 7-10 per cent Dry Steam. Outstripping all competitors.

Send for Circular and Cornell test report.



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HINE ELIMINATOR CO., 106 Liberty St., NEW YORK.

This advertisement appears every other week.

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UNION HARDWARE CO.,

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—AND—

95 CHAMBERS STREET, NEW YORK.

The WADDELL-ENTZ COMPANY,

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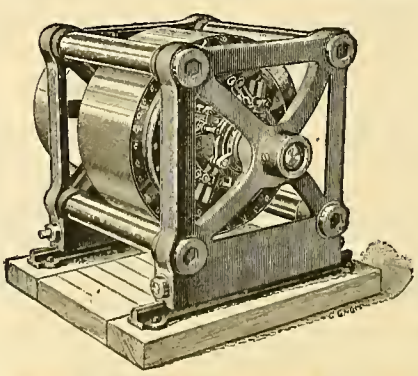


Improved Slow-Speed Generators and Motors. "DIRECT-DRIVEN" Slow-Speed Generators for Electric Lighting and Power. Low Running Expense. Insulated Wire and Flexible Cords. Estimates furnished. Isolated Plants a specialty.

PHILADELPHIA, 501 Girard Building, BUFFALO, 50 Terrace.

WORKS AT BRIDGEPORT, CONN.

Western Electrician.

EVERY SATURDAY.

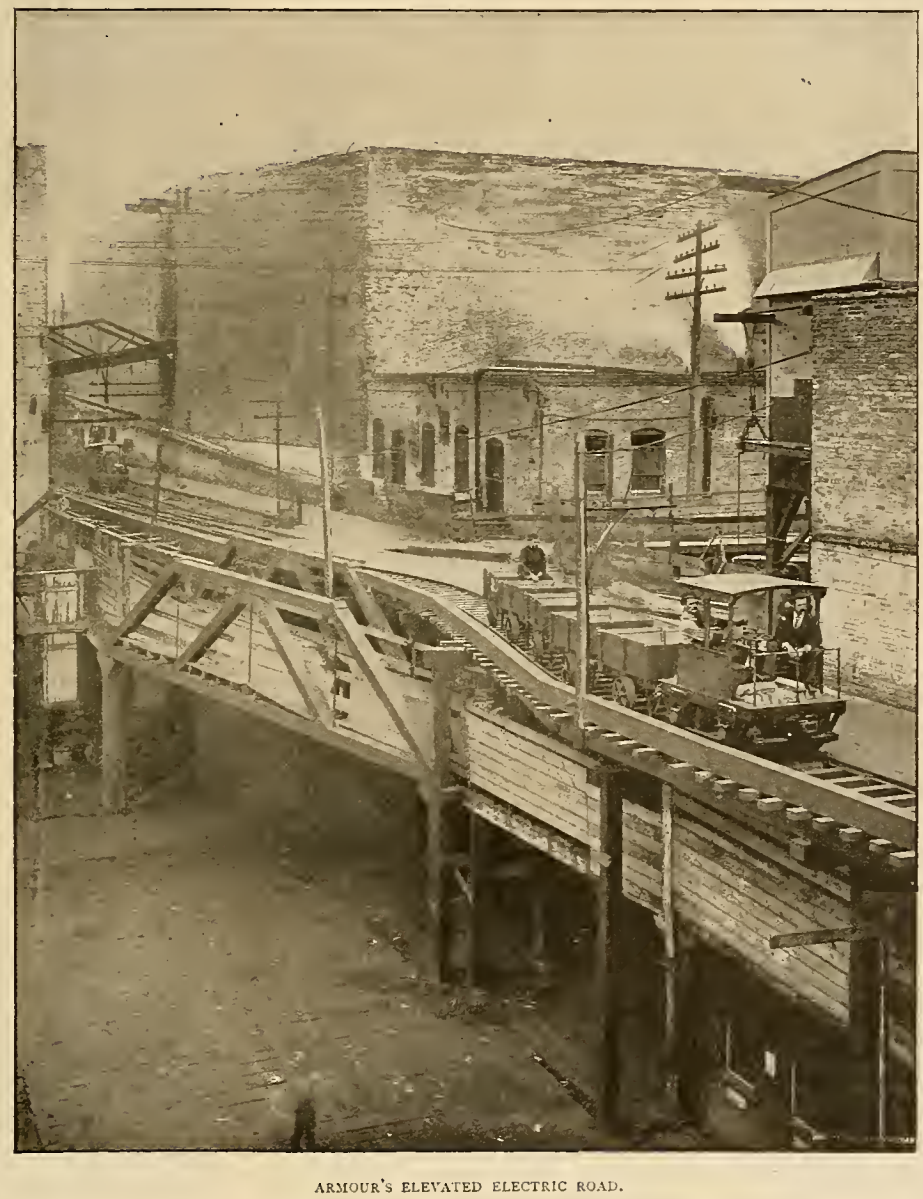
Vol. XI. CHICAGO, OCTOBER 1, 1892. No. 14

Armour's Elevated Electric Road.

To P. D. Armour, the well known Chicago packer, is due the credit of having introduced into his immense establishment at the Stock Yards, in the World's Fair city, what is, very probably, the first elevated electric railway of any size in this country. Six thousand feet of 3-foot gauge track is now finished, and extensions of about two miles more are under way.

The Armour elevated railway system connects all the warehouses and slaughtering houses, and is so planned that the entire product of the establishment will be handled by electricity. After a careful investigation Mr. Armour decided that, by this arrangement, the work could be done for one-third of the former cost, to say nothing of the convenience and saving of space. The rapid transit, too, of fresh material from slaughter houses to cooling rooms is a very important factor both to the consumer and the company.

The elevation of the road is twenty-three feet above the surface of the ground. Where the line runs between the main buildings the structure s of steel; the remainder is of Georgia pine. The numerous switches necessary to reach all parts of the buildings made the construction very difficult to plan satisfactorily. The iron work was laid out and erected by Master Mechanic John Bouchard of Armour & Co. The electrical work was done under a contract made with the Thomson-Houston company through Manager Geo. P. Nichols of the motor department of the western office of the electrical company in consultation with Armour & Co.'s chief electrician, A. Shillinglaw, and his assistant, James Malia. An inspection of the accompanying view of one of the most interesting portions of the road will show what these gent'emen have accomplished. The cut shows a locomotive hauling a train of empty cars. At present there are in service on the system two 20 horse power locomotives of the standard Thomson-Houston type. It should also be stated that the cars, which have each only two wheels, were designed by Mr. Nichols. These cars are provided with what might be called flat flanged wheels, in order that, when desired, they may be run off the rails on to the floors of the different houses.



ARMOUR'S ELEVATED ELECTRIC ROAD.

The power house is located about a quarter of a mile from the road, and will be some distance beyond that when the company moves into its new electric station, which will be one of the most complete in the country, occupying a building 125 by 150 feet, and comprising three stories, built of steel and brick, with the engines located on the first floor, shafting on the second and dynamos on the third. Current for the present railway equipment is supplied from a Thomson-Houston 135 horse power generator. There is also ready for service a National 80 horse power machine.

The amount of produce handled over this road will average 400,000 pounds per day, and the innovation will displace about 150 men. In addition to this, when the extensions are completed to the coaling station, there will be dispensed with ten horses and carts and about fifteen men, and the coal will be delivered directly to the boilers in better condition and with less waste. Much surface room, too, will be gained.

It is also announced that Armour & Co. are considering the question of a further centralization of power by the use of motors around the works to take current from the railway system.

Electric Light Companies as Manufacturing Corporations.

The question as to whether electric light companies are manufacturing corporations has just been considered by the Supreme Court of Alabama in the case of Beggs against the Edison Electric Light & Illuminating company. The question was raised by the Edison Electric Illuminating company and the Merchants' Electric Light & Power company attempting to consolidate under the Alabama statute providing that "any two or more mining, quarrying or manufacturing corporations may unite or consolidate their capital stock, property and business."

The word "manufacture" means the making of anything by hand or artifice. Worcester's Dictionary defines it as "the process of making anything by art, or of reducing materials into a form fit for use by the hand or by machinery." The definition that the word is given by the Century Dictionary is: "The production of articles for use from raw or prepared materials by giving these materials new forms, qualities, properties or combinations, whether by hand labor or by machinery."

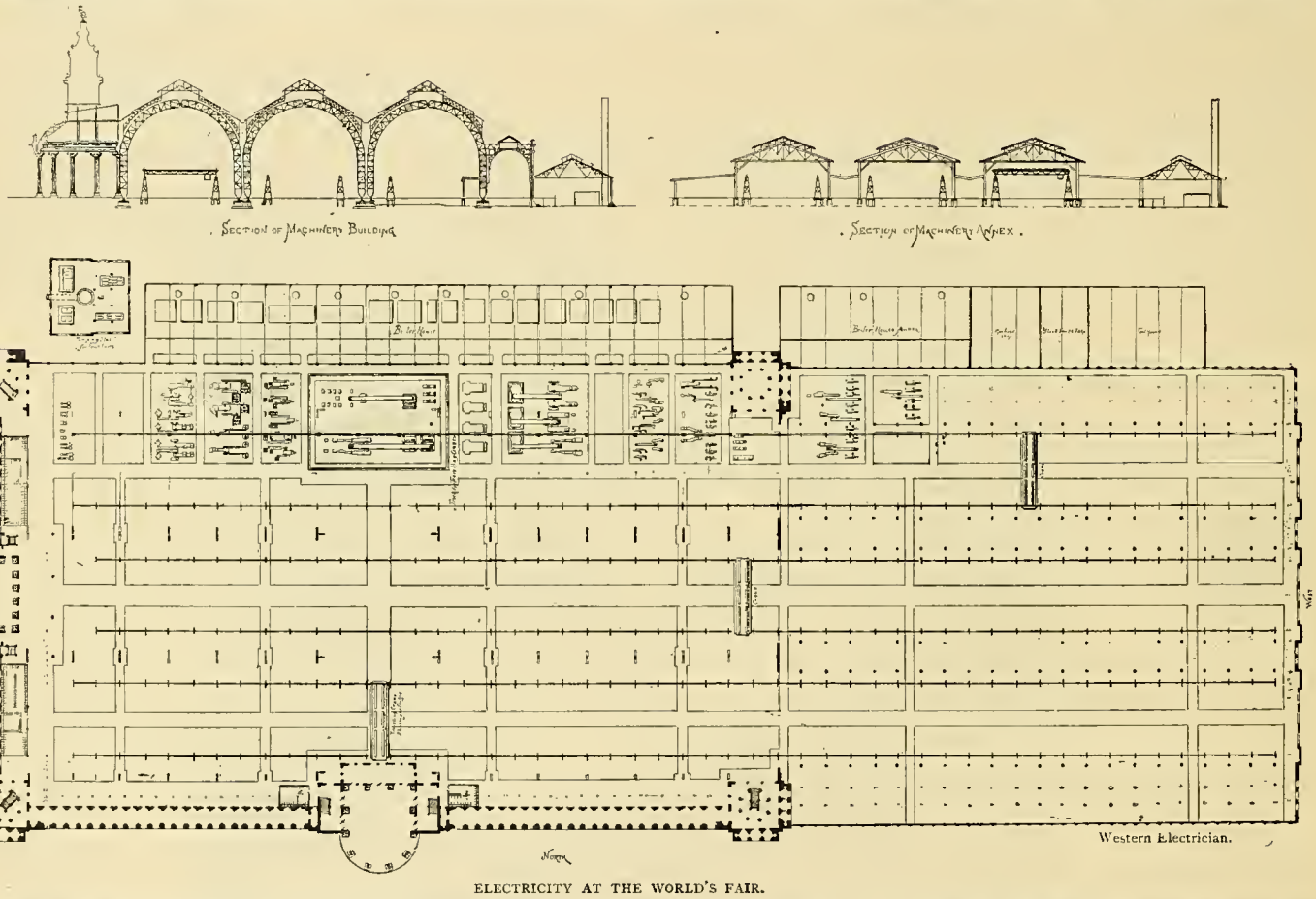
According to these definitions of the word "manufacture" the court declared an electric light company a manufacturing corporation to all intents and purposes. According to the court's opinion it is no answer to this argument to say that electricity exists in a state in nature, and that a corporation engaged in the electric light business collects or gathers such electricity. This does not fully or exactly express the process by which such corporations are able to make, sell and deliver something useful and valuable. The business in which an electric light company is engaged makes it necessary to invest large capital in the plant, and there is purchased and consumed coal and other materials to produce steam in order to furnish the power for the operation of the machinery. Then there is supplied and operated a complicated system of machinery, like that commonly used in manufacturing establishments, such as boilers, engines, dynamos, shaftings, belting, etc., and then, by means of wires, cables and lamps, the mysterious power generated by the machinery used from the material furnished is transmitted, and lights the streets and private houses. But the electrical current that produces these results cannot be said to be "the free gift of nature, gathered from the air or the clouds." It is the product of capital and labor, and in this respect cannot be distinguished from ordinary manufacturing operations. The collection, storage, preparation for market, and the transportation of ice, as found in nature, is not manufacturing, but the production of ice by artificial means is. It might as well be said that a gas company, organized under the corporation laws, is not a manufacturing corporation.

Both gas and the electricity generated are the result of artifice. Their purpose is the same and their transmission is in a similar manner—the one by pipes and the other by wires. It has been expressly decided that a gas company is a manufacturing corporation. When it is attempted to establish the proposition that the gas which lights one room is a manufactured product, and the electricity which lights another is not, one is obliged to rely more on the definition of terms and the distinctions of scientists than the actual, practical processes and productions by means of which results in all respects, or at least substantially the same, are produced.

When it is taken into consideration that the electricity now used and applied in the ordinary business of life is essentially the product of skill and labor, one can find no difficulty in reaching the conclusion with the court that a corporation engaged in generating, storing, transmitting and selling such electricity to be used for lighting purposes is a manufacturing corporation, and entitled to the corresponding rights of such a corporation. So the New York Court of Appeals decided recently, thereby exempting electric light companies within that state from taxation.

Electricity at the World's Fair.

Visitors to the World's Fair who are at all interested in electricity will find the great central station plant in machinery hall one of the most attractive and instructive features of the exhibition. Here will be seen the latest type of engines, boilers, arc and incandescent dynamos and power generators, while large electric traveling cranes, fitted up for passengers, will slowly traverse the great building from end to end, giving visitors an admirable opportunity to view the machinery on the floor below. The plan of the plant, which will supply 90,000 or 100,000 incandescent lamps, about 5,500 arc lamps, and some 2,500



ELECTRICITY AT THE WORLD'S FAIR.

horse power for motor service, is shown by the accompanying drawing. The installation takes up the southern portion of machinery hall and the southeastern corner of the annex.

These buildings, which are practically one, together have dimensions of 1,193 by 490 feet. The electrical plant will be included in a space 800 feet long and 100 feet wide or 80,000 square feet. The boiler house is distinct, adjoining machinery hall on the south, and is 630 feet long and 85 feet wide. It will contain Root, Gill, Heine, National, Campbell & Zell and Babcock & Wilcox boilers, arranged in the order given, from east to west, the total capacity being about 20,000 horse power. In the dynamo and engine room the first compartment, on the east, in the southeastern corner of machinery hall, contains four Eddy power generators of 250 kilowatts capacity each, driven by three Phœnix engines of an aggregate capacity of 1,000 horse power, and a 500 horse power Reynolds Corliss engine directly connected to a Westinghouse power generator of equal capacity. The next compartment is also given over to power generators, containing two 120 kilowatt and two 225 kilowatt Mather machines, and four 80 kilowatt C. & C. generators, driven by two Woodbury engines of 550 and 350 horse power respectively and two other 200 horse power engines not yet determined. The next section west is occupied by sixteen Brush arc machines, each of fifty lights capacity. These are driven by five Ball & Wood engines, of a combined capacity of 800 horse power. Then comes the Westinghouse incandescent installation. There are to be ten 10,000 light alternators. Two of these in the central space, which, as indicated on the plan, is larger than the other sections, are belted in tandem to the big 2,000 horse power Allis engine, the largest steam engine at the exposition. In this section there is also a 10,000 light machine, operated by a 1,000 horse power Fraser & Chalmers engine, and three smaller Westinghouse direct connected power generators. In the next space are four great direct connected Westinghouse machines, each of 10,000 lights' capacity. Then come three more Westinghouse dynamos, belted directly to 1,000 horse power engines of the Buckeye, Atlas and McIntosh & Seymour types. A blank section is next indicated on the plan, but this will undoubtedly be utilized for the Western Electric company's arc dynamos. Fourteen Fort Wayne 50 light arc machines will be installed in the next compartment on the west, the engines being of the Buckeye type, with a combined rating of 850 horse power. Twenty Standard arc dynamos, each a 50 lighter, occupy the space adjoining, which is in the southwestern corner of the great building. They are driven by three Russell engines of 950 horse power. The Thomson-Houston arc 50 light dynamos, 26 in number, are in the annex, operated by one 500 horse power Atlas engine and three Lane & Bodley engines of a combined capacity of 750 horse power. Aisles for visitors separate the sections, and the plant is so arranged that the machinery can be seen from all sides. When in operation the installation will undoubtedly constitute the largest electrical plant in the world. It was planned by Frederick Sargent and R. H. Pierce.

Considerable attention is now being given to the subject of lighting the grounds and buildings for the dedicatory exercises. This will be done by arc lamps, but the extent of the illumination is still unsettled. Probably the manufactures, transportation, mines and machinery annex buildings, and a portion of the grounds will be lighted. The transportation building is nearly all wired for the permanent arc lighting. The cross-arms are now being placed in the subways, and the work of stretching the arc light wires will soon be begun. About 75,000 feet of wire for the fire and police alarm telegraphs has been laid. The principal electrical display at the dedication will be obtained by the use of two Schuckert projectors, by which it is proposed to throw a flood of light on the buildings and out on the lake.

Work on the elevated electric railway is well under way, and many foundations have been already put in.

The eight electric elevators for the administration building have been placed in position.

The Electric Railway in New England

Electric railroad enterprises have advanced with such gigantic strides in the season now drawing to a close that a new feature is developed in summer resort travel New lines are being projected along the whole New England coast, so that it seems that it will be possible in the near future to make the grand tour of the beaches from Coney Island to Bar Harbor in electric cars. The road which is to be built from Lynn to Salem is another link in the system. When this is done it will be possible to take an electric car in Boston and ride to Salem Willows without a change. This prospect is contemplated with pleasure all over New England. Competing lines on which electricity is the motive power serve to keep the passenger tariffs of the steam roads down to reasonable figures, and thus build up the suburbs by enabling the poor as well as the people in fairly comfortable circumstances to live within a radius of from five to fifteen miles from their work in the city. Boston's suburban towns are building up very rapidly now, and this can be attributed almost solely to cheap fares introduced by electric roads. When the West End road can carry passengers for five cents to Arlington, a distance of seven miles, the steam roads have to put their fares at a correspondingly low figure. No wonder the electric railway is popular in New England.

New England already has a number of electric roads connecting its large cities, and it would not be much of an undertaking to build connecting links from Providence through Brockton to Boston and thence by way of Lynn and Salem to Haverhill. The Merrimac Valley road now connects the principal cities of this valley. There is now an electric line connecting Worcester, Leicester and Spencer, and Natick also has an electric road. A line from Boston to Natick, and thence to Framingham and Worcester, is among the possibilities now under discussion. It could probably be made to pay. In fact there will be no limit to these projects when once they get under way. In thickly settled districts the electric road seems to be the only one to fill the bill. In many cases it is thought that a profitable express and baggage business could be carried on in this manner.

During the last hot wave a man was seen walking down the most crowded street in a large city with a unique load. He had in one hand a storage cell about the size of a hand valise, and in the other he carried a tripod on the head of which was fixed a fan motor. A flexible cord connected the motor with the battery cell, and the fan was spinning away at a rate that produced a lively breeze all around. There are, perhaps, few people who are desperate or enthusiastic enough to carry their fan motor outfit with them in their peregrinations through a crowded city, but that the thing is possible has now been demonstrated.

Electrical Development on the Pacific Coast.

The electrician who travels over the Pacific Coast learns in a very short time that the states of Oregon and Washington lead California by a long way in the matter of general electrical equipment, and he at once attributes the cause of this to the fact that in the states first named power is very cheap. Seeing the application of electricity permeating almost every branch of industry, as it does in Oregon and Washington, one is inclined to the belief that after all the keynote of success in operating either electric lighting or power plants rests in the ability of the station

FIG. 1. ELECTRICAL DEVELOPMENT ON THE PACIFIC COAST.

manager to obtain cheap power to drive his generators. All believe that an abundant supply of falling water affords the cheapest source of power known, but through the timbered sections of the extreme northwest, where hundreds of thousands of tons of sawdust, chips, bark and slabs are a drug on the market, cases are found where, both steam and water power being available, steam is used. At Port Blakeley, Wash., the Renton Holmes Mill company has constructed a wrought iron furnace, lined with fire brick, that is 34 feet in diameter and 100 feet high. In this over 100 tons of sawdust is burned each day, and an equally great amount of chips, bark and slab wood is burned in other fires daily just to get rid of it. At Ballard, Wash., the Stimson Mill company has paid part of the cost of the construction of a branch road from its mill to the main line of the West Street & North End Electric Railway company of Seattle, provided the railway company would take its fuel from the sawdust pile of the mill. At Portland a solitary fireman attends to the big battery of boilers that are automatically fired with sawdust brought over in conveyers from the Willamette Lumber & Mill company, 1,500 feet away. Here six 175 kilowatt Edison railway generators are operated, and the manner in which they are operated is so novel that it will be an ample excuse for a slight diversion. Current is supplied to two different lines of street railway, and as the center is nearly two miles from the station, to supply nearly 1,000 horse power at 500 volts at a reasonable loss, that distance called for a formidable investment in copper. The machines were therefore coupled up on the three-wire system,

FIG. 2. ELECTRICAL DEVELOPMENT ON THE PACIFIC COAST.

the neutral was grounded, one line fed positive from its trolley circuits, the other line was negative, and the value of the copper used was not nearly so appalling. The current on the outside wire is metered and charged to the proper companies.

Reverting to the matter of cheap fuel, the big 450 horse power Thomson-Houston multipolar railway generator of the City & Suburban Railway company of Portland—the next to the largest dynamo on the Pacific coast—is driven from the refuse sawdust of the Inman-Paulsen mill, as are also the two 150 kilowatt Edison generators of the Willamette Bridge Railway company. The Tacoma Light & Water company burns slabs to run its twenty dynamos, and the Albina, Ore., Light & Water company, with refuse sawdust for fuel, is working its way into the territory of the Willamette Falls Electric company with water power. Generally, if sawdust fuel is cheap in the far Northwest, water power is cheaper, although not quite so plentiful. Wherever found, it exists in abundance, particularly at Spokane Falls, Oregon City, Tumwater, Olympia and North Yakima. At some few places, such as at Salem, Eugene and Albany, Ore., water is used for nine or ten months, and steam for the remainder of the year. At Dayton, Wash., the load is carried jointly by water and steam.

Next to that at Oregon City the water power of Spokane Falls, Wash., is the finest in the two great states of Oregon and Washington. Through the remarkably interesting plant of the Edison Electric Illuminating company of Spokane Falls, which has been illustrated and described in the columns of the WESTERN ELECTRICIAN, Spokane Falls has become more or less familiar to electricians. To obtain power at Oregon City is almost impossible, for the reason that the Willamette Locks & Transportation company controls and jealously guards it. At Spokane, however, water power may be obtained at the ridiculously low figure of $1 per horse power per annum, and for twenty-four hours a day if desired. Steam power at Spokane costs $80 per annum.

It is but reasonable to suppose that with power so cheap there should be remarkable activity in the electrical line at Spokane, and this is the case. To substantiate this it is only necessary to refer to the illustrations herewith presented, which are reproductions from photographs taken by the correspondent of the WESTERN ELECTRICIAN. On the bank of the river in Fig. 1 will be seen a small square house, with peaked roof and shed attached, standing on piles. Five years ago this little house and shed was the

FIG. 5. ELECTRICAL DEVELOPMENT ON THE PACIFIC COAST.

only station of the Edison Electric Illuminating company of Spokane. Its electrical equipment consisted of one No. 12 Edison incandescent machine, and one 12-light 1,200 candle power Brush arc dynamo. The little old station is now used as a power house for the brewery on top of the bank, power from water wheels being carried thence by rope transmission. This, by the way, is soon to be supplanted by electric power from the Edison station, two motors of 90 horse power having been contracted for. In Figs. 2 and 3 is shown the present station of the Illuminating company, the electric equipment of which consists of two No. 32 Edison and three 80 horse power (type D 62) Thomson-Houston railway generators, 500 volts, two No. 16 and eight No. 20 125 volt Edison incandescent generators, ten 50 light 2,000 candle power Thomson-Houston arc light dynamos and two American arc machines, one of 50 lights and one of 35 lights. Stillwell & Bierce water wheels are used, there being six pairs of 10 inch wheels, giving 120 horse power per pair, and two pairs of 15-inch wheels returning 300 horse power per pair. The nightly load is about 6,000 incandescent lamps of 16 candle power capacity each, while about 300 horse power in stationary motors, between 500 and 600 horse power in street railway work and 500 arc lamps are operated. In addition, the cable for a road running westerly up over the "backbone" is driven from the station, which makes a noteworthy showing for a city of about 25,000 people. Everything electrical in Spokane, street railways and all, is operated from this station.

The remaining illustrations show other views of Spokane Falls, Figs. 4 and 5 being views of the upper falls looking up the river, while Fig. 3 shows the lower falls, looking from a bridge down the river toward the station. The upper and lower falls each make a descent of seventy feet, and it is from the dam forming the lower falls that the Illuminating company takes its water through two steel flumes, each seven feet in diameter and about 500 feet long. It can always be depended upon that wherever such water powers exist there will be found remarkable activity in the application of electricity.

Chicago Electric Club.

Members of the Chicago Electric club will remember that last January a committee of five was appointed by the club for the purpose of canvassing the advisability and practicability of reorganizing the club's finances on the basis of a stock company. Since the time of the committee's appointment the matter has been very carefully con-

FIG. 4. ELECTRICAL DEVELOPMENT ON THE PACIFIC COAST.

sidered, and about a week ago three of the committee, Messrs. Sunny, Terry and Kreidler, at a private dinner, to which had been invited several other prominent members of the club, made a report in favor of a reorganization on a stock basis.

This idea was unanimously approved by the members present, and over $3,000 in stock was at once subscribed. A committee of three, composed of Messrs. Horne, Meeker and Gregory, was then appointed to solicit additional stock subscriptions.

Apparently the reorganization committee's work has met with the club's approval, for on the day following the date of the meeting at which the report in favor of reorganization on a stock basis was presented thirteen applications for membership were filed. Since then three more have been received, and the prospects for further additions to the membership are decidedly encouraging.

The literary committee appointed for the coming season will consist of the following named members: James W. Johnson, chairman, George Cutter, E. F. Keller, Charles Wirt and L. A. Ferguson.

Government Telegraph and the People's Party.

"I could quote you a good argument in support of the views of the people's party out of the mouth of Postmaster General Wanamaker," Senator Kyle of South Dakota said to a Chicago reporter recently. "I was speaking with him the other day and he declared that if the management of the telegraph system was in his hands—under govern-

FIG. 3. ELECTRICAL DEVELOPMENT ON THE PACIFIC COAST.

ment control, of course—he would arrange a scale of 100 words for 25 cents. Do you not think that would be a benefit to the nation? The Western Union company has now raised its stock from $50,000,000 to $100,000,000. Where is the thing to stop should this daily increasing monopoly continue? Moreover if the telegraph system were owned by the government we should hear nothing of a strike of employes, nothing of these periodic disputes which destroy business while they last."

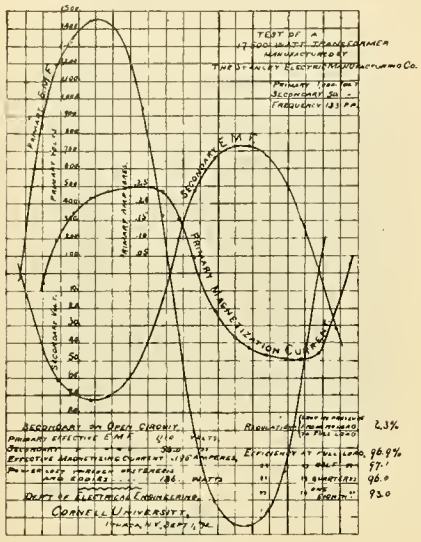
A stock company has been formed in Redwood Falls, Minn., to put in an electric light plant immediately. The company has a franchise for five years and the city has the privilege of buying the plant when the franchise expires

Cornell University's Test of a 17,500 Watt Stanley Transformer.

By Harris J. Ryan.

The method employed in testing the 17,500 watt, 1000-50 volt transformer, for a frequency of 132 p. p. s., was as follows:

The power dissipated through hysteresis, eddy currents, etc., was determined by the use of a contact maker, con-



CORNELL UNIVERSITY'S TEST OF A 17,500 WATT STANLEY TRANSFORMER.

denser and electrometer as described in the paper on transformers in the proceedings of the American Institute of Electrical Engineers, Vol. VII., p. 1. The transformer received current from a Westinghouse alternator at 132 p. p. s. This machine was driven by a high speed 60 horse power tandem compound automatic engine that had a fair speed regulation. It was found at the start, however, that the total loss of power in the transformer at full load was in the neighborhood of but 3 per cent. of the load. On account of the natural drift of the speed of the engine within certain limits, it was not found practicable to measure the total power delivered to the transformer and that given out by it with such a degree of accuracy that the probable error would be less than 1 per cent. This would mean a probable error in the determination of the total power dissipated by the transformer of 30 per cent.

Were there no magnetic leakage in transformers we would get a measure of the power lost through heating of the primary and secondary conductors by the product of the drop in volts observed on the secondary into the current output of the same. This measure would then be rigidly accurate when the secondary is at work on incandescent lamps, and the primary magnetizing current is as small as it is for this transformer. Actually, however, there is always some magnetic leakage that increases with the output of each transformer, and lowers the electromotive force of the secondary by lessening the magnetization through the same. Since this action results in no waste

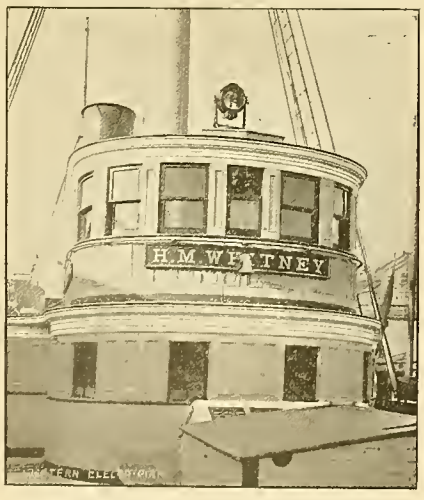


FIG. 2. THOMSON-HOUSTON SEARCH LIGHT ON THE STEAMER MAINE.

of power, in ignoring its presence we shall make an error that counts against the transformer. It is highly probable that in a transformer with a drop in pressure due to load of only 2 per cent. or 2½ per cent., the error thus made against the efficiency at full load will not amount to more than ½ per cent.

The drop of secondary pressure due to load was observed by taking simultaneous readings of the effective pressure at the terminals of the primary and secondary when the transformer was loaded with lamps to an output of 17,500 watts and when it was unloaded. In this way errors due to the drift of the speed of the engine are eliminated.

The accompanying diagram, with its curves, gives graphically the observations made for determining the power taken up by the transformer with the secondary on open circuit. From the curves of primary impressed electromotive force and primary current the power lost through hysteresis and eddies in the iron core was determined to be 186 watts, with the pressure at the primary terminals of 1,110 volts. It is desirable to know the power lost at the standard pressure of 1,000 volts. In making this deduction it was assumed that this loss varies as the 1.7 power of the magnetic density in the iron core. The power lost in the transformer on open circuit at a primary pressure of 1,000 volts is therefore 157 watt.

The drop in the secondary pressure due to load was determined from the following effective primary and secondary pressure readings which are given as the mean of a number of observations:

Full Load.		No Load.	
Primary	Secondary	Primary	Secondary
1,077	53.50	1,122	57.03

Reduced to a primary pressure of 1,000 volts.

Full Load.		No Load.	
Primary	Secondary	Primary	Secondary
1,000	49.67	1,000	50.83

Drop, 1.16 volts, or 2.32 per cent.

Power lost in heating the conductors, $1.16 \times 350 = 405$ watts.

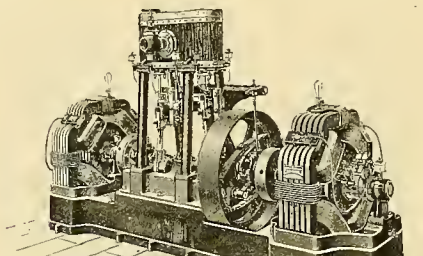


FIG. 3. THOMSON-HOUSTON SEARCH LIGHT ON THE STEAMER MAINE.

The variation of the efficiency with the load is given by the following equation:

$$\text{Efficiency} = 100 \frac{W}{W + H + KW^2}$$

Where W = the output of the transformer in watts

H = the power lost through hysteresis and eddies in the core.

K depends upon the effective resistance.

Substituting the numerical values of H and K we have:

$$\text{Efficiency} = 100 \frac{W}{W + 157 + .000000132 W^2}$$

The efficiencies at full load, half load, quarter load and one-eighth load are 96.9 per cent., 97.1 per cent., 96.0 per cent., and 93.0 per cent. respectively. For one 16 candle power lamp the efficiency is about 24 per cent.

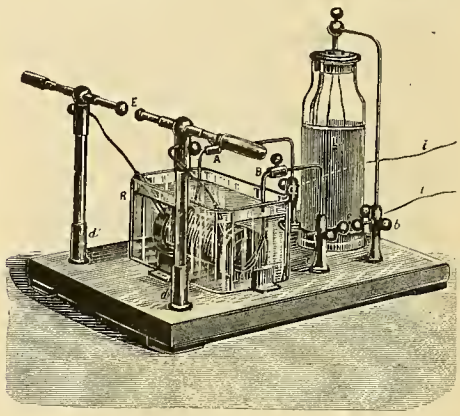
For a determination of the all day efficiency when the primary pressure is kept up at all hours of the day it is assumed that this transformer would have a working output equivalent to 17,500 watts for five hours out of every 24. Under these conditions the all day efficiency is 93 8 per cent.

Ducretet and Lejeune's Apparatus for Generating Alternating Currents of High Potential.

The accompanying cut, which is reproduced from the *Elektrotechnischer Anzeiger*, shows a simple device for producing alternating currents for high tension experiments. The apparatus is thus described in the German journal:

After observing with much interest the wonderful experiments of Thomson and Tesla with currents of high potential and unusually great number of alternations, attention is naturally directed to the apparatus by which these interesting phenomena can be reproduced, and that in the simplest possible manner; that is, without the employment of complicated machinery. First of all it will be necessary to have the familiar Ruhmkorff coil and interrupting attachment modified slightly for the present purpose. The accompanying cut shows the general arrangement of Ducretet and Lejeune's apparatus, which was used by D'Arsonval and Janet in their experiments in the Societe de Physique. As a reference to the cut will show, the current is developed in an induction coil and its interrupting device *r v*, the primary current coming from a primary or secondary battery. The induced current is taken off at the secondary binding posts and wires *i i*. In this machine the potential was so high as to pierce through an air space of 50 millimeters.

With this source of current were connected a series of other pieces of apparatus, set up on a special support or



DUCRETET AND LEJEUNE'S APPARATUS FOR GENERATING ALTERNATING CURRENTS OF HIGH POTENTIAL.

plate. This auxiliary apparatus consisted of a Leyden jar *L*, a small oil transformer *T*, with its primary winding connected to the binding posts *A* and *B*. The secondary winding was connected to sliding metal rods, which were provided at their ends with metal balls and which could be separated from each other any desired distance.

As was the case with the experiments of Thomson and Tesla, the number of the impulses was greatly multiplied by the so-called oscillating discharge in the Leyden jar. As has been shown the operation of currents of this kind can be greatly assisted by directing against the discharge point a blast of air. D'Arsonval, however, obtained the same result by the employment of an electro-magnet. In these experiments the phenomenon observed by Thomson and Tesla was also noticed—the absolutely harmless character of the current, in spite of its extraordinarily high potential. It was possible, for instance, to touch the two discharge rods while sparks 4 centimeters long were being thrown across—indicating a pressure of many hundred thousand volts, and yet without danger, and in fact without experiencing the slightest pain, if care was taken to first bring the rods together and then gradually draw them apart, and then, before letting go, to bring the rods back in contact.

If this arrangement of D'Arsonval and Janet presents nothing new, it at least shows that these interesting and promising phenomena can be obtained in a very simple way—a very great essential for the general and thorough

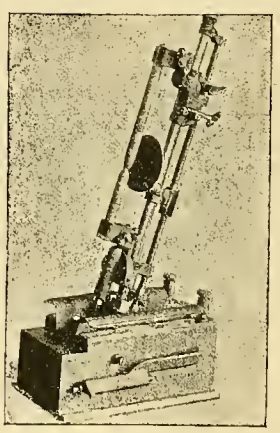


FIG. 4. THOMSON-HOUSTON SEARCH LIGHT ON THE STEAMER MAINE.

investigation of a new principle or scientific truth. It might be added that the employment of the Ruhmkorff coil and the Wagner "hammer" is of value in that it permits of the regulation of the number of the vibrations of the interrupter, and thus in this simple way controls the number of impulses in the secondary—a condition not possible with a dynamo with a fixed number of coils and constant speed.

Recent Growth of Electric Lighting in Chicago.

Colonel J. J. S. Wilson, who has charge of the electrical inspection department of Chicago, under City Electrician Barrett, has recently devised a new system of keeping the records of the electrical inspections made by municipal authority in Chicago. When completed and perfected these records will contain the principal data of every electrical installation in Chicago. Already they contain much interesting information. A representative of the WESTERN ELECTRICIAN who lately visited the office of the bureau was enabled to make up the following table, giving official details of the electric lighting plants of eight of the large commercial buildings of Chicago that have been completed within a year:

Name.	No. of Incandescent Lamps.	Length of Electric Wires.
Great Northern Hotel.....	5,364	63 miles 1,760 feet
Masonic Temple.....	5,149	56 " 3,325 "
Monadnock Building	4,100	46 " 575 "
Title and Trust Building..	3,200	37 " 380 "
Woman's Temple.....	3,600	27 " 3,152 "
Ashland Block.....	3,138	Not computed
Venetian Building.....	2,700	27 miles 2290 feet
Unity Building.....	1,900	13 " 1,042 "

These figures give some idea of the recent extension of commercial electric lighting in Chicago, and indicate a rate of growth in this direction probably unequaled by any other city in the country. Of the installations enumerated in the table, the Great Northern, Monadnock and Venetian buildings are supplied from the Chicago Edison company's Adams street station; the Masonic, Unity, Woman's and Ashland buildings have isolated plants, the first named on the Thomson-Houston system, the second on the Edison system, the other two employing Western Electric machinery; and the Title and Trust building is furnished with current from a small central station plant in the basement of the University building. In the eight buildings there are 28,851 lamps, an average of 3,606.

The manner of procedure now adopted in the electrical inspection department is interesting. First, the person desiring the inspection of a new electrical installation or an addition to an old one, in compliance with the requirements of the city ordinance, fills out an "Application for Electrical Inspection." In this he describes the plant, giving the location, quantity and quality of wiring, number of arc and incandescent lamps, generators and motors, description of the system and particulars of the converters, if alternating current is used. This is duly filed, and City Inspector Haskins then makes a careful examination. If he is satisfied with the condition of the plant a certificate is issued on his recommendation, in the name of the city electrician. This certificate is worded as follows:

THIS CERTIFIES that the undersigned, superintendent of city telegraph for the city of Chicago, has inspected the electrical wires and apparatus located at.....
comprising.....
used for power.....illuminating purposes, whereof.....
.....user. And having performed said service, now, on this.....day of..... ...18...
does further certify that the said apparatus, wires and attachments are properly arranged and insulated, as contemplated in and by the ordinances of the city of Chicago, and that they are now in proper condition to be used for purposes specified.

.....

Do not allow any plumber, gas or steam fitter, carpenter or other mechanic to interfere with these wires. Read these extracts from the ordinance governing electric lighting.

Sec. 5. No alterations shall be made in the plant, after inspection, without first notifying the city electrician and subjecting the plant to inspection, subject to the provision of the ordinance.

Sec. 6. Any person who shall use any electric lights in violation of any of the provisions of this ordinance shall be subject to a penalty of not less than fifty dollars nor exceeding one hundred dollars, and to a like penalty for each day during which he shall continue such violation.

The possession of a certificate of this character, properly filled out, is a guaranty that a plant is properly wired.

The Detroit Strike.

On September 13th the strike of the trimmers of the Detroit Electric Light & Power company was begun, the men claiming that an effort was being made to break up their union and demanding the discharge of the foreman. After that for several nights certain portions of the city were in darkness, and it was charged that the strikers cut the wires. This was denied by the union. On one night it was reported that over two-thirds of the lights supplied by the company were out. The strikers claimed that more lights were not burning on account of defective trimming by new men, than through any wire cutting. On the 18th a patrolman reported that he saw two men with bicycles in Cass park. One of them had just cut a wire. He started in pursuit, but they sped away like the wind on their machines. The previous night two men similarly equipped cut wires at the corner of Grand River and Third street, but the policeman who witnessed the deed was not sufficiently fleet of foot to compete with the bicycles. On the 22d a conference was held between the company and the strikers and the trouble was settled, the company agreeing to nearly all of the demands of the men.

The Thomson-Houston Search Light on the Steamer Maine.

The building of large search light equipments is becoming a very important branch of the business of a number of American manufacturers of electric lighting apparatus. The search light maneuvers of the white squadron a year ago and the more recent experiments in signaling from Mt. Washington, N. H., to Portland, has done much to excite comment and awaken prediction as to future applications of such machines. The WESTERN ELECTRICIAN has referred a number of times to the usefulness of the electric search light equipment in lake navigation. The search light, or projector, located on the pilot house, Fig. 1, is under perfect control, and is invaluable as a means of safety in showing buoys, docks, wharves and approaching vessels, and the coast along which the vessel is running. Its value in time of fog and as a means of signaling cannot be too highly estimated. That the steamboat companies of the country are appreciating what the search light can do for them is evidenced by the accompanying illustrations which show the electrical apparatus used on the steamer Maine, of the Providence & Stonington Steamship company.

FIG. 1. THE THOMSON-HOUSTON SEARCH LIGHT ON THE STEAMER MAINE.

The dynamos on the Maine, Fig 3, are of 8,000 watts capacity each, and are used both to supply current for the incandescent lamps distributed throughout the vessel and for the search light or projector, a cut of which is also shown.

This projector has been brought to its present state of perfection after many experiments. Is is built of non-magnetic material, so as not to affect the compass, and also to withstand atmospheric conditions. The lamp, Fig. 4, is constructed so that both carbons are automatically fed, and the arc maintained in a fixed position in the focus of the lens. The lamp can be drawn out of the projector case when it is desired to renew the carbons, and all contacts are made by simply sliding the lamp into position in the case. The direction of the beam can be controlled from a distance by means of electrical devices. The light is readily seen at a distance of several miles. By throwing the ray vertically, the presence of a vessel can be located from a great distance during fogs.

All the appliances throughout are very substantially constructed and adapted to stand the severe atmospheric conditions to which they are subjected.

The use of the direct coupled machines saves much floor space, and it is needless to say is a great improvement over the old belt-driven dynamo. Similar apparatus has been placed on the New Hampshire, of the same line, and the steamer Fairfax, of the Merchants' and Miners'. Thomson-Houston apparatus has also been used to equip the United States cruisers Newark, Miantonomoh, Vesuvius, Petrel and Dolphin.

Substituting Electricity for Steam on Elevated Railroads.

The Interstate Consolidated Rapid Transit Railway company, which operates an elevated steam railway in Kansas City, Kan., and part of Kansas City, Mo., is changing its motive power to electricity, using the trolley system. The company's cable feeder line, running from the business part of Kansas City, Mo., to the eastern terminus of the elevated road, has already been changed to an electric road. The work of erecting poles and stringing wires along the elevated road goes steadily on. This company is not satisfied with its present scope in Kansas City, Mo., and, it is said, has a project on hand to gain control of the Tenth street cable line, and make it part of its electric system, connecting with the original line by means of a new electric line on Wyandotte street. An ordinance to grant the franchise for the Wyandotte street line is now before the city council, and it is meeting with considerable opposition.

It is said that nine-tenths of the new houses in Indianapolis are being fitted with electric light wires.

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CORRESPONDENCE relating to electricity, or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

	PAGE.
Armour's Elevated Electric Road. Illustrated	169
Electric Light Companies as Manufacturing Corporations	169, 170
Electricity at the World's Fair. Illustrated	170
The Electric Railway in New England	170
Electrical Development on the Pacific Coast. Illustrated	171
Chicago Electric Club	171
Government Telegraph and the People's Party	171
Cornell University Test of a 17,500 Watt Stanley Transformer. Illustrated	172
Ducretet and Lejeune's Apparatus for Generating Aberrating Currents of High Potential Illustrated	172
The Thomson-Houston Electric Search Light on the Steamer Maine. Illustrated	172, 173
Recent Growth of Electric Lighting in Chicago	173
The Detroit Strike	173
Substituting Electricity for Steam on Elevated Railroads	173
Editorial	174
The Convention of the New York State Street Railway Association at Saratoga	175, 176
Electrical Decorations at Washington	176
Cause of the Trouble	176
The General Electric Company's Mining Locomotive. Illustrated	177

DEPARTMENTS.

Correspondence	177, 178, 179
New Incorporations	179
Electric Lighting	179
Electric Railways	179
Telegraph	179
Miscellaneous	179, 180
Trade News	180
Business	180
Electrical Patents	180

IF IT can be proved that the arc lamp trimmers who went on strike in Detroit recently cut the wires leading to the lamps and so plunged portions of the city in darkness, as is charged, the miscreants should be severely punished. Plenty of light constitutes one of the most important elements of police protection in a large city, and it is a serious matter to cut off the supply, and one in which all good citizens are interested. Cutting arc light wires without proper tools or knowledge of the normal condition of the load on the station is an expedient that inexperienced men would not be likely to put in practice, however ardent their sympathy for the strikers. This fact emphasizes the natural suspicion of the strikers entertained in the public mind, and will divert whatever moral support they might otherwise have from the community, despite the protestations of innocence made by the union. The matter should be thoroughly investigated.

IT IS gratifying to Chicago pride to contemplate the fact that within a year eight large buildings have been completed in the western metropolis, containing over 28,000 incandescent lamps. It is also an indication of the lavish use of electric lighting in the great commercial buildings in this city. Of course the figure given represents only a portion of the year's growth in this direction, as hundreds of other buildings were fitted for electric lighting during the same period. Were it possible to obtain the exact figures, it would be interesting to know the increase for the year, and also the total number of lamps now installed in Chicago. No doubt the result would be astounding. The figures for the eight buildings, which are given in the article on "Recent Growth of Electric Lighting in Chicago," presented in this issue, are very large, but it must be remembered that they only refer to new buildings. The largest private installation in the city—that at the Auditorium, with 10,000 or 12,000 lamps—is not included.

THE decision of the Supreme Court of Alabama that electric light companies are manufacturing corporations, reported on another page, will have an important bearing on the question of stealing electricity, which recently came up in St. Louis. In that case much doubt was expressed as to whether the theft of electricity produced by commercial companies was a crime that could be punished under existing laws, owing to the intangible nature of the thing taken, and the contention that it was a "free gift of Nature," like air and water. The Alabama court has decided, however, that the latter assumption is not correct. It lays down the proposition that electricity produced by central station companies "is the product of capital and labor, and in this respect cannot be distinguished from ordinary manufacturing operations." The court continues:

Both gas and electricity generated are the result of artifice. Their purpose is the same and their transmission is in a similar manner—the one by pipes and the other by wires. It has been expressly decided that a gas company is a manufacturing corporation. When it is attempted to establish a proposition that the gas which lights one room is a manufactured product, and the electricity which lights another is not, one is obliged to rely more on the definition of terms and the distinctions of scientists than the actual, practical processes and productions by means of which results in all respects, or at least substantially the same, are produced.

It would seem to follow from this decision that electricity can be stolen from wires exactly as gas can be stolen from pipes, and if the question was brought up in Alabama the court would undoubtedly so decide. This is the common sense view, and it is to be hoped that it will prevail in all the state.

ELECTRIC clubs have a most important field of operation not only in a social and commercial sense, but as educational mediums. The Chicago Electric club, for instance, has a regular committee whose duty it is to provide a literary programme for its meetings. Each year the club considers the questions that are occupying the attention of experimenters and investigators in this field, and the contributions to electrical literature that have been presented through the agency of the club have made the organization known not only throughout this country, but abroad. The coming season, it is promised, there will be a plentiful supply of contributions, and as the papers generally will treat of subjects of considerable popular interest, no doubt the discussions will be equally interesting.

There are many other organizations in the west planned on similar lines, and although it could not be expected that the scope of their work would be as extended as that of the Chicago organization, yet they have done excellent service in promoting interest in electrical science. One of the latest organizations of this character is the St. Louis club, whose plans indicate that the members have the right idea of the work to be performed.

The American Institute of Electrical Engineers has already begun this season's work. The aim of this organization is to enlist the efforts of investigators in every field of electrical activity throughout the country. The last general meeting of the institute, which was held at Chicago, showed that the organization was rapidly attaining the national character to which it aspires. All of these organizations deserve the support of the electrical fraternity, as they are engaged in disseminating information that can not fail to be productive of good results.

THAT street railway men of the Empire state are fully convinced of the merits of the overhead trolley system is clearly shown by the emphatic indorsement which is contained in the resolutions adopted at the convention at Saratoga Springs last week. In these resolutions the Street Railway Association of the State of New York "congratulates the company and the public of the greatest city in the Union upon the adoption of the latest and most improved method of street railway traction." This was done after the discussion of the plans of the Union Railway company which proposes to utilize the trolley system in the metropolis. These resolutions should have considerable weight with the authorities of the city of New York. The men who have thus indorsed the trolley system are street railway managers and capitalists in good standing, who could not afford to lend the use of their names to an enterprise that entailed danger to life, and the destruction of property. They have had ample experience to convince them that the much abused trolley system is a very desirable improvement in street railway traction. Concerning the malicious attacks upon this system the association has spoken in no uncertain manner. In its resolutions it says:

This association earnestly deprecates the opposition manifested against the trolley system in various quarters, as being founded upon neither reason nor fact, and as being contrary to the best interests of any community seeking rapid transit facilities and suburban homes for a growing population.

This sentiment will be heartly commended wherever the trolley has been given a trial. It is a most emphatic indorsement and is worthy the serious consideration of all who are desirous of securing authentic information on this important subject. It may serve to enlighten the people of New York and open their eyes to the fact that, in the matter of improved rapid transit facilities, they are far behind many of their smaller neighbors.

THE *Chicago Tribune* prints the following paragraph relative to the liabilities of insurance and electrical companies:

There is a growing belief that in all cases where electrical companies put in improper connections and improper wiring they may be held strictly accountable for all loss occurring to buildings so connected and wired. And why not? Railways are made to pay for damages from sparks from their locomotives and for fires which are directly traceable to their negligence, and there appears to be no good reason why electrical companies that ought surely to know all about proper and improper converters and wiring should not be made to pay for deficiencies and palpable faults. If the increase of fire losses of this year and last can be directly traceable to any cause let the cause bear its proportion of it. Neglectful and careless is the general opinion of fire underwriters.

Here is an interesting point, and one that might be made the subject of much discussion. If it could be proved that an electric light company had wired a building in an improper manner and that a conflagration had been the direct result of the poor or careless work, it is possible that a case might be made against the company. But in how many cases are defects in wiring and fixtures due to hard and rough treatment on the part of the consumer? It should be remembered that it is decidedly to the central station man's interest to keep his lines in the best possible order. Contrary to the policy of the gas man, who figures upon a most substantial loss from leakage, the central station man for numerous and really very selfish reasons spends much time and money in the work of maintaining the highest possible insulation upon his supply conductors. Leakage to the gas man means only that so much of the product of his works passes off without a return; leakage to the electrical man, as evidenced by the electrical company's careful inspection, may mean a very serious accident to property or person. But the greatest care will not prevent accidents from a consumer's careless handling of apparatus not his own. Locomotives give off sparks that cause damage and juries render verdicts against the railways for fires traceable to the sparks. But are the two cases parallel? In the one instance we have machinery directly in charge of the railway company, while in the case of a fire from electrical conductors we have the consumer virtually in charge—or at least as much so as he would be with his oil lamp or gas jet or gas stove.

Beside, do not the underwriters' inspectors pass upon all apparatus and fixtures within a building and keep a continual and careful watch for every change that might increase or decrease a risk?

There is an installation of another character, too, that should be of decided interest to insurance men, and one concerning which many interesting points might be raised. Take the case of an isolated electric light plant turned over to the building's owner. Where should the liability rest in this case? An installation may have been constructed in all its details in a most thorough and scrupulous manner and while in proper hands be perfectly safe; and yet it may be the direct cause of fire by reason of the ignorance or carelessness of men operating it. In order to show how all precautions may be made of no avail it is but necessary to call to mind one trick sometimes resorted to by dynamo men—of inserting copper wire for fuses. In Chicago a representative of the board of underwriters passes upon wiring done throughout the city and his opinion has a bearing in the decision as to rates. This would seem to be a virtual admission of responsibility. The insurance companies should continue to insist upon a high standard of construction and employ thoroughly competent electrical engineers to pass upon all risks. This is a much better policy than attempting to figure out how the central station or consumer might be held responsible. The "ounce of prevention" is all that is needed.

THE CONVENTION

Of the New York State Street Railway Association at Saratoga.

The tenth annual meeting of the Street Railway Association of the State of New York was held at the United States Hotel, Saratoga Springs, on September 20th. The president of the association, John N. Beckley, of Rochester, presided.

The following named delegates of railway companies were present: John W. McNamara, president Albany railway, Albany; Daniel F. Lewis, president Brooklyn City Railroad company, Brooklyn; W. J. Richardson, secretary Atlantic Avenue Railroad company, Brooklyn; James A. Powers, superintendent Glens Falls Electric railway, Glens Falls; John N. Beckley, president and Charles J. Bissell, counsel, Rochester Railway company, Rochester; Charles Clemiohaw, president, and Charles H. Smith, superintendent, Troy and Lansingburgh Railroad company, Troy.

There were also present H. C. Evans, Johnson company; J. A. Hanna, McGuire Truck company; W. F. D. Crane, W. H. Johns Manufacturing company; D. W. Pugh, John Stephenson company; W. J. Clark, A. Lewis and Prof. Feary, General Electric company; W. H. Delaney, Royaline Manufacturing company; W. S. Silver, Graduated Car Spring company; F. D. Russell and E. Packer, Rochester Car Wheel company; C. S. Merrill, Engineering Equipment company; G. N. McKibben, Reed & McKibben; Elmer Morris, Thomson-Houston company; J. E. Wallace, Smith & Wallace; A. R. Cook, Q. & C. company; J. F. Ostrom, Pennsylvania Steel company; Frank R. Ford, Short Electric Railway company; Willard S. Brown, American Casualty & Insurance company; John Patterson, Taylor Truck company; Frank A. Magee, The E. S. Greeley & company; J. H. Jones, West Troy, and Louis Pfingst, Boston.

The first business was the address of the president, which was as follows:

The past year has been without special incident, so far as the street railroad interests of the state are concerned. I shall take your time but a few moments in giving a brief summary of the record of the year, and in calling your attention to a few practical matters.

Many members of the association feared that the street railroad interests would be subjected to uncalled for attacks on the part of the Legislature at its late session, and much apprehension was felt that unjust and hostile legislation might be successful in impairing the value and usefulness of street railroad properties throughout the state. The executive committee of this association took early action looking to the protection of our common interests. The report of the work done by the committee in this regard, will, I am sure, meet your approval. The success which has attended the efforts put forth is evident to every member of the association. No bill striking street railroad interests, and no bill which injuriously affected street railroad interests, became a law. The obligation of protecting the properties which we are called upon to manage against adverse and iniquitous legislation is lost sight of. Certain of our brethren seem to rely upon the success of efforts which they trust will be put forth by others who, perhaps, have no larger interests to protect than have they.

The most important function of a state street railroad association is to furnish information to the members of the legislature as to the needs of street railroad companies, and to combat before legislative committees, and in personal intercourse with senators and assemblymen, the erroneous propositions which are often advanced without adequate knowledge of the condition of things. A great majority of the members of our legislature are honest men, who, when informed as to the facts, will act intelligently without injury to any legitimate industry or business. There always have been and there always will be others in every legislative body who take advantage of every opportunity which ingenuity can suggest, to strike corporations by the medium of unjust and hostile legislation. Thus far, the street railroad companies of the state have not been injured by unwise or dishonest legislation. But immunity cannot always be secured, except as the result of diligent and intelligent effort on the part of the street railroad companies themselves. A fair and intelligent presentation of the facts as they exist, made at the proper time, I believe, will always protect the interests with which we are identified; but such presentation ought to be made by the representative of this association, and such representative ought to stand for every street railroad corporation in the state.

I trust the time will very soon come when every street railroad company in this commonwealth will not only have its name enrolled on the books of the association, but will be as well an active, earnest and enthusiastic member. Our interests are common; our efforts should be united.

During the past year much progress has been made in the education of the people of the larger cities of the state upon the subject of the "trolley system" of propelling street cars. Even in the city of New York, where a year ago it seemed electric cars could never be operated because of the intense and unreasonable prejudice of the people, franchises are now being obtained, and there is every reason to believe that the old fashioned, slow moving and nuisance-causing horse car system of that great and prosperous city will soon give place on all the lines to the modern systems of propulsion by electricity or cable.

Our Brooklyn friends have carried on their campaign of education with skill and unceasing effort, and the complete success of such effort seems now to be assured. So throughout the state, until as error, ignorance and hostile interests are cleared away, the people of every community are coming to realize that they live in the last decade, and not in the middle, of the nineteenth century. The improvements which have been made in electric and cable railroad appliances, machinery and construction may be said to have kept pace with the demand for the same. The electric motor of to-day represents a great advance over the electric motor of last year, and the cable roads under construction in the city of New York represent the cable system at its best.

Street railroad men are learning that in the management of our properties it pays to be liberal. I do not mean that it is wise to be extravagant, or reckless, or improvident in the management of such properties, but that a broad and progressive policy, which furnishes to the people increased facilities for travel, adds to the net income to be derived from the operation of street railroads. The public, as most of us have come to know, are quick to appreciate improvements made, and as quick to respond with their nickels to the effort of a company to intelligently and efficiently serve them.

It seems to me wise, and in accordance with the best business principles, to keep a little in advance of the reasonable demands of the people with reference to improvements, additions and extensions. I do not mean that a company should heed the request or demand of a hundred families to extend a line where it will require 1,000 families to support that line when extended. But constructing an extension somewhat, perhaps, in advance of the time when such an extension will pay operating expenses is, in my opinion, as a rule, the wise thing for a railroad company to do. The same principle obtains as to the number of cars to be run on each line, and as to other improvements and betterments of the system. We depend upon the people for our patronage, and every railroad man knows that a good feeling on the part of the people toward the company which serves them adds to the receipts of the line, makes it easier to obtain needed concessions from city governments as well as from individuals, and prevents the granting of franchises on parallel lines to competing companies where, perhaps, only one line can be made a commercial success.

While upon this subject of liberality of treatment on the part of railroad companies I desire to call your attention to the advisability, from a business standpoint, of adopting, whenever local conditions will warrant, a transfer system. It seems to railroad companies who now obtain two fares from passengers who desire to go from one part of the city to another by means of the cars on two lines, that the income of the company must necessarily be decreased if passengers are carried for a single fare of five cents.

After a careful study of this whole question, we decided at Rochester to introduce a transfer system under which a passenger can ride from any point in that city reached by the lines of the Rochester Railway company to any other point reached for a single fare. We commenced giving transfers on this plan on October 5th last. We provided reasonable restrictions and necessary conditions. The experiment has proved an undoubted success, not only from the standpoint of the passenger, but from the point of view of the company as well. There is no question that the receipts of the company have been materially increased by the adoption and use of the transfer system. Perhaps the location of lines and other local conditions prevailing in other cities of the state may prevent the successful introduction of a transfer system. But I thought it might be of interest to members of the association to know of the pronounced financial success of the undertaking, so far as the Rochester Railway company is concerned.

Until March 1st the conductors and motormen of the Rochester Railway company were paid the same wages as were formerly paid to conductors and drivers of horse cars. We very soon found after commencing operating electric cars that we required men of higher capacity to perform the duties of motorman and conductor than seemed to be necessary with the old system. It seemed to us that as the duties of the positions which the men held under the new system were more onerous and exacting, and as it required more judgment and skill to properly handle electric cars, that the men should be paid a somewhat higher compensation than they had before received. Therefore, the company, before the men themselves made any request for an increase, advanced their wages. The action of the company, of course, gave great satisfaction to the men, and the result has been very beneficial, so far as the company itself is concerned. It has been found that while the item "wages of employes" has been materially increased the cost of operating the road per mile has in fact been diminished. This is accounted for by the fact that the men are more attentive to duty than before, and more careful in the handling of cars, by the greater freedom from accidents, and by the material lessening in the cost of maintenance.

I am satisfied that the management of many street railroad corporations, where electricity is the motive power, have not as yet given sufficient attention to the thorough instruction of their motormen as well as conductors, as to the function of each part of the motor, and as to the proper thing to be done by the motorman and conductor when trouble develops while the car is in service on the line.

Some weeks since I had occasion, while riding on an electric car in a city of another state, to ask the motorman some questions about the motors he was running. I found he did not know whether the motors were Thomson-Houston, Westinghouse, Edison or Short. He did not know whether they were double or single reduction. He did not even know whether he had under his car body one or two motors. I asked him what he did in case he had any trouble on the line? And he said, "If the motor don't work I wait until another car comes along and pushes me in." I found that this motorman had been for nearly nine months in regular service as motorman in that city. This motorman knew enough to turn on and turn off the current and to set and loosen the brake. This, of course, is an extreme case, but it illustrates a principle. My own judgment is based upon some experience, that too much pains cannot be taken to thoroughly instruct the motorman as well as the conductor, so that each will know the cause of trouble when the trouble develops in either of the motors in service.

The plan the company with which I am connected has adopted, is to select from among the motormen one of the men who is pronounced by the master mechanic, the electrician and the superintendent, the best posted as to the construction and use of a motor, and make such man, for the time being, instructor of motormen on cars in actual service. This instructor rides with motorman after motorman, observes the manner in which he handles his car under all conditions and gives detailed instructions as to exactly what to do whenever trouble of the usual sort develops. The instructor spends from half a day to three days with each man until he pronounces him in every way qualified to run a car on every portion of the line, and to do that which needs to be done when trouble develops.

I might call your attention to many other matters of practical interest if occasion seemed to call for further statement. It is, perhaps, presuming in me to say what I have said, addressing as I am many who have had more experience than I. My only object in calling your attention to the matters I have referred to, is to make some suggestions which may be of value to some who have had less experience than I have, brief and limited though that experience may be.

The executive committee in its report says: "Electricity has been booming in this state since we last met." Continuing, the report says: "Brooklyn, fortunately for its citizens, will soon be blessed with the overhead system on a scale nowhere equaled in the world; the very best construction both for track and overhead work having been adopted throughout the city. When fully developed to successful operation in that city, the system will bring about the condition of things throughout the country by the substitution of electricity for horses, set forth in the advertisement of a famous patent medicine, of which it is declared the 'children cry for it.'

"Already some of the leading dailies of New York city are beginning to change their hitherto insane abuse of the so-called 'deadly trolley,' that has never yet killed even one human being; and they will soon be tumbling over one another in their enthusiastic advocacy of a system regarding which they have finally decided to learn something; and no longer to depend upon their imagination for the facts."

The president then introduced Charles J. Bissell, counsel of the association, who briefly reported the work that had been accomplished at the state legislature, at Albany, during the recent session. Mr. Bissell stated that the result of his experience was that he believed that the great majority of the members of the legislature were honest and straightforward, and needed only to have matters presented to them in a logical and open manner, to properly appreciate the right side of any question, and vote accordingly.

Mr. Lewis called attention to the fact that much more effective work could be done in this direction if the smaller companies in the state could be brought into membership in the association, the dues in such cases being merely nominal. He suggested that the supply men present could be instrumental in bringing the matter of joining the association before the smaller companies in the state in the course of their business calls upon them.

Mr. Ostrom, on behalf of the supply men present, said that they would be willing to use their best endeavors in this direction. This was indorsed by W. J. Clark. During a brief recess a meeting of the supply men was held, of which Major Evans was chairman, and a committee appointed to report measures for the formation of an auxiliary to the association to secure this end. The committee consisted of Messrs. Ostrom, Clark and McGraw.

Later in the day another meeting was held, and a permanent organization effected, of which the following named gentlemen were elected officers: W. J. Clark, president; John W. Fowler, first vice-president; D. W. Pugh, second vice-president; John H. Jones, third vice-president; Edward H. Gilbert, fourth vice-president; Clarence E. Stump, secretary; W. J. Clark, C. E. Stump, H. C. Evans, T. C. Martin, John A. Wood, W. S. Silver, F. D. Russell, S. W. Baldwin and D. A. Breckenridge, executive committee.

The report of the committee on "Recent Improvements in Electric Traction" was read by Mr. McIntire, as follows:

Recent Improvements in Electric Traction.

BY L. H. M'INTYRE.

We understand that anything which tends to an increase of reliability or economy of operation of an electric railway is an improvement; and it is with the intention of bringing before you in a brief manner the results of my experience and observation during the past year upon these points that this article has been written.

As you of course know, electric systems as first constructed were built on altogether too light a plan, and the increasing tendency year by year has been, and is, for heavier and more solid construction in every department, but particularly in the way of track and station equipments. It has been well said that no new departure is ever perfect at the beginning, and no one realizes this more than he who has watched the development of electric traction during the last few years.

The storage battery has made but little progress during

the past year, and is not likely to cut much of a figure in electric traction until it is able to make a better showing, financially, than it has in the past.

It may seem strange that the management of roads, even at present operated by horses, cannot see that a change of some kind must come soon owing to the great cry for rapid transit; and yet I know of roads at present being laid with flat center bearing rails on stringers in streets being newly paved. I do not mention this as an "improvement," but simply to show that what may be regarded as an improvement by some would be called simply a makeshift or temporay piece of work by others.

The general tendancy of the times to consolidate all common interests under one management is showing its effects in electric traction more now than ever, and scarcely a week passes that we do not hear of some syndicate obtaining control of some horse road, and the information usually ends with the statement that "it is intended to equip all the lines with electricity." From many points of view this is an improvement and a marked one.

The improvement in track construction has been very great, and although many expensive errors have been made, we ought, on the whole, to feel satisfied with the progress.

The early forms of track construction were too light and soon went to pieces; but during the past year heavier rails have been rolled and better joint plates made, so that it is possible to keep the roadbed in perfect line and surface. This improvement has been a great help to the electric equipment and has reduced the cost of maintenance. As the cost of laying tracks is about the same, whether light or heavy, it is economy to put in only the best.

Now, on the question of what constitutes the best form of track there is considerable variance of opinion. My experience and observation has convinced me that the deep girder rail, about nine inches high, spiked directly to the ties, is the best form for paved streets, and in dirt or macadam streets, a six-inch girder rail laid in the same manner. In the country and where the local authorities are willing, I would lay a T rail spiked directly to the ties.

The weakest place in all forms of track construction is at the joint. Every manufacturer of rails, and many of the railroad companies, have tried to overcome this trouble. There are probably as many patents upon rail joints as upon car couplers, and most of them about as impracticable. Up to the present time there has been nothing brought out which surpasses a properly designed "fish plate."

While speaking of track construction, it might be well to call attention to the bonding of rails for the return circuit. Many forms have been used, and some of them are still in operation. I believe that a No. 0 copper bond wire long enough to connect with the web of the rail on each end of the fish plate is the best plan, and then grounding the whole system at frequent intervals, and abandon the supplementary wire which it has been the custom to use with the common form of bonding.

Probably the greatest advance in any particular line has been in the matter of armatures for motors and dynamos. I consider that the introduction of the "iron clad" type will do more towards reducing the bill for repairs in that direction than any other one thing that has been introduced during the year. The electric companies have all, I believe, now adopted this form as their standard, and all roads that have tried them will, I think, agree with me that, for simplicity, ease of repair and ability to stand the hard usage they receive, they stand at the head.

In the manner of controlling the motors most of the companies still use the time-honored rheostat; although I believe one company is endeavoring to introduce a new type of controller, which they will, doubtless, be happy to explain at a later date.

Many roads, acting under a misapprehension of the requirements, started off with motors too small for the work, and endless trouble has been the result. Some new classification should be adopted by the electrical companies for designating the power of their motors, as the present "office classification" does not afford a proper understanding of its capacity, and the "horse-power" term is but little better, depending on so many limiting conditions. A more satisfactory way would be to specify the number of pounds the motor can pull at different speeds, with the maximum current for which it is designed.

The first car trucks employed in electrical work were of the pedestal form; that is, the trucks were fastened to the car body and oscillated with the car. The motors, of course, had to be suspended from the car body, and the result was that the grinding of the gears was transmitted through the whole car; also, the oscillation of the car body caused the motors to correspondingly rise and fall. This was very undesirable, and it was soon found necessary to adopt the post form, in which the truck was complete in itself and the motors supported directly on the frame of the truck. The body was connected with the truck only by springs, thus being entirely free from the jolts and pounding of the truck.

In this form slight spiral springs were first used, the same as in the previous styles, but it was soon found that the high speed attained caused the body to oscillate to such a degree that it became very objectionable, and the different builders then modified their trucks by extending the side bars beyond the axle boxes a sufficient distance to allow an auxiliary spring to be added at each end. For this auxiliary support, coil and elliptical springs have been used, both forms with marked success, and it is now possible to carry a car body 28 feet over all, practically without oscillation. This last modification has been a very great improvement, and has settled the long car question on most street railways. I mean by this that but very few double truck cars will be used, though, of course, there are places where two trucks can be used to advantage, and in such places they will still be employed. But where we are able to carry nearly as many people on four wheels as on eight, and to apply the power equally on each axle, so that there is no possibility of lack of traction, there can be no gain to the railroad company in using eight wheels.

The car bodies first employed were of the same style and proportions as those used for horse roads, and were not properly designed for electric purposes; first, the framing of the roof was too weak and would not support the trolley board properly; second, the framing of the floor was not adapted for the use to which the cars were put, for not only was the framing too weak, but it also was not well planned for putting in the trap doors which are required in order to inspect the machinery underneath the floor.

The car which it seems to me is best adapted for the present service is one 18 feet six inches long inside, with platforms three feet six inches long. The rafters should be strengthened with steel plates and the framing throughout should be heavier.

The coloring of the cars and the necessary signs are attracting considerable attention from the different railway companies, but up to the present time I do not think any concerted action has been taken. For my part, I believe that all of the cars on a system should be painted the same color; that is to say, each separate line should not have a distinct color, but signs should be used to designate the different routes, preferably by means of the well known reversible sign on the top of the car both at the sides and front. At night the lines might be distinguished by the color of the ventilator glass, which would in each case be the same as the ground color of the reversible sign.

There has been a general improvement in all parts of the overhead material. We are using stiffer poles, stronger span wires, better trolley wire insulators and handsomer curve fittings; so that the general appearance of the system is much pleasanter. The quality of insulation now in general use is far superior to what we had two years ago, and as double insulation is now employed on the span wires, very little trouble from leakage is experienced

The method of feeding the line is a very important matter and should receive careful attention. The best arrangement is to divide the system into several sections, so that in case of trouble along any portion of the line, such as fire, etc., that section can be cut out and the balance of the system run as usual.

This may be rightly called the heart of any electric system. The trolley and feeder wires form the arteries, the rails and return wires the veins, and the cars the capillaries connecting them. The biblical injunction to "Guard thy heart with all diligence, for out of it are the issues of life," would certainly seem applicable to the station. The chief element to be considered should be reliability, and, after that, economy. Just what means shall be used to attain this end seems so far to have been a disputed matter, as shown by the stations now in operation, which contain almost every conceivable device, good, bad and indifferent; all shapes, sizes and descriptions of engines, boilers and dynamos. Many designers of stations —if some of them can be said to have been designed at all—seem to have gone at their task utterly regardless of the future and oblivious to the experiences of the past. However, through it all I can say that a very marked improvement is observable lately. The designers of stations are learning wisdom from their past experiences, and the makers of apparatus are more alive to the requirements of the system, and better material and workmanship can be had where required.

The recent introduction of large multipolar dynamos has brought about a change in station arrangements not heretofore obtainable, and in all large stations now being built countershafting is dispensed with entirely, and the general tendency is toward reduction of parts, which in turn means simplicity. It is very probable that we have reached now a form of station that will be fairly permanent, and the main point in the future will be the size of the units. For medium size stations engines with releasing valve gear belted direct to a multipolar dynamo will be the best where the price of land is not excessive, and direct coupled engines and dynamos for larger stations. To my knowledge there have been no comparative tests made as to the economy of the various types of stations, although all reasoning would point to these latest types as being by far the most economical.

There has been heretofore too much taken for granted or assumed in electrical work, and the rapid growth of the business has called into it many who were totally unqualified for the positions which they obtained. I attribute much of the unsatisfactory work in the past to this course, but am happy to note that the great majority of these are passing into the background, and their places are being filled with men of good judgment and mechanical resources.

At the conclusion of the reading of the report, Mr. Lewis offered the following resolution, which was adopted:

WHEREAS, The Street Railway Association of the State of New York, assembled at Saratoga Springs for its tenth annual meeting has learned that the Union Railway company of New York has put in operation this week the first electric trolley cars within the city of New York;

Resolved, That the association congratulates the company and the public of the greatest city in the Union upon this adoption of the latest and most improved method of street railway traction;

Resolved, That this association earnestly deprecates the opposition manifested against the trolley system in various quarters, as being founded upon neither reason nor fact, and as being contrary to the best interests of any community seeking rapid transit facilities and suburban homes for a growing population; and

Resolved, That the association hereby tenders to L. H. McIntire, engineer of the Union company, its thanks for his able address on the work already accomplished in New York, and its wishes for the development in the metropolis of the system thus inaugurated.

George W. McNulty, engineer of the Broadway railroad of New York, announced that his paper on "Recent Improvements in Cable Traction" which he had promised to prepare for this meeting was not ready, as his road which he had intended to describe was not yet in operation.

Messrs. Cleminshaw, Lewis and McNamara were appointed a committee on nominations. They reported the following names, and the gentlemen were thereupon elected:

President, C. Densmore Wyman, New York; vice-president, Daniel B. Hasbrouck, New York; second vice-president, James A. Powers, Glens Falls; secretary and treasurer, W. J. Richardson, Brooklyn.

Executive committee: D. F. Lewis, Brooklyn; John N. Beckley, Rochester; John W. McNamara, Albany.

Mr. Lewis offered an amendment to the by-laws, increasing the annual dues of members in the first class to fifty dollars, as recommended by the executive committee, which was adopted.

The meeting then adjourned to meet in Rochester, the third Tuesday in September, 1893.

In the afternoon all in attendance at the meeting were invited by the Union Railway company of Saratoga, to participate in a trip on the electric road to Saratoga Lake. The ride was enjoyed by all.

Electrical Decorations at Washington.

The special electrical illumination of Washington, D. C., in honor of the G. A. R. convention was on an elaborate scale. Pennsylvania avenue, from the capitol to Seventeenth street, was ablaze with light. Every available dynamo in the city, public and private, was brought into requisition, and numbers had been installed especially for this display. The result of these efforts of the committee having the matter in charge was exceedingly satisfactory. One of the features of the illumination was the display along both sides of the famous avenue of brilliant representations of corps badges. Seventy or more of these were placed at convenient distances in three colors—red, white and blue—the respective colors of the First, Second and Third Divisions. Each of these was outlined by incandescent lights of the same color as the badge.

A design of special interest was erected at the head of Fifteenth street, at the head of the White lot. It was a monster fac-simile of the G. A. R. badge, eighteen feet in height. It was made up of incandescent lights of the various regulation colors, and produced a grand effect. The duplicate of this piece was also shown at the corner of Pennsylvania avenue and Seventeenth street. Over one of the entrances to the White House spanning the arch of the gateway was placed a great fan of 1,300 lamps arranged so that they could be turned on and off, giving the fan the appearance of opening and shutting. Over the other gate was a great shield with an eagle surmounting it. A fine display, and something entirely new in Washington, was shown in the White House grounds in front of the mansion. Here innumerable lights were half hidden in the shrubbery, all of them changeable in character, disappearing and reappearing in the most bewildering manner. Throughout the grounds were a number of other electrical devices, among them wheels turning and changing colors with each revolution.

The illumination of the Treasury Building with colored lights was especially fine, and notable also were a number of set pieces along the avenue, probably the most conspicuous being a great anchor of blazing light placed at the corner of Tenth street. During the display powerful search lights thrown from the tops of high buildings produced a dazzling effect.

New Chicago Electrical Firm.

Considerable interest has been aroused among the members of the electrical fraternity in Chicago by the announcement of the formation of the firm of Taylor, Goodhue & Ames, which proposes to manufacture and sell electrical material, with an office at 827 Monadnock building, Chicago. All the members of the new concern occupied responsible positions with the Electrical Supply company until very recently, and Mr. Ames will not sever his connection with the old company for a week or two yet. In the new association William Taylor will be president, Wells Goodhue vice-president, and H. D. Ames secretary and treasurer. Each of these gentlemen has a wide acquaintance in the electrical field, and it is announced that the new firm has already secured some valuable agencies.

Cause of the Trouble.

Electric car 199 of the Main street line was stopped, not by the motorman, but apparently by the failure of power, last evening at the junction of Sophia street, says the Rochester, N. Y., *Post-Express*. The conductor and motorman alighted and took a long look at the wheels and other running gear without finding the source of the trouble. Another car came up, and its officers joined in the search. Just then it seemed to occur for the first time to one of the men to look up, and, wonderful to relate, he discovered that the trolley was off. That and nothing more had been the trouble!

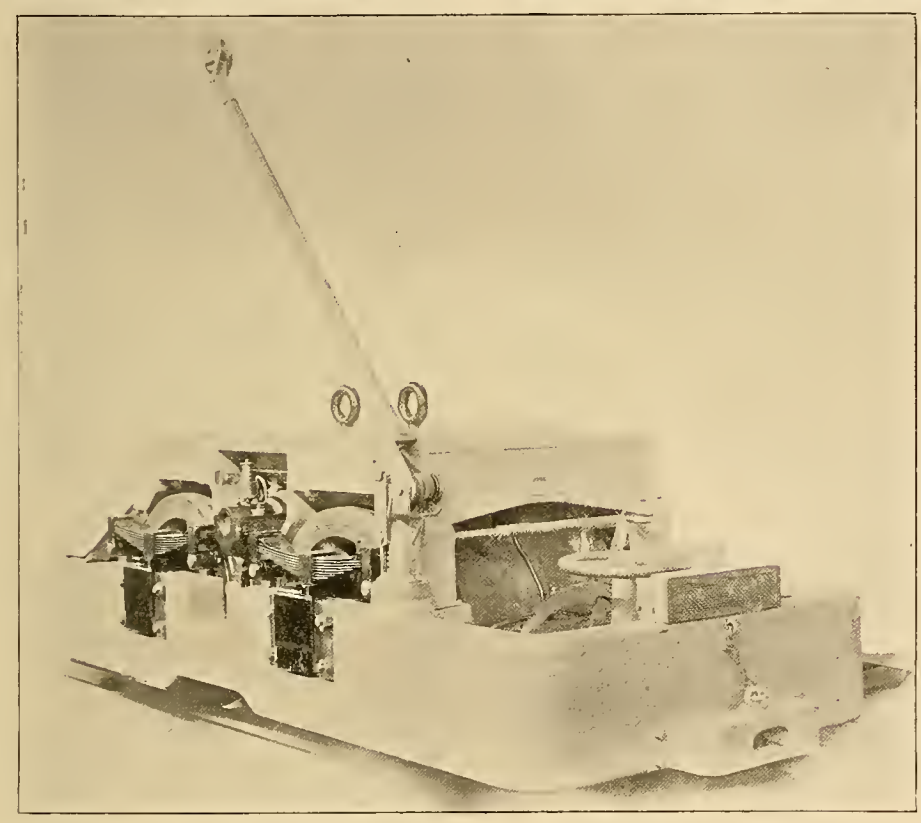
There is talk of connecting Iron Mountain, Florence and Crystal Falls, Mich., by a telephone line, and there is some probability that such a line will be built before the end of 1892.

Eight thousand five hundred red, 6,000 white, 4,200 blue, 1,800 green, and 800 yellow incandescent electric lights were used for street displays along the line of march of the Knights Templar parade in Denver recently.

The General Electric Company's Mining Locomotive.

The mining locomotive herewith illustrated is known as the "G. L. M." type of the General Electric company, and is of an entirely new design, and is arranged for operation in particularly low and narrow entries.

The frame consists of but a single heavy box-shaped casting with recesses in the sides for the axle boxes. Space is allowed at one end for the operating platform, and at the other end for the rheostat, the motor being placed in the center. Recesses are also provided in the frame casting for the brake levers and axle gears. The motor is of a type similar to the "W. P." railway motor, and consists essentially of two main castings. The lower casting forms the lower pole piece, and supports the bearings for the armature shaft, the two intermediate shafts (placed one on each side of the armature) and the field spool. The gears are set in pockets in the frame of the motor, and are completely and tightly covered by the iron castings thus doing away with the separate gear cases. The top pole piece is part of the upper casting of the motor, and is of such shape as to make a complete cover for the motor, thoroughly protecting the armature, field spool and other interior parts. The armature itself is of the iron clad ring type. The



GENERAL ELECTRIC COMPANY'S MINING LOCOMOTIVE.

intermediate shafts, two in number, are placed on each side of the armature, and transmit power directly to both axles. The axle gears are set in fixed bearings supported by the frame of the locomotive, and are fastened to the axle by a flexible coupling of novel design which allows free movement of the axle in all directions, except a longitudinal one, with reference to the gear and frame. This coupling is built entirely of heavy steel castings with gun metal linings, so that it will easily withstand the rough wear and tear of mining service.

The following advantages are claimed for this construction: First, by gearing the armature to two intermediate shafts on opposite sides, the thrusts of the gears tend to neutralize each other so that the resultant pressure on the armature bearings is very slight. Second, by doing away with the parallel connecting rods on the axles it is possible to largely decrease the width of the machine. Third, it allows a spring suspension for the whole machine, motor included, the advantages of which will be readily appreciated by every one. Fourth, the axle boxes are on the outside of the machine and are easy of access for oiling, or for the removal and replacement of the linings.

The locomotive is equipped with a new form of trolley, insulated so that the operator may take hold of it at any part except at the wheel. In case it is necessary to move the trolley wire from one side of the entry to the other, the trolley may be lifted entire from its socket, and placed in a corresponding socket on the opposite side of the locomotive.

All connections are automatically made by simply setting the trolley in place. The rheostat used is of the standard railway type provided with a special filling. The brake is a very powerful form of toggle joint made of substantial steel castings. The locomotive is also equipped with headlights and sand boxes. The following are some of the general dimensions of the 30 6 and 30-10 locomotives as made for a 30 inch gauge: Draw-bar pull, 3,000 pounds; speed, 6 or 10 miles per hour; length over all, 9 feet 6 inches; total height, 36 inches; width over all, 48 inches; wheel base, 40 inches; gauge, 30 inches; diameter of wheels, 28 inches; weight, 15,000 pounds. The same type of machine is made of different capacities, draw-bar pulls varying from 750 to 4,500 pounds.

CORRESPONDENCE.

New York Notes.

NEW YORK, Sept. 24.—Now that the rapid transit commission is bringing its arduous undertaking to a completion, the croaker has appeared; this time in the shape of a real estate paper. The *Record and Guide*, whose editors have the reputation of talking common sense in regard to matters of public interest, is inclined to be skeptical about the ability of the rapid transit commissioners to find a purchaser for the franchise which they will presently offer for sale. It is the opinion of that paper that, if the franchise is offered only for a limited number of years, or if it is conditioned with safeguards and restrictions in the interests of the patrons of the road—as, for instance, in respect to the frequency and speed of trains, the rate of fare, and the character of the accommodations—no purchaser will come forward to put in a bid. Even if the franchise is offered without any conditions whatever, the chances are held to be not better than even that any purchaser will be forthcoming.

As has been suggested in a criticism of the *Record and Guide's* opinion, it would, perhaps, be well to wait until the matured plans of the commissioners are submitted to the public and the capitalists. They are said to be nearly ready for presentation. They may be of such a character that the critics and doubters will be able to take a more hopeful view of the future of rapid transit.

Bathing by electric light, horse racing by electric light, base ball by the same illuminant—with all these the arc lamp has played an important part. But now we are to have the "very latest and improved" sporting novelty, viz.: foot ball by electric light. Word comes from Orange that the foot ball team of the Orange Athletic club will play a number of practice games by electric light. The club team is now hard at work training for the opening of the club's foot ball season on October 1st. Within a short time, it is stated, the team work at night will be commenced on the Orange Oval.

Yes, the electric railway is a very deadly something—at least so many would think did they believe all the wild nonsense and trash which a number of New York papers have been printing. It is a peculiar fact, though, that out of many accidents that have occurred of late there is hardly one which was due to the action of the current. For instance, under the misleading head of "Another Victim of Trolley Poles" the public is informed that in Newark, N. J., a motorman on the Rapid Transit electric line was at the front of one of the cars on Lister avenue when something attracted his attention. Leaning over the side of the dashboard, he looked back, and an instant later his head was brought in contact with one of the iron poles. The blow stunned him, and, falling unconscious over the rail, he had been struck by three poles before the car was stopped.

Of course this was the fault of the electric system.

On Monday afternoon last Dennis Sullivan, superintendent of the Slocum trolley road in Brooklyn, was shot by Frank Gateley, a discharged employe of the company, and so seriously injured that he will probably die. W. F. O.

Northwestern Notations.

MINNEAPOLIS, Sept. 24.—The starting up of the fine new power station at Duluth last week was an event of much local interest and importance. The people of the town are elated over the completion of the improvements. The end of the season will find the city provided with 38 miles of street railway, just about double the amount at the beginning. Double tracks have been laid in many directions where singles have done duty heretofore. Sixty pound rails have been used. The equipment now includes 5 cars. The new station has a capacity of 98 cars. The power house is a beauty. The big band wheel is the largest in the country, with a diameter of 28 feet and a weight of 85 tons. The machinery rests upon the solid rock, and everything is made to stand the test of time. It has a rated horse power of 1,000 and will develop 1,500.

The receiver of the Stillwater Electric Street Railway, company reports receipts for August amounting to $2,482.19, against disbursements of $2,044.57. That is a pretty good showing for a bankrupt road.

The Minneapolis Street Railway company has changed the time schedule on the interurban line so as to reduce the number of cars by one and at the same time keep the six minute intervals unchanged. This was accomplished by shortening the time each way three minutes. From Minneapolis to St. Paul the time is now 54 minutes and from St. Paul to Minneapolis it is 51.

The regular train service to Lake Harriet has been discontinued for the season. Cars will be run hereafter on Sundays only. This has not been so profitable a season as last on account of the misunderstanding between the company and the Minneapolis park commission on the subject of attractions and who should pay for them.

During the Minneapolis exposition the street railway company has provided a special service which has proved very satisfactory. On some days the rush has been big enough to recall the grand crush of the Republican National Convention week.

The Minneapolis building inspector got after the telephone company the other day for undertaking to set poles without a permit. The battle was brief and bloodless.

Work has been commenced on the electric line at Ashland, Wis. C. K. Stearns of the Thomson-Houston company is looking after the construction. The poles are being placed on the side of the street.

The Duluth Street Railway company has contracted with W. C. Doherty to build an extension to Lakeside, to be completed by Nov. 15th. When this is completed the Superior street line will be fifteen miles long.

St. Paul is considerably stirred up over the report that the next step toward the removal of the Northern Pacific railway offices to Chicago will be the transfer of the superintendent of telegraph.

The Butte, Mont., General Electric company has filed articles of incorporation with the secretary of this state. St. Paul is named as the principal place of business, although Butte is the local habitation of the plant. The capital stock is $600,000. The incorporators are Henry M. Byllesby and Howard C. Levis of St. Paul and Jesse R. Wharton of Butte.

On account of the difficulty in getting poles the company which is putting in an electric plant at Luverne, Minn., has had to ask for an extension of time. The delay will not be long, however. Most of the material is on the ground, and F. E. Scoville, who is to superintend the construction, is on hand.

Another very large grist of damage suits begun in the St. Paul courts against the street railway company makes the company long for the happy days when an insurance company was shouldering all the consequences of this sort.

It is noticeable that in the majority of cases the complaint is that the car was started so suddenly that the person was thrown and hurt. It would seem as though a few more lessons of this kind would lead to a radical reform in this respect.

The St. Paul aldermen are brooding over the matter of underground conduits. It appears that the National Subway company, the St. Paul Street Railway company and the telephone company have authority to lay wires underground. The two latter are using conduits while the only wires in the Subway's are those of the fire department. The Edison Electric company has a franchise and is preparing to put its wires down, laying them along each side of the street with connections every 25 feet and manholes at street intersections. The Western Union Telegraph company and the Economy Steam Heat & Power company are asking for franchises. There is likely to be trouble finding space in the streets for the manholes, which are necessarily large. The city engineer is also afraid there may be some danger in allowing so many companies to tear up the streets.

H. C. Emery, of Indianapolis, who is interested in street railways after sizing up the system has pronounced the Twin Cities lines the finest he ever saw with one exception. He criticises the lack of an enclosed warm transfer station located somewhere along the loop.

The Northwest General Electric company has contracted with the street railway company at Great Falls, Mont., to exchange all the old style motors for water proof single reduction motors. The Great Falls company is disposed to give its patrons the best of service, although the investment has not as yet proved very profitable. The cars now average 700 miles a day. The track and equipment are excellent.

S. D. Davidson has bought the Sauk Center, Minn., electric light plant and will run it in connection with his mill.

H J. Spencer, J. N. Nevens and H. Spaulding have turned over to C. N. Parker all their interests in the proposed electric street railway at Brainerd, Minn. Mr. Parker will spend $40,000 in putting in a first-class plant.

The new machinery for the electric light plant at Sioux Falls, S. D., has been installed and is working well.

The city authorities of Deadwood, S. D., and the street car company are wrangling over the tearing up of a track. The company threatens to sue for damages. H. C. C.

Milwaukee, Wis.

MILWAUKEE, Sept. 24.—The Milwaukee Street Railway company's big cable at Michigan street bridge, which supplies the current for the Farwell avenue, Greenfield avenue and Holton street lines, gave way recently and these lines were then supplied from a cable used for the West Side and South Side lines. The increased current proved too much for the cable. It parted, too, and many of the fuse boxes and motors were badly damaged. The whole system was at a standstill for several hours. The damage to machinery, etc., was about $5,000.

It is not only proposed to extend the Milwaukee and Wauwatosa railway from the state fair grounds to North Greenfield, but to equip the whole line with electricity, and eventually extend it to Hale's Corners and Muskego Lake. The distance from the fair grounds to North Greenfield is one and a half miles. North Greenfield people are willing to bear part of the expense of making the extension. The company asks them to build the road, or give a bonus of $15,000, which would practically be the same thing. The track will be a double one. From North Greenfield to Hale's Corners a single track would be built. The distance is about six miles, and the road, it is said, could be built for $65,000.

The experience of state fair week has proven that better rapid transit facilities will be necessary in order to make the next agricultural show a success. Although the St. Paul and Northwestern Railway companies ran trains to the grounds at intervals of half an hour, the crowds were not accommodated properly. The Milwaukee & Wauwatosa Motor company was unable to run trains of any size, for one thing, and the National avenue electric line, with its omnibus adjunct, was far from satisfactory. Next year the National avenue electric cars will run right to the grounds, and the Rapid Transit electric line will also be extended to that point in all probability, so that there will be little or no trouble about transportation.

Henry C. Payne, of the Villard syndicate, has just returned from a business trip to New York. He announces that the Milwaukee Street Railway company will probably not take possession of the West Side railway or Becker line until April 1st next. It has been generally supposed that the change would be made on October 1st. It is learned that the time fixed in the contract for making the last payment is April 1st, but it is provided that by giving thirty days' notice the Villard people may take possession of the Becker line on October 1st. Such notice has not been given, however, and the change will be delayed until spring. Mr. Payne adds that some of the Becker line will be rebuilt this fall and that it will be supplied with additional rolling stock, which is being built by Jones & Co., of Troy, N. Y. The work of equipping all of the city lines with electricity will be practically completed by the end of the year. The policy of the company, Mr. Payne says, speaking of the construction of suburban lines, is to extend its system and give first-class service as rapidly as business warrants and the towns secure right-of-way franchises. The town board of Lake has granted the Howell avenue franchise and the line will be built as soon as possible. Property owners raised a bonus of $25,000.

C.

New England Notes.

BOSTON, Mass., Sept. 24.—The big electrical concerns of Boston are vitally interested in an ordinance recently passed by the city government. This order provides that: "No person shall use bituminous coal for the purpose of generating steam in boilers in any building, unless the furnace in which the coal is burned is provided with some effectual device for consuming its own smoke." After this order was passed the inspector of buildings received many complaints from persons who suffered from the smoke nuisance. He ruled that a smoke consuming device, in order to be approved, must consume at least ninety per cent. of the smoke emitted, but after repeated trials, no device was found which would comply with this requirement The inspector was in a quandary, but the city council came to his relief September 8th by ordering that the conditions of this ordinance should not be enforced during such time as would be necessary to allow him to investigate and report upon the merits of the devices on the market. A meeting of the soft coal consumers was held on Monday last, to assist the inspector in his investigation. Among those present were E. W Burdett, F. A. Gilbert, of the Boston Electric Light company, F. S. Pearson, chief engineer of the West End street railroad, and other electrical experts. Mr. Burdett called the meeting to order. The general opinion seemed to be that the order could not be effectually enforced because it does not prohibit the use of soft coal by the railroads running in and out of Boston. It was finally decided to appoint a committee of three to investigate the matter. The committee consists of F. A. Gilbert of the Boston Electric Light company, F. S. Pearson of the West End, and Moses Williams, representing the real estate interests. Mr. Gilbert promised one hundred dollars toward the expenses of the committee, and said two other gentlemen had promised similar sums. W. W. Gouch, for the Edison Electric Light company, also promised one hundred dollars. At present there is no successful device of this kind in use in Boston. If nothing can be found to meet the requirements of the city government, it will be necessary for consumers to give up the use of soft coal. This will be a hardship in most cases. To the Boston Electric Light company alone it will mean an additional expense of over $20,000 per year. Supposing this ordinance were enforced it would embarrass the companies in two ways. First there would be the extra cost of anthracite coal and contracts already made for bituminous coal would have to be canceled. Probably the coal companies would attempt to compel consumers to carry out their contracts. Until people know what to expect in this matter there will probably be no more long-term contracts made. If these companies are compelled to use anthracite coal, rentals will probably advance. Both gas and electric lights would also be higher. The Edison company uses about a hundred thousand pounds of soft coal a day. The Boston Electric Light company uses about a hundred and ten thousand pounds a day. The market price of anthracite coal is $1 30 per ton higher than bituminous. One engineer who has made the change says he uses 10 per cent. more coal now. He figures that it costs 40 per cent. more to get up steam with anthracite than with bituminous.

Arrangements have been made for giving the daily forecasts from the top of Mount Washington by means of the electric search light. At 8 o'clock in the evening the light is directed toward Portland, Me., and after 10 or 15 short flashes the forecast is given for the following day. After the warning signal, long flashes of from 6 to 8 seconds duration refer to weather and short flashes of from 2 to 4 seconds in duration refer to the temperature. Those for the weather are always given first. This is the code:

One long.....Fair weather.
Two long.....Rain or snow.
Three long.....Local rains.
One short.....Lower temperature.
Two short.....Higher temperature.
Three short.....Frosts.

Interpretation of combined flashes: One long, alone, fair weather, stationary temperature; two long and one short, rain or snow, lower temperature; three long and two short, local rains, higher temperature; one long and three short, fair weather, cold wave.

After the signal has once been given toward Portland, it is turned toward Augusta, and then Lancaster and so on around the horizon. After Portland is reached again the whole thing is repeated so as to avoid error. It is not necessary to be in a position to see the top of the mountain in order to see the signal. High in the air overhead can be seen the small beam of light.

By December 1st very few horses will be used for drawing Boston street cars. Within two months the West End expects to have the Milton, Upham and Field's Corner line running with electricity. The Malden line is equipped with electricity as far as West Everett. Another line to Malden will shortly be made electric as far as Everett. A line between Grove Hall and Boston by way of Warren and Northampton streets, one from Harvard square to Bay View, South Boston, one from Brighton to Boston and the Bedford line will soon be run by electricity, and then there will be little left to equip.

More than 75 per cent. of the stock of the Lynn & Boston road has been transferred to the books of the syndicate which has bought it The Lynn & Boston, the Lynn Belt Line and the Naumkeag roads will probably be called the North Shore Traction company when fully consolidated. Superintendent E. C. Foster has been appointed general manager. The Boston offices will probably be abolished and the business transferred to Lynn. It is said that Vice-President Oliver is to be treasurer. Stock is being bought at $190 a share as fast as presented.

Extensive changes are being made in the power station of the Watertown electric lighting works. The present plant is now overtaxed. A new 30 by 50 engine house is to be built and will contain a 700 horse power Wheelock engine. A shaft is to be run the entire length of the power house and all the dynamos will be run from it. This means a change from a high to a slow speed station. The company has recently put in a dynamo of 2,000 commercial lights capacity, and as soon as the new engine is ready for use this will be started. At present the company is furnishing power for 105 arc, 783 street and 2,600 commercial lights. Applications for over 600 incandescent lights have been received. The improvements will cost about $25,000.

Electric power for manufacturing purposes is to be had in Bath, Me., soon. On the 16th inst ex-Mayor Patten paid $5 000 toward the purchase of a water power for this scheme, and it is believed that the balance of the $20,000 needed, will soon be subscribed. The plan is to buy the lower fall of the Androscoggin, just above Brunswick and to generate electricity to be carried to Bath, 14 miles away. The water privilege is of 6200 horse power.

A new electric road is soon to be operated between Springdale and Sanford, Me., a distance of 2½ miles. There are ten mills at Sanford and heretofore they have not had any connection with other towns. The nearest railroad station was at Springdale and from there things had to be carted to Sanford. The new road will be a combination passenger and freight line. The equipment will consist of two passenger cars and an electric locomotive for handling freight cars. The primary power will be taken from the waterfall and will operate a 100 horse power multipolar generator. Westinghouse apparatus will be used. This road is expected to be in operation in a month.

The Interstate Electrical railway between Providence, R. I., and Attleboro, Mass , has fallen into financial difficulties, which, however, are expected to be soon dissipated, as they arise principally over a dispute about the amount of a bill. The Clemons Electrical company has attached the road for $40,000. Treasurer Otis of the railway says the bill is due for construction, and should be only $20,000. The company claims the construction bill was too high.

A mysterious new storage battery company for electric traction is one of the possibilities talked of. On each car one motor will be used and it will be connected with both trucks.

The Meriden, Conn., Horse Railroad company has sold its cars, horses, buildings, etc., to J. W. Coe of that city for $60,000. Mr. Coe expects to put in an electric plant.

The Fairhaven & Westville Railway company of New Haven, Conn., has applied for permission to operate its road by electricity. It will use the trolley system.

C. E. Riley & Co., of Boston have received an order from the Shove Mills, Fall River, for drawing-frames to be supplied with Howard & Bullough electric stop motions. The Newmarket Manufacturing company of

Newmarket, N. H., has also placed a similar order with them.

The electric road between Salem and Danvers via Peabody was opened for travel on Saturday last.

W. E. Ayer of Newbury, N. Y., has purchased land in Monterey on which he will build an electric experimental station employing 30 men.

George Westinghouse Jr. has had a party of Boston capitalists in Pittsburg visiting the Westinghouse works during the last week.

The Newport, R. I., Illuminating company is going to have its old style alternating current dynamo reconstructed into the new toothed armature of the latest Westinghouse type.

The Holyoke, Mass., street railway will partially adopt the Westinghouse system. The company is now operating six cars of the Thomson-Houston system.

The Littleton, N. H., Water & Electric Light company has elected these officers: Directors, B. H. Corning, Charles F. Coffin, E. Summerfield, B. A. May and John T. Masteadall; clerk, O. W. Hunkins.

J. C. E.

PERSONAL.

W. J. Johnston of the *Electrical World*, New York, was in Chicago last week.

J. H. McGraw of the *Street Railway Journal*, New York, was in Chicago last week.

H. E. Webb, representing the Solar Carbon & Manufacturing company, Pittsburgh, made the WESTERN ELECTRICIAN a pleasant call on Saturday last. Mr. Webb is making a business trip for his company, and expects to remain in the West for some weeks.

B. E. Greene, New York, publisher of *Electricity*, was in Chicago several days last week. Mr. Greene has had considerable experience in newspaper work and he possesses a wide acquaintance in the East. He will give the management of the paper his personal attention, and we extend our best wishes for his success.

S. A. Douglas has been appointed western manager of the Brush Electric company, to succeed Alexander Kempt, whose resignation takes effect October 1st. Mr. Douglas, who is already in the city, came here from the Cleveland office of his company. He is an energetic and popular young man, and will no doubt score a distinct success in his new position. Mr. Kempt, the retiring manager, is widely acquainted among the members of the electrical fraternity, and will bear the good wishes of his friends where ever he may go

NEW INCORPORATIONS.

Electric Light & Power company, Syracuse, N. Y.; capital stock, $800,000; to furnish light, heat and power.

Cooperstown Electric company, Cooperstown, N. Y.; capital stock, $12,500; furnishing light, heat and power.

Empire Electric company, New York, N. Y.; capital stock, $25,000; to manufacture and sell electrical appliances.

Nevada County Electric Power company, Grass Valley, Cal.; capital stock. $500,000; to generate electric power and light; Fred Searles, Nevada City, Cal.

American company, Portland, Me.; capital stock, $750,000; to manufacture and deal in all kinds of electrical appliances; Clarence Hale, Portland, Maine.

Barberton Electric company, Barberton, O.; capital stock, $40,000; manufacturing and distributing electricity for illuminating, power and heat; Edward A. Huene, Barberton, O.

Higham Electric company, Portland, Me.; capital stock, $5,000,000; to secure and develop patent rights connected with electric lighting; Edward Woodman, Portland, Maine.

Sierra Water & Power company, Los Angeles, Cal.; capital stock, $200 000; to develop and deal in water and water rights, water, electrical and other power; R. H. F. Variel, Los Angeles, Cal.

San Bernardino Electric company, San Bernardino, Cal.; capital stock. $500,000; to erect and operate electric plants, deal in electric, water and other power; William Gird, San Bernardino, Cal.

Butte General Electric company, St. Paul, Minn.; capital stock, $600,000; to manufacture electricity, gas and steam for light, heat and power purposes and all kinds of electrical apparatus; H. C. Levis, 403 Sibley street, St. Paul, Minn.

Whiting, Hammond & East Chicago Street Railway company, Hammond, Ind.; capital stock, $100,000; owning, constructing, maintaining and operating electric street railways, switches and side tracks within the state of Indiana; Chas. F. Griffin, Hammond, Ind.

Warren Water, Light & Power company, Summit, N. J.; capital stock, $100,000; manufacturing, producing, selling and supplying water, gas and electricity for municipal, domestic and any and all other purposes; Sullivan & Cromwell, 45 Wall street, New York, N. Y.

Minneapolis General Electric company, Minneapolis, Minn.; capital stock, $2,500,000; to generate, manufacture, use and sell electricity, gas and steam for lighting, telegraph, telephone, heat and power purposes, buy, own, sell, construct and operate gas, electric telegraph, telephone, heat and power plants; Hahn & Hawley, 53 Guaranty Loan and Trust building, Minneapolis, Minn.

ELECTRIC LIGHTING.

Canton, O., has been having races by electric light.

Salamanca, N. Y., expects to have electric lights by November 1st.

The cars of the Toledo, O., Electric Street Railway company are to be heated by electricity.

The Chicago Edison company is testing a system of down draft furnace which promises to effectually consume smoke.

At Palma, in the Canary Islands, an electric light installation is to be established, both for public and private purposes.

The city council of Salem, Va., has decided upon the purchase of the Salem electric company's lighting plant for $19,000.

The electric light company at Silver Creek, N. Y., has about completed its work, and expects to be able to turn on the current soon.

The Electric & Water company, of Little Falls, Minn., has filed an amendment to its articles of incorporation fixing the limit of indebtedness at $75,000.

As a result of a disagreement over a contract between the trustees of Batavia, N. Y., and the consolidated Gas & Electric company, the village is in darkness.

Henry Keller, of Sauk Center, Minn., has sold his electric light plant to S. D. Davidson, who will run it in connection with his mill. The consideration was $12,000.

W. R. Yeargin, of Dyersburg, Tenn., will probably erect an electric light plant and construct a system of waterworks in Greenwood, Miss., as the city officials have promised to subscribe for water and lights if he will do so.

An isolated electric lighting plant of 800 lamps' capacity has been placed in the new Beveridge apartment building, Twenty-sixth street and Calumet avenue, Chicago, by the Chicago Edison company, which furnished machinery, wiring and lamps complete.

At a recent meeting of the stockholders of the Edison Electric Light company, of Philadelphia, the original contract with the General company was modified by the reduction of the royalty about 70 per cent., and the capital was increased by the addition of $1,000,000.

Frank P. Arbuckle of Denver, has closed negotiations for the sale of the Longmont, Colo., Electric Light & Power company, of which Mr. Arbuckle is the principal stockholder. The property was sold to a syndicate of Longmont people for $20,000, and all the stock is to be owned by citizens of the town of Longmont.

At a meeting of the stockholders of the Edison Electric Illuminating company, of Lancaster, Pa., several important matters were voted upon, chief of which was the increase of the bonded indebtedness from $35,000 to $250,000. The bonds will be issued on October 1st. The capital stock will remain the same—$135,000.

The contract of the city of Montreal with the Royal Electric Light company expires Dec. 31, 1892, and other companies have an eye on the franchise, judging by the letters the mayor is receiving, asking that the tenders be called for at once, so that whoever gets it will have time to put in the plant, etc. The price paid under the present contract is $148 per lamp. Voluntary bids have already been put in for $100 per lamp.

ELECTRIC RAILWAYS.

An electric railway to connect Sandusky, Milan and Huron, O., is talked of.

The Central Railway company, of Baltimore, has equipped its entire line with electricity. The Thomson-Houston system is used.

The Savannah Electric Railroad company will shortly commence the extension of its road to the railroad wharves at a cost of about $50,000.

The property and franchises of the Lansing City Electric Railway company have been sold at receiver's sale to Charles H. Osband, representing the Continental Trust company, of New York, the owner of the bonds. The price paid was $35 000, and the sale was made subject to a mortgage of $50,000. The road will be operated by the trust company.

The adoption of electricity for operating the Baltimore & Ohio Belt Line tunnel in Baltimore has called attention to the applicability of electric locomotives to tunnel service, and it is now reported that the Grand Trunk is considering the problem of hauling its trains through the St. Clair tunnel by means of electricity. As this company is now using the largest decapod locomotives ever built, weighing 195,000 pounds on the drivers, for this purpose, it is evident that the problem to be solved is by no means an easy one.

The *Philadelphia Record* says: "A big plunge of Philadelphia capital into street railways is revealed by the incorporation of the North Shore Traction company of Massachusetts, with a capital stock of $6,000 000, of which amount $20,000 has been paid in. The names of the incorporators as given are Edward E. Denniston, John P. Ilsley, and C. Ford Stevens of Philadelphia, A. Hass of Chester, and John McNeill. But it is understood that E. W. Clark, Clarence H. Clark and Edward E. Denniston are the principals interested in the new combination. The road, which is a combination of the horse car roads running out of Boston to Lynn, Marblehead, Salem, and other towns along the north shore of Massachusetts Bay, will be operated by the trolley system."

The cars for the Liverpool Overhead Electric Railway company of Liverpool, Eng., are 45 feet long, 8 feet 6 inches wide, carried upon two four-wheel trucks, 32 feet apart between the centers of truck pins. Truss rods are used as in American cars. The truck frames are of pressed steel, and the wheels are 33 inches in diameter, with steel tires and wrought iron spokes. Each truck has a 70 to 100 horse power electric motor, supplied by the Electric Construction company of Wolverhampton. The ends of the car are closed, and the interior is divided into two main compartments—first and second class, with one door in each side of each compartment. There is also a separate smoking compartment. Each car has seating accommodation for fifty-six passengers. The framing is of oak and teak. The interior finish is of oak and walnut for the first class, and yellow pine for the second class. The roof is arched and has no clear story. Each train will consist of two cars. The cars are lighted by electricity and are fitted with hand brakes, as well as the Westinghouse automatic brake, the arrangement for the latter being similar to that of the locomotives and cars of the City and South London railway.

TELEGRAPH.

It is said that the telegraph operators on the Vanderbilt system of railroad are contemplating an appeal for higher wages.

The Pennsylvania Railroad company has discharged four telegraph operators at Toledo for refusing to renounce their connection with the Order of Railway Telegraphers.

O. M. Stone, a Chicago grain commission merchant, has filed a bill in the Circuit Court to restrain the Western Union Telegraph company, the Postal Telegraph company and the Chicago Board of Trade from removing telegraph wires from his office, at the corner of La Salle and Washington streets, and connecting with his place in the Imperial building, on Clark street. He claims that he has been paying the necessary money for the quotations and that the defendants have threatened to disconnect his wires without any cause. It is alleged that the defendants are seeking to discriminate in favor of special customers,

A formidable antagonist to telegraph construction in Mexico is found in the monkey. The favorite diversion of these animals when not in quest of food is to betake themselves to the telegraph lines for gymnastic exercises, and linemen assert that often 100 able bodied monkeys have been seen swinging on the wire, festooned, monkey fashion, by looping their tails. The continuous vibrations of these forest gymnasts start the iron nails used on the cross-arms, and these often come down, bringing the wire with them. And it is not a safe matter to undertake to disperse these robust monkeys. Linemen have found that on shooting a monkey swinging on the wire they have been pursued by a whole regiment of monkeys.

MISCELLANEOUS.

It is asserted that the General Electric company possesses insurance policies amounting to $24,000,000.

A Boston dispatch says: "There is no authority for the statement that negotiations are pending toward consolidation of the Westinghouse and General Electric companies. Westinghouse people will not go in less than par for all classes of stocks."

The Peninsular General Electric company has filed a mechanic's lien for $4,890.63 on the Shepard-Hartman building, at Grand Rapids, Mich., covering the amount claimed to be due for labor and material furnished in the building. Fifteen hundred dollars of the amount was due Sept. 16, 1892, and the balance was to have been paid May 5, 1893.

A gentleman of leisure in England has just built a dairy, the like of which has never been seen. The building, which is of Carrara marble, is fitted throughout with electric light, and all the motive power for separators and churns and washing purposes is supplied by electricity. The opening of the edifice was performed with great ceremony by the Lady Mayoress of London.

The Acme Storage Battery & Manufacturing company was incorporated at Trenton, N J., last week with a capital stock of $5,000,000 by George C. Warner, C. T. Griffin and William L. Barker of New York; Jacob Herbert Potts of Jersey City, and W. M. McDougall of Orange. The object of the company is to purchase and deal in storage batteries and generators and erect a plant to carry on the business.

Preliminary steps have been taken by a body of gentlemen in Milan for the organization of an electrical exhibition in that city in the spring of 1894. Further information can be obtained from Angelo Bertini, electrical engineer; Francesco Grassi, professor of physics at the Societa d'Incoraggiamenti d'Artie Mestieri; Palamede Guzzi, engineer; Cesare Saldini, professor at the Instituto Tecnico Superiore; and Augusti Stucchi, manufacturer.

A damage suit against the Louisville Railway company and the Ohio Valley Telephone company was brought in the Common Pleas court yesterday by John Sweeny, says the *Louisville Commercal*. Sweeny is a fireman for the city, and was at the Dow wire works fire on Market street on the 3d of last July. While engaged in the discharge of his duties as fireman he came in contact with a wire of the telephone company which had broken and was down in the street, but crossed a wire of the railroad company. A severe shock was received from the wire, and Sweeny was rendered insensible. He was confined to bed, and, as his

petition claims, permanently injured. He wants $2,000 damages.

An electric light pole possessing several novel features has been invented in England. The object of the invention is to provide a safe and simple means of ascending high poles, and to do away with the necessity of requiring the lamp trimmers to carry ladders or movable steps to fit the holes usually made in the poles. Inside of the pole is a gearing which takes the form of an eccentric or cranked horizontal bar. Steps are attached to this at regular intervals. By means of a key at the base, the bar is raised, thus causing the steps to shoot out of the pole, forming a safe and strong ladder. By another turn of the key the steps can as readily be withdrawn within the pole. The gearing is so constructed that the steps are perfectly rigid and cannot fail or give way. These can be renewed or taken out only by those in charge, and all danger of tampering by mischievous or malicious persons is averted.

An Albany, N. Y., daily paper calls attention to the fact that very few people have any idea of the uses that electricity is put to aside from the propulsion of street cars and lighting purposes. The Albany Electric Light & Power company furnishes power to upwards of a dozen small establishments where a power of from one-half horse to ten horse power is used. The Edison Electric Light company does much more of a business in this line, upwards of 35 subscribers being upon its books. This form of power is very popular and is exceedingly economical, for the reason that no engineer is needed to run the motors. Several printing offices, laundries, carpet-beating establishments and tailor shops are fitted with motors with most economical and satisfactory results. The power is also used for revolving fans, coffee and peanut roasters and for running elevators, and in a variety of other ways.

An entry made on the trial docket of the Court of Common Pleas at Cleveland, O., shows that Morton W. Cope, as guardian of Gustav Pfannkuche, insane, has made a settlement with the Brush Electric company for $5 000, to be paid by the company to the guardian for Pfannkuche, the guardian to pay the costs out of the estate. Pfannkuche was an Austrian inventor, who sued the Brush company for $150,000 in matters growing out of the alleged wrongful use of his patents by that company when his contract to work for it was terminated. A demurrer was filed by the Brush company and sustained by Judge Solders last April. Mr. Cope meant to take the case up, but on settlement Judge Solders' entry of judgment was vacated by consent, and Judge Hamilton entered a judgment as above. After beginning the suit a series of misfortunes caused Pfannkuche to go insane, and hence the appointment of Mr. Cope as his guardian to look after his affairs.

TRADE NEWS.

The McGuire Manufacturing company, Chicago, has just issued a new and very tasty catalogue descriptive of its improved electric street car trucks.

Waterhouse Brothers, of Hartford, Conn., well known as manufacturers of arc lamps, are sending to the trade a neat pamphlet describing every part of their lamp.

Huebel & Manger of Brooklyn are very busy in filling orders now on hand for a new electric bell. They manufacture these bells in a number of styles and sizes.

The Automatic Switch company of Baltimore has recently placed one of its switches in connection with the freight electric elevators installed in Baltimore for Parr & Johnson. The Edison motor installed by J. P. Judge is used.

The Ball Electric Light company, New York, reports the sales of the Ball automatic dynamo as being very large. During the past month very large shipments have been made to Illinois, New Orleans and throughout the New England states. The company's illustrated catalogue is very interesting, containing many valuable hints.

Queen & Co. of Philadelphia report steadily increasing sales of magnetic vane ammeters and voltmeters. These instruments meet with much favor for switch-board use on account of an entire absence of permanent magnets and other changeable parts. Four manufacturing concerns have adopted these instruments, and installed them in both light and power plants.

The Waddell-Entz company of New York has issued its price list "No. 1" of belt driven generators and motors. Upon this same circular there is illustrated also the Waddell-Entz combination ventilating set designed for the United States Navy. This company is also busy manufacturing its improved slow-speed multipolar generators and motors, and directly connected motors for power purposes.

The Southern Electric company of Baltimore has recently made a number of changes necessary to meet the rapid growth of its business. A new store has been added in connection with the one now occupied, and the lease of a large warehouse for the storage of its street railway supplies has also been secured. This firm has begun to manufacture a number of specialties. The company is now at work, too, upon several large contracts for the United States government. Orders were received this week for wiring and lighting the postoffices of Rochester, N. Y., and Toledo, O.

Engineers and others who have been fortunate enough to obtain pure, soft flake graphite, properly prepared, do not question its value as a lubricant. On the contrary, they make daily use of it in many ways, and recommend it in the highest terms. Those who have desired to test the virtues of graphite and the claims of its advocates, and who have been unfortunate enough to obtain only impure and gritty graphite, naturally condemn its use. It is for the better understanding of mechanics that the Jos. Dixon Crucible company has prepared and published a pamphlet on this subject. The value and some of the uses of pure flake graphite as a lubricant and the reason why some experiments with the ordinary commercial graphite resulted in such little success, are pointed out.

The Electrical Supply company has secured the exclusive control of the Carpenter car heating apparatus for Cook county, Ill., also the general western selling agency. With the introduction and development of these devices there seems to open a new era in the application of electricity. Probably one of the most important uses to which it will be applied is that of heating electric cars. Among the numerous applications of this device are bake ovens, smoothing irons, hair curlers, soldering irons, glue pots, coffee pots, teakettles, broilers and griddle cake bakers; in fact, there seems to be no limit to the purposes to which it can be put. Next week, and for some time thereafter, the general public will be given an opportunity to witness the operation of these devices in actual use, as the Electrical Supply company will make a display in its large show windows, corner of Michigan avenue and Randolph street, Chicago. This certainly will be an exposition of unfailing interest.

BUSINESS.

The Lodge & Davis Machine Tool company, Cincinnati, O., is introducing new combination upright and radial drills. These machines are fitted with ball bearings, which make them very easy in adjustment.

"A Scientific Opinion of Graphite as a Lubricant" has been published in pamphlet form by the Jos. Dixon Crucible company, Jersey City, N. J. This little book is worth reading and can be secured from the Dixon company for the asking.

"A Key to Engineering" is a hand-book published by the Mason Regulator company of Boston, Mass. This book is an exhaustive catechism of the steam engine and boiler and contains many practical ideas gathered from wenty-four years' experience with the steam engine.

The Dover, N. J., Electric Lighting company speaks most favorably concerning the Ries socket. This company states that it expects to have some in every building that it supplies. These sockets are a great convenience to the user, and are a potent factor in gaining new customers for lights.

George Cutter has removed his office and salesrooms from 333 to 329 Rookery, Chicago. The new quarters afford considerably more room, which was made necessary by the expansion of the business due to the addition of the new enameline electric heater to Mr. Cutter's list of specialties.

The Crescent Insulated Wire & Cable company, of Trenton, N. J., is considering the advisability of adding quite materially to its works, as the large increase in business during the last few months has taxed its plant to its utmost capacity. The call for this company's well known seamless rubber wires and cables has been unusually large.

E. W. Wilkins, of the Partrick & Carter company, Philadelphia, reports that orders were received in one mail for 650 of the company's new automatic hotel annunciators. This firm is at work upon a large amount of this apparatus, and guarantees prompt delivery. Mr Wilkins will begin an extended trip through the West and South about October 1st.

The Central Electric company, Chicago, is preparing an exhibition at its warerooms of interior conduit and supplies. The company is erecting a house complete, showing the method of wiring and the connections by junction boxes. The exhibition will be unique and practical. The company reports large sales of triple and double braid weatherproof wire, beside a steady demand for Okonite wire, cord and Manson tape. The sales of Washington carbons also during the last week have been very large.

The National Time Recorder company, Milwaukee, Wis., will shortly commence the manufacture of a clock device to be known as the Bolte automatic timekeeper. The company is not yet ready for business, but its first models are being rapidly built. This device shows at a glance the exact time of arrival and departure of employes. The time recorder is so made that the proprietor, passing through the door in the morning, sees at one glance, without opening the clock, just how many employes were late, and how much time was lost. The employes themselves, too, can see the time their keys register, either at the time of recording or at noon when going to dinner. James Ilsley of the Marshall & Ilsley Banking company, of Milwaukee, is president; F. H. Bolte, of the Sercombe-Bolte Manufacturing company, is the inventor, and P. H. Sercombe, of the same company, one of the stockholders.

The Railway Equipment company of Chicago has secured the right to manufacture and sell the new electric heater invented by T. Ahearn of Ottawa, Ont., and which was recently described in the WESTERN ELECTRICIAN. The negotiations were concluded by W. R. Mason, the president of the company, who paid a recent trip to Ottawa for the purpose. The territory that the Railway Equipment company will supply includes all the world except Canada. In an interview in the *Ottawa Journal*, Mr. Mason, who is described as "a young man of sharp, business-like appearance," said of Mr. Ahearn's system: "His heaters, while they do not take markedly less power, give better results for the same amount of power. In his system the heat is better distributed. But the main advantage I take to be the fact that the appliances are wired in such a way they do not fuse. In the past the wires have never been properly protected. In other patents, if the closest attention was not paid, they would burn out; and if attended to, too much valuable time was occupied."

ELECTRICAL PATENTS.

Issued Sept. 20, 1892.

482 719. Conduit for Electric Railways. Francis O. Blackwell, Boston, Mass.

The conduit comprises transverse yokes and slot rails one, at least, of which consists of an inverted channel iron set flush with the street surface and bolted to the yokes.

482,724. Electrolytic Apparatus. Thomas Craney, Bay City, Mich.

An anode consisting of a body of carbon arranged to expose a number of separate horizontal surfaces, and a cell of non conducting material incloses the anode and has openings leading to the surfaces.

482,727. Suspension Bracket for Electric Lamps. Thomas Dillon, Indianapolis, Ind.

482,753. Insulated Electric Wire. Thomas L. Reed, Providence, R. I.

A conducting wire is covered with a textile wrapping filled with a composition of petricide, wax tailings and linseed oil.

482,778. Electric Signaling Device for Firemen. George L. Barnard, Milwaukee, Wis.

482,780. Signal Telegraph. Claudius V. Boughton, Buffalo, N. Y.

482,820. Carbon Holder. Ernest P. Warner, Chicago, Ill.

The clamp is of angular cross-section, and is adapted to give three points of contact to the carbon, two of which are provided upon lips running in a horizontal direction.

482,825. Armature Winding for Dynamo Electric Machines. Rudolf Eickemeyer, Yonkers, N. Y.

Strands or lengths of wire are bent into various forms and constitute separate sets or series of strands, each a destructive form and all being secured in place by pins in holes, in the ends of the armature cores.

482,863. Electric Locomotive. Conrad M. Conradson, Madison, Wis.

482,872. Insulator. Charles T. Lee, Boston, Mass,

The insulator comprises a block composed of a series of mica sheets compressed together, the block being provided with a parallel sided seat, and a casing inclosing the block.

482,879. Method of and Apparatus for Tempering Wire. Fred Purdy, Englewood.

The wire is heated by a current of electricity and the heat is equalized by moving the wire through a heated tube and then chilling the wire.

482,913. Insulator. Herbert H. Brooks, Cambridge, Mass.

The insulator consists of a cylinder of insulating material and a trough holder in which the cylinder is placed and loosely held, the holder having lips or projections which partially inclose the cylinder and keep it in place.

482,936 Electric Switch and Case. Augustus Wright, Providence, R. I.

482,940. Frame for Electric Arc Lamps. William F. Bossert, Utica, and John H. Findlay, Ogdensburg, N.Y.

The supporters for the lamp hood have a segmental portion on which the edge of the hood rests, projecting lugs being adapted to receive the edge of the hood, the hood being secured in position by a screw.

482,964. Electric Railway Conduit. Rudolph M. Hunter, Philadelphia, Pa.

A slotted conduit is provided with an upper longitudinal compartment and a lower drainage compartment opening into the former, in combination with a flexible, suspended, bared conductor in the upper compartment supported at intervals within the conduit.

482,974. Alternating Current Motor. Otto T. Blathy, Buda Pesth, Austria-Hungary.

A rotary field alternating current motor is provided with two sets of field magnet coils supplied from a source of simple alternating currents, and self induction coils and condensers are connected up with the field magnet circuits, whereby the currents are displaced in phase.

482,979. Storage Battery. Edward R. Knowles, Brooklyn, N. Y.

The element consists of a metallic plate provided with a cavity for an active material, the metallic walls of the cavity being lined with an easily oxidizable metal.

482,986. Electric Arc Lamp. James A. Stuart, Philadelphia, Pa.

482,993. Closed Conduit for Electric Railways. Levi P. Bunce, Minneapolis, Minn.

483,043 Apparatus for Covering Wire with Fibrous Material. James Buckner, Boston, Mass

483,044. Attachment for Electric Lamps. Joseph Clift, Dorking, England.

483 061. Trolley Stand for Electric Railways. John C. Hough, Pittsburg, Pa.

In this device a disk having springs upon its opposite sides is combined with a forked trolley pole socket, pivoted to the disk and passing astride the spring and disk.

483,074. Joint for Electric Conductors. Joseph W. Marsh, Pittsburg, Pa.

The adjacent ends of the cable sections are united by a recessed supporting block of insulating material, the adjacent ends of the corresponding conductors being united and supported in the recesses carried upon the supporting block.

483,108. Electrical Stop Valve. Adolf Franke, Berlin, Germany.

483,110. Manufacture of Rubber Coated Wire, etc. C. Theodore Guilleaume, Cologne, Germany. Patented in England June 18, 1890, and in Germany Aug. 14, 1890.

483,123. Circuit Switch. George W. Russell, Jr., and Daniel B. Minor, Denver, Colo.

The main circuit is provided with a pair of solenoids, within which is supported a reciprocating bar. The solenoids lie in a branch circuit and push buttons are provided whereby the current is alternately passed through the solenoids, and the main circuit closed or broken.

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Agents to sell our

Niagara Electric Motors and Dynamos

In cities where we are not already represented. Liberal discounts and exclusive territory to responsible dealers in electrical apparatus.

LOVELL MFG. CO., Ltd., Erie, Pa.

FOR SALE.

One 220 Volt, 150 Ampere Generator,
One 220 Volt, 200 Ampere Generator,

In perfect condition, suitable for power circuit or incandescent lighting. For sale at a big bargain.

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100 H. P. Ide Engine, 13x18, with 5-inch shaft 14 inches long, with four large driving pulleys and bearings. One 66x16-inch tubular boiler with Worthington Pump and piping complete.

Send for list of other good second-hand engines, including Reynolds, Corliss, Armington & Sims, Rice, Westinghouse, and other "Best" makes taken in exchange for Ideals, used a short time, in perfect order, and for sale at half price.

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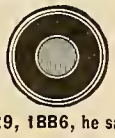

Insulation Guaranteed wherever used, Aerial, Underground or Submarine.

In a letter from the Inspector of the Boston Fire Underwriters' Union, under date of March 29, 1886, he says: "A thoroughly reliable and desirable Wire in every respect."

The rubber used in insulating our wires and cables is especially chemically prepared, and is guaranteed to be waterproof, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather and is not affected by heat. The insulation is protected from mechanical injury by one or more braids, and the whole slicked with Clark's Patent Compound, and special extra finish, which we have now adopted for all our solid wires as an extra weatherproof protection, and also preventing chafing and abrasion, which is water, acid, and to a very great extent fireproof. Our insulation will prove durable when all others fail. We are prepared to furnish Single Wires of all gauges and diameter of insulation for Telegraph and Electric Lights from stock. Cables made to order. We are now prepared to furnish our Clark Wire with a white outside finish for ceiling cleat work as well as our standard color.

Clark Joint Gum should be used for making waterproof joints. This is put up in half-pound boxes, in strips about one foot long and five-eighths inch wide, and when wrapped about a joint and pressed firmly it makes a solid mass. **FOR RAILWAY and MOTOR use**, we make all sizes of stranded and flexible with Clark insulation.

WE GUARANTEE OUR INSULATION WHEREVER USED, AERIAL, UNDERGROUND OR SUBMARINE, and our net prices are as low, if not lower than any other first-class Insulated Wire. We shall be pleased to mail Catalogues with terms and discounts for quantities.

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61 to 65 Hampshire Street, BOSTON, MASS.

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MANUFACTURERS OF ALL KINDS OF

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PROPOSALS FOR ELECTRIC LIGHTING.

Sealed proposals will be received by the city of Kalamazoo, Michigan, to light said city for the term of ten years with arc electric lights of 2,000 candle power each, with a minimum number of 150 to a maximum of 250, of which number from 30 to 40 lamps are to be all night lamps on the dark night scale, and 120 to 160 to run till midnight, the city reserving the right to purchase the plant at the end of the term of ten years. Bids to be accompanied with specifications as to style of power, lamps, wire, poles, etc.

The city reserves the right to reject any or all bids. All bids to be accompanied with a certified check of $100.00 and to be indorsed "Bids for city lighting" and addressed to

THERON F. GIDDINGS, City Clerk,
Kalamazoo, Michigan.

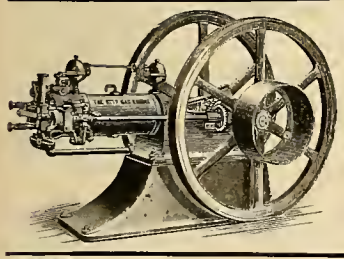
Bids will be received up to 12 o'clock, September 30, 1892.

SEALED PROPOSALS.

BOARD OF PUBLIC WORKS,
MUSKEGON, MICH., September 15, 1892.

Bids will be received at this office until 6 o'clock p. m. Monday, October 17, 1892, for lighting the streets of the city of Muskegon with Electric Arc Lights. Proposals to be made on a basis of a 1,200 to 2,000 candle power light, and not less than 150 lights. Proposals should be made both for 365 nights a year, or moonlight nights excepted. Contract is to be made for a term of five years. Each bidder will be required to deposit a certified check of five hundred dollars. The right is reserved to reject any and all bids. All communications and proposals should be addressed to the office of the Board of Public Works.

JAMES GOW President
Board of Public Works.
J. KUPPENHEIMER, Secretary.



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Sizes: 50 Horse Power and Upward.

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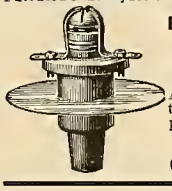

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Multiple Lighting

For Churches, Theaters and Public Halls.

Are used all over the country. Send for estimates or prices to

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All Sizes and Qualities

For Electrical Purposes.

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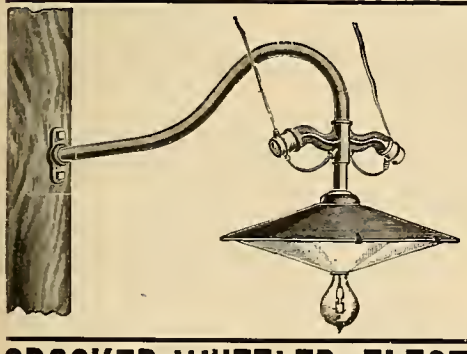

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Mechanically Strong.
Insulation Perfect.

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PLATINUM

For all kinds of Electrical Use. Sheet or Wire of any Degree of Hardness.

Special Attention given to Platinum for Incandescent Lamps.

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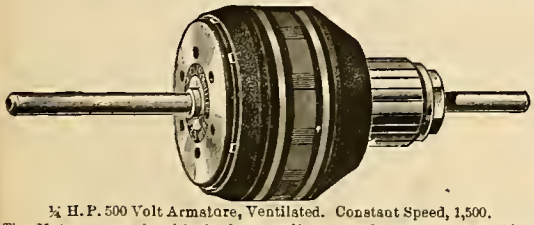

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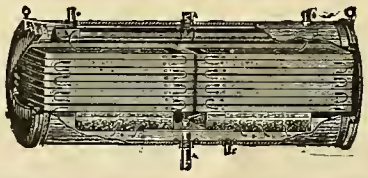
Stilwell's Patent Live Steam-Feed Water Purifier.



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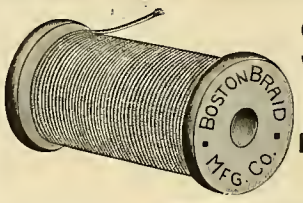

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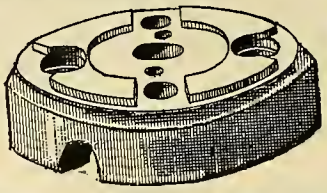

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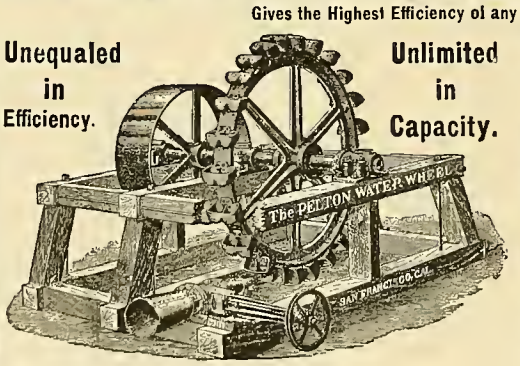

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Affords the most simple and reliable power for all mining and manufacturing machinery. Adapted to heads running from 20 up to 2,000 or more feet. From 20 to 30 per cent. better results guaranteed than can be produced from any other Wheel in the country.

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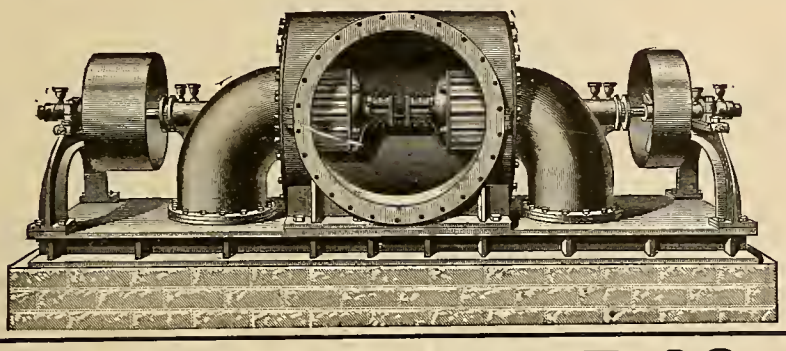
VICTOR TURBINE WATER WHEEL.



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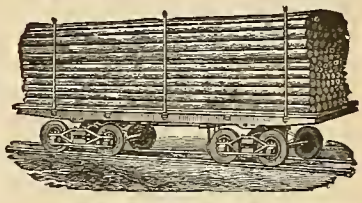

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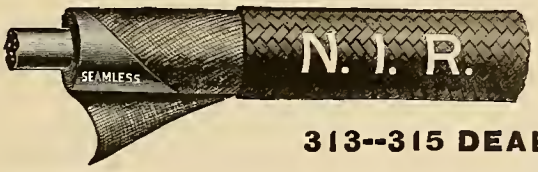

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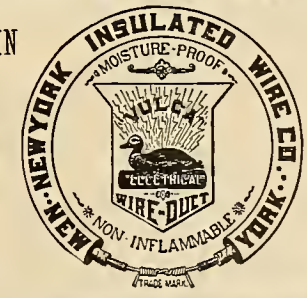

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Lamps for all Systems. **Any Voltage or Candle Power.**

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FILAMENTS WITH OR WITHOUT HOOKS.
MINIMUM CURRENT CONSUMPTION, with
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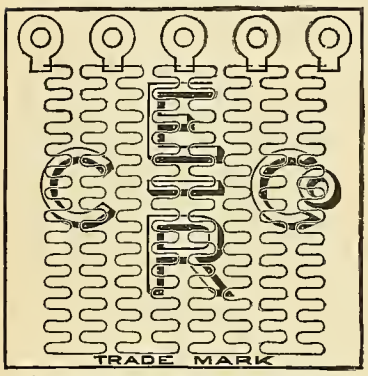

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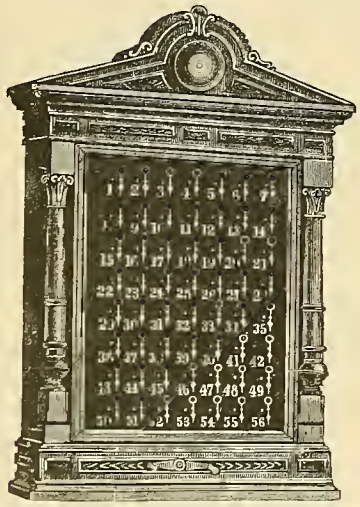

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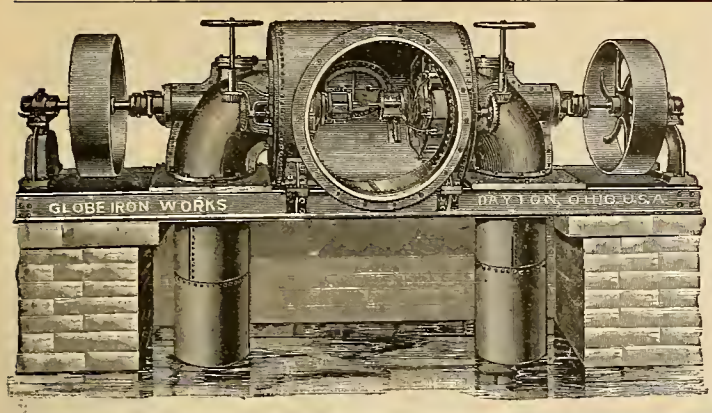

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PARTICULARLY ADAPTED TO DRIVING

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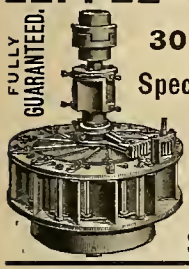

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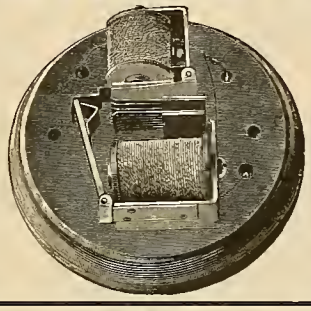

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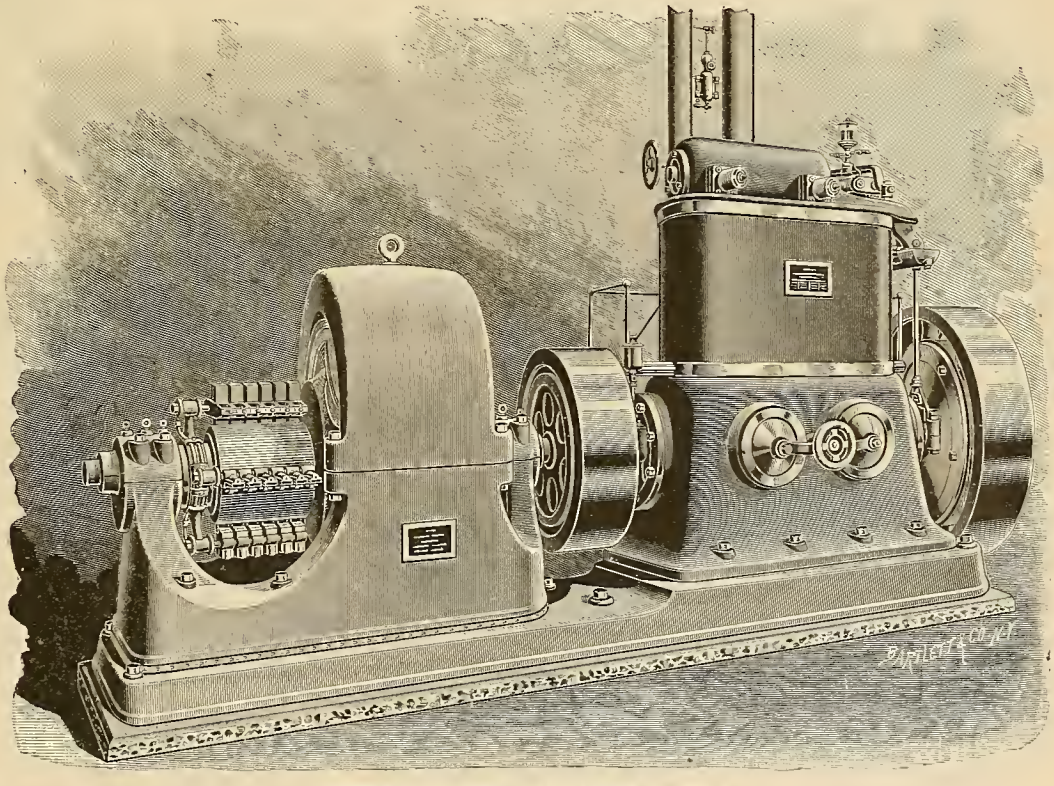

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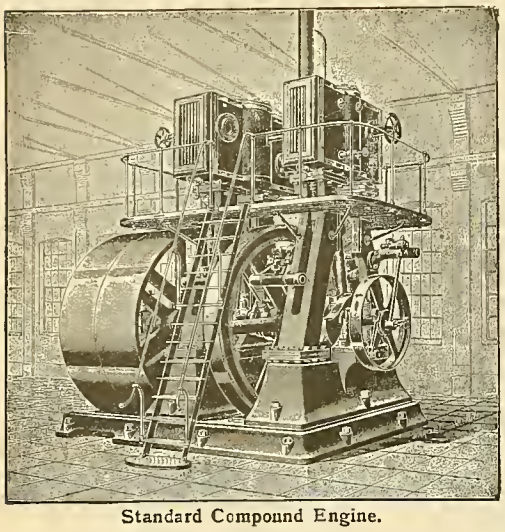

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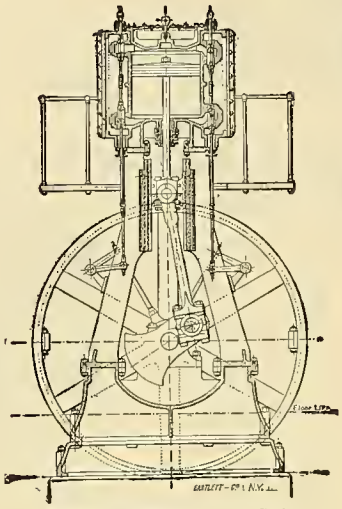

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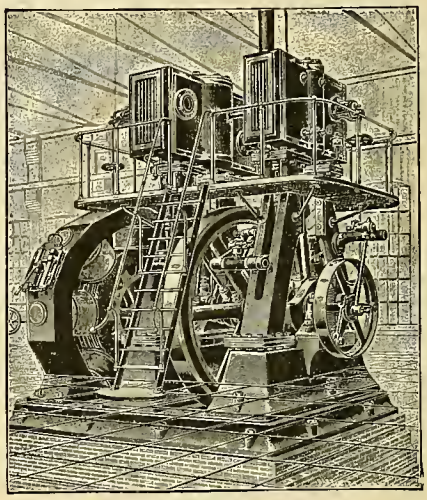

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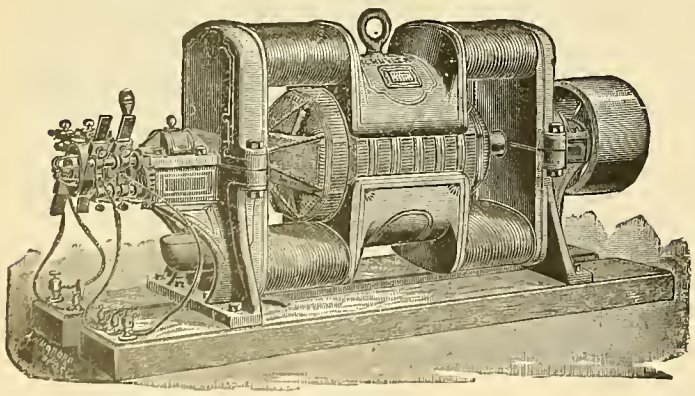

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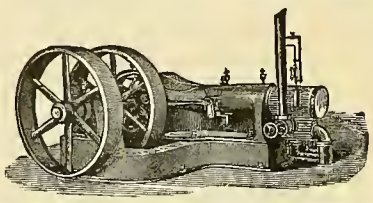

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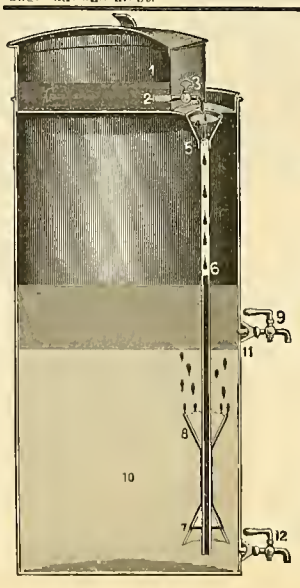

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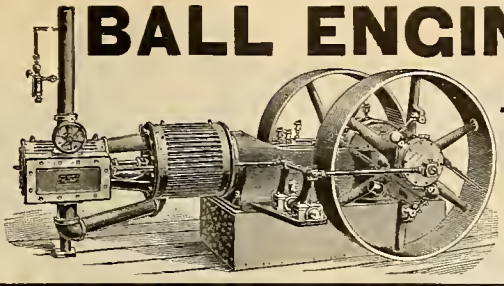

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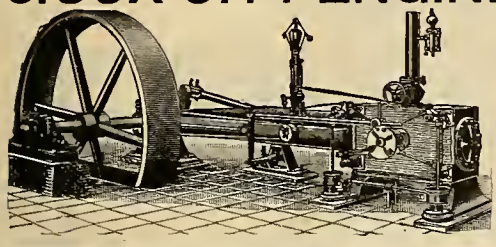

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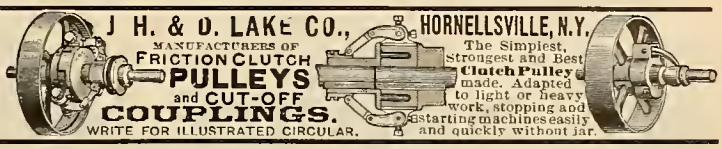

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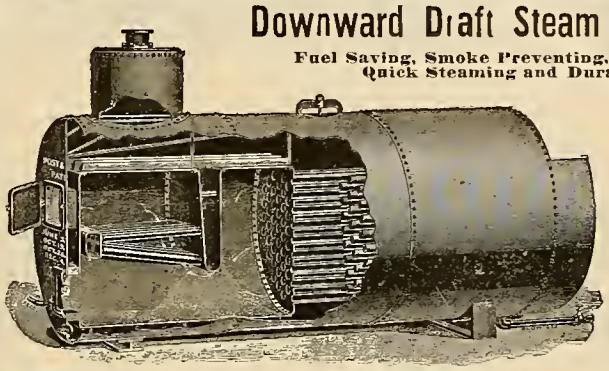

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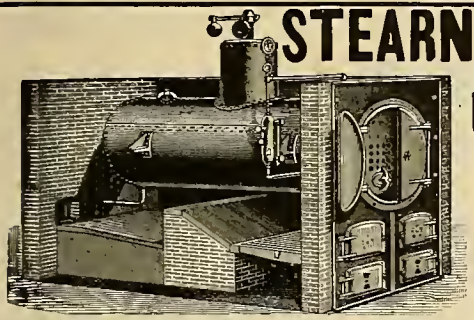

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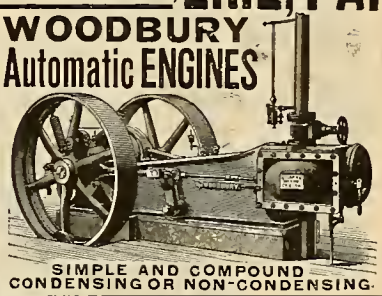

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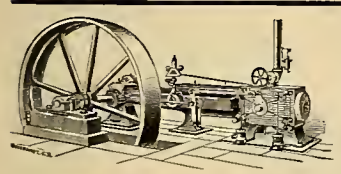

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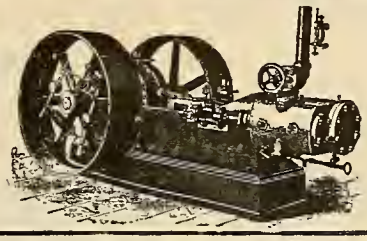

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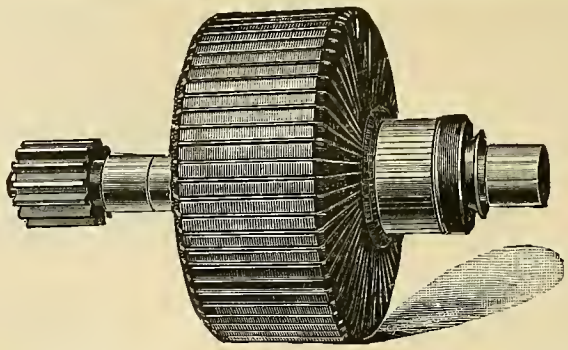

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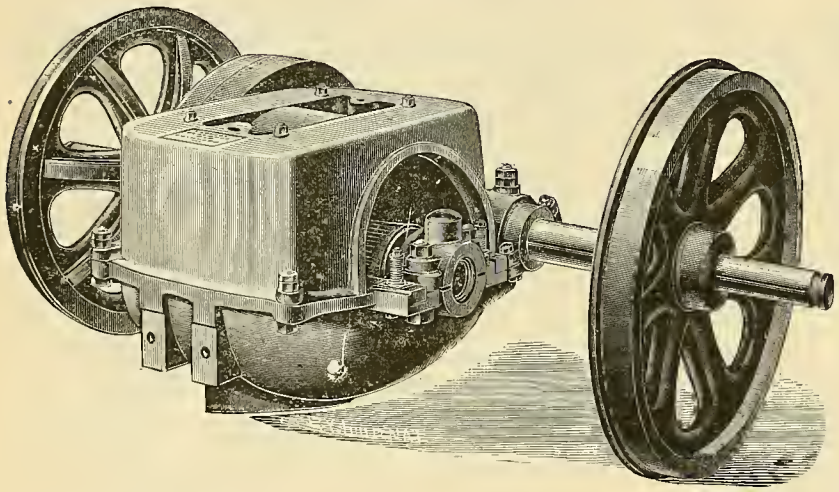

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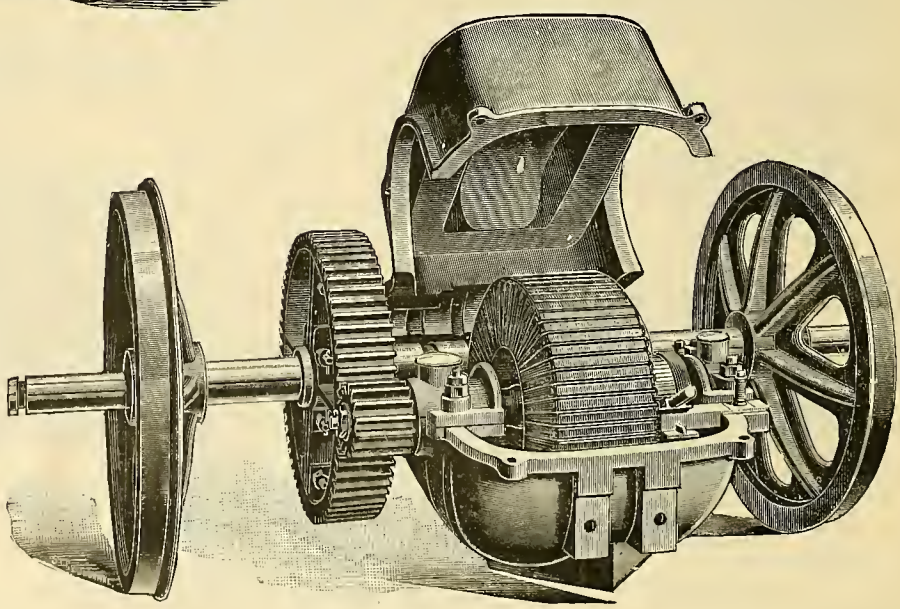

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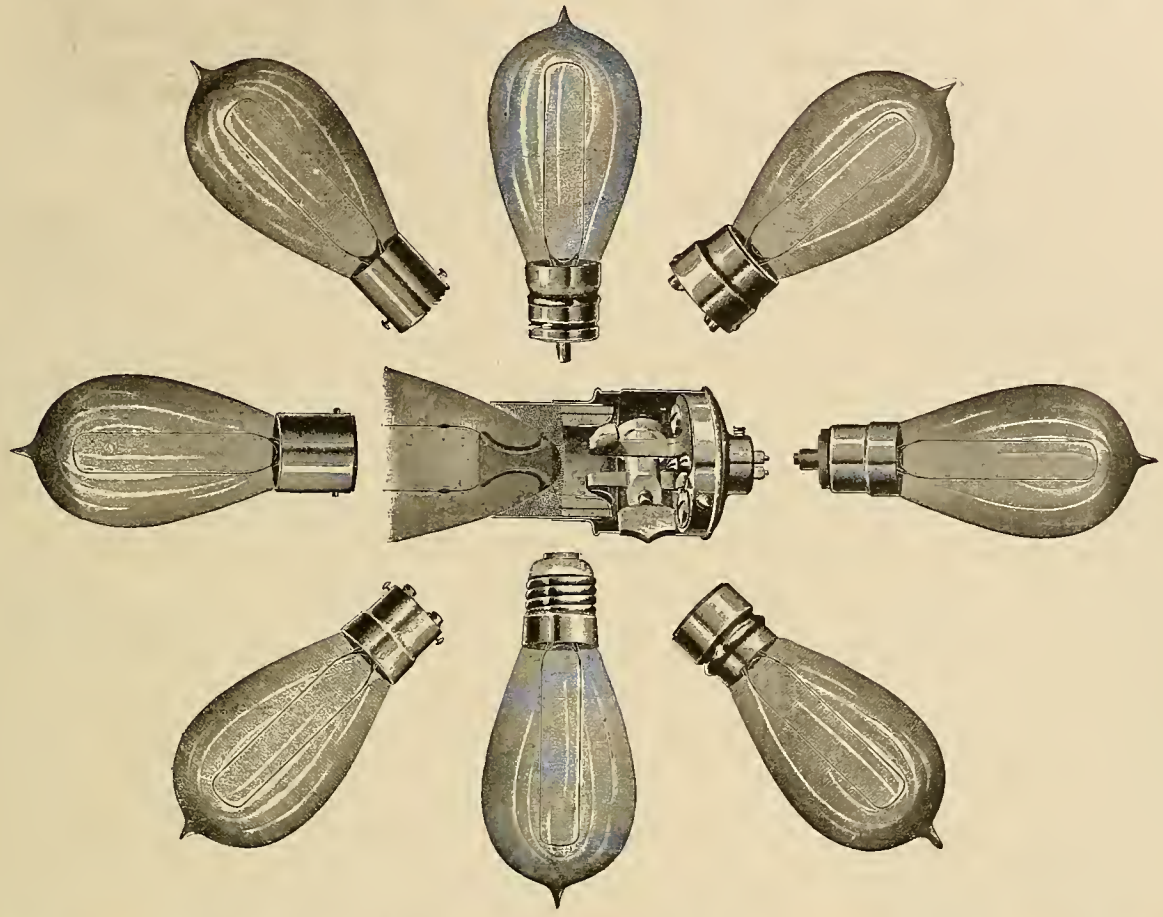

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Listen when I call de figgers! Watch de music es you go!
Chassay forrard! (Now look at 'em! some too fas' an' some too slow!)
Step out when I gibs de order; keep up eben wid de line;
What's got in dem lazy niggers? Stop dat stringin' out behin'!
All go forrard to de center! Balance roun' an' den go back!
Keep on in de proper 'rection, right straight up and down de crack!
Moobe up sides an' mind de music; listen when you hear me speak!
(Jes' look at dem Pea Ridge niggers, how dey's buckin' gin de Creek!)
Dat's de proper action, Sambo! den you done de biznis right!
Now show 'em how you knocked de splinters at de shuckin t'udder night;
Try to do your lebbel bes', an' stomp it like you use to do!
Jes' come down on de "Flat Creek step" an' show de Ridge a thing or two!
Now look at dat limber Jonah tryin' to tech de fancy fling!
(Who ebber seed a yaller nigger dat could cut de pidgin-wing?)
Try dat lick agin, dar, Moses; tell you what, dat's hard to beat!
(How kin sich a little nigger handle sich a pile o' feet?)
Swing your corners! Turn your pardners! ('Pears de motion's gittin' slow.)
What's de matter wid de music? Put some rosgum on dat bow!
Moobe up, Tom—don't be so sleepy! Let em see what you kin do!
Light off in de "gra'-vine-twis" and knock de "double-shuffle," too!
Gosh! dat double j'inted Stehen flings a hifalutin hoof!
He kicks de dus' plum out de planks an' jars de shingles on de roof!
Steady, now, an' check de motion! Let de fiddler stop de chune!
I smell de 'possum froo de crack, an' supper's gwine to call you soon!
De white folks come it mighty handy, waltzin' 'roun' so nice an' fine;
But when you come to reg'lar *dancin'*, *niggers leabes 'em way behin'!*

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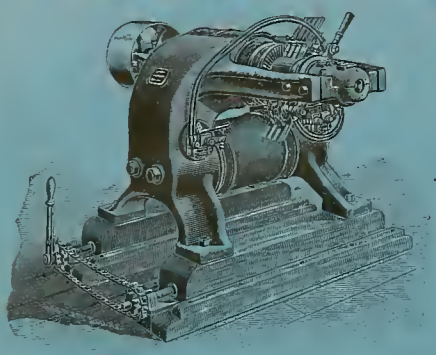

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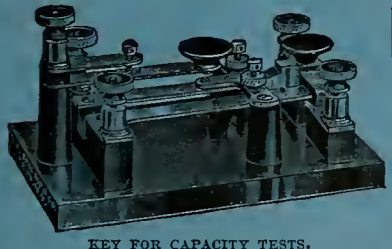

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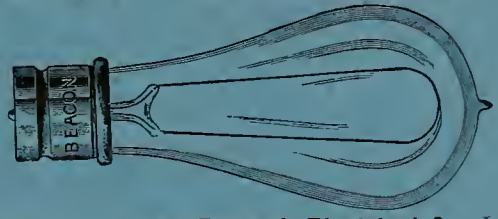

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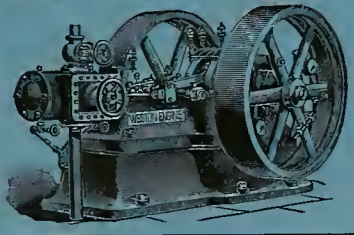

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INDEX AND CLASSIFICATION OF ADVERTISEMENTS.

ALPHABETICAL LIST.

American Battery Co..... ix
American Desk & Seating Co..—
American Electrical Mfg. Co.. ix
American Engine Co..... xii
Andrews & Co., A. H.... .. —
Babcock & Wilcox Co., The.... i
Baggot, E xiv
Ball Electric Light Co..... xvi
Ball Engine Co.....xix
Ball & Wood Co., The i
Beacon Vacuum Pump & Elec. Co.i
Becker Mfg. Co., John..... xiii
Beggs, J. E., Mch. & Supply Co. x
Bernstein Electric Co..... xii
Blanchard, Albert... .....—
Boston Braid Mfg. Co..... xiv
Bowers Bros..... xvi
Bridgeport Mach. Tool Wks.. —
Brookfield, Wm..... xii
Brush Electric Co viii
Bryan, W. H.. xiv
Bryant Electric Co..... xii
Buckeye Electric Co , The..... ix
Carpenter Enamel Rheostat Co. xvi
Central Electric Co..... ... v
Chicago Rawhide Mfg. Co..... —
Columbia Inc Lamp C ..... —
Crescent Ins. Wire & Cable Co. xiii
Crocker-Wheeler Electric Co.. xiii
Cushing, F. W..... vii
Cutter, Geo i
Cutter Electrical & Mfg. Co..—
Dayton Globe Iron Works Co..xvii
Densmore Typewriter Co..... xii
Detroit Electrical Works..... xxiv
Diamond Electric Mfg. Co.... xii
d'Infreville, G..... xiii
Dixon Crucible Co., Jos..... xv
Dudley & Co., W. W..... xvi
Duplex Electric Co., Ltd.....—
Eastern Electric Cable Co..... xiii
Eastman Kodak Co..... xiv
Electric Appliance Co..... xii
Electric Cons. & Supply Co... vi
Electric Engr'g & Supply Co.. iv
Electrical Mfg. Co , The..... xv
Electric Secret Service Co..... xix
Electrician Pub Co..... xvi
Electrical Construction Co. The.xiii
Electrical Eng & Supply Co.The.—
Electrical Supply Co., The... xxii
Elektron Mfg. Co..... xvii
Empire China Works..... xiv
Enterprise Electric Co..... xv
Falls Rivet & Machine Co..... ix
Ferracute Machine Co..... x
For Sale Advertisements. x, xii, xiii
Fort Wayne Electric Co..... xxiv
General Electric Co .....ii, xx
Great Western Elec, Supply Co—
Greeley & Co., The E. S.....1
Hart & Hegeman Mfg. Co..... xvii
Heisler Electric Co..... —
Hill Clutch Works..... xix
Hine Eliminator Co..... .....—
Holmes, Booth & Haydens.... xiv
Hood & Co., Wm.... xv
Hughes Bros. Mfg Co..... xv
Ide & Son, A. L .....xiii, xvii
Illinois Electric Lamp Co..... viii
India Rubber & G. P. Ins. Co. xxiii
Institute of Technology..... xv
Interior Conduit & Insulation Co. x
International Okonite Co..... i
Jewell Belting Co..... i
Johns Mfg. Co., H. W..... viii
Kartavert Mfg. Co..... xvi
Klipstein, A..... xiii
Knapp Electrical Works..... xxi
Lake, J H. & D., Co ..... —
Lake Erie Engineering Works.xviii
Lane & Bodley Co..... —
La Roche Electric Works..... x
Lasell & Co., Edw..... xvii
Leclanche Battery Co., The .. x
Lefmann, Julius xv
Leffel, & Co., Jas xvii
Link Belt Machinery Co xv
Loud, H. M. & Sons Lumber Co. xiv
Mather Electric Co iv
Midland Electrical Wks.....xii
Moore, Alfred F..... i
Morse & Co., A. M..... .. xii
Munsell & Co., Eugene..... xii
National Carbon Co..... xiv
National Electric Mfg. Co.... —
National India Rubber Co .... —
New York Insulated Wire Co.. xv
N. Y. Safety Steam Power Co.xvii
New York & Ohio Co..... i
Otto Gas Engine Works..... —
Ostrander & Co., W. R..... xix
Page Belting Co..... xvii
Partrick & Carter Co..... —
Pearson & Co., W. B.....xviii
Pelton Water Wheel Co..... xiv
Penn. Electric Engineering Co.viii
Perkins Elec. Switch Mfg. Co. ix
Phoenix Glass Co..... xix
Porter-Leavitt Elec. Motor Co. xiii
Proposals for Elec. Ltg..... xiii
Queen & Co..... xiii
Racine Hardware Mfg. Co.....—
Railway Equipment Co..... ix
Redding Electric Co.....x
Ries Electric Specialty Co..... x
Roebling's Sons Co, J. A .....—
Rose Elec. Light Supply Co... xii
Samson Cordage Works..... xii
Sawyer-Man Electric Co..... xi
Schuyler Electric Co..... iv
Sechrist, Albert..... xvii
Shawmut Fuse Wire Co xvii
Shultz Belting Co.....—
Siebert, G.....—
Siemens & Halske Electric Co vi
Sioux City Elec. Supply Co...—
Sioux City Engine Works.... xix
Smith, A. T..... .....—
Smith, Thos. G. Jr.....—
Somoff, J. L..... —
Sperry Elec. Mining Mach. Co. xvi
Standard Electric Co..... vi
Standard Paint Co x
Stanley Electric Mfg. Co..... v
Stearns Mfg. Co..... xix
Steuten Lamp Works..... xiii
Sterling, W. C..... xv
Stilwell & Bierce Mfg. Co . xiv xv
Sunbeam Incand. Lamp Co... xxiii
Taylor Engine Co..... —
Union Hardware Co..... xii
Utica Elec. Mfg. & Supply Co. x
Van Nuis C. S..... i
Vulcanized Fibre Co..... xv
Waddell-Entz Company..... xii
Wannopee Pottery Co..... xix
Want Advertisements ...xiii, xvii
Washburn & Moen Mfg. Co.. iv
Western Electric Co.....xiv
Westinghouse, Church, Kerr & Co.....xviii
Westinghouse Elec. and Mfg Co. xi
Weston Engine Co..... i
Woodhouse & Rawson, Ltd.... x
Worthington, Henry R..... xii

CLASSIFIED LIST.

Annunciators.
Central Electric Co.
Detroit Electrical Works.
Electrical Supply Co., The.
Knapp Electrical Works.
Ostrander & Co., W. R.
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Leclanche Battery Co., The.
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(See Insulated Wires.)

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Great Western Electric Supply Co.
Heisler Electric Co.
Ide & Son, A. L.
Lake Erie Engineering Works.
Lane & Bodley Co., The.
La Roche Electric Works.
Lefmann, Julius.
Mather Electric Co.
Morse & Co., A. M.
N. Y. Safety Steam Power Co.
Pearson & Co., W. B.
Racine Hardware Mfg. Co.
Siemens & Halske Electric Co.
Sioux City Engine Works.
Smith, Thos. G. Jr.
Standard Electric Co.
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Crescent Ins. Wire & Cable Co.
Cutter, Geo.
Detroit Electrical Works.
Electrical Supply Co., The.
Enterprise Electric Co.
Holmes, Booth & Haydens.
International Okonite Co., The.
Knapp Electrical Works.
Moore, Alfred F.
National India Rubber Co.
Roebling's Son's Co., J. A.
Sperry Elec. Mining Machine Co.
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Central Electric Co.
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Electrical Supply Co., The.
Hughes Bros. Mfg. Co.
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Cut-Outs and Switches.
American Electrical Mfg. Co.
Bryant Electric Co.
Central Electric Co.
Cutter, Geo.
Cutter Electrical & Mfg. Co.
Electric Engineering & Supply Co.
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Electrical Supply Co., The.
Enterprise Electric Co.
Great Western Electric Supply Co.
Hart & Hegeman Mfg. Co., The.
Hood & Co., Wm.
Knapp Electrical Works.
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Smith, A. T.

Electric Railways.
Detroit Electrical Works.
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Siemens & Halske Electric Co.
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Bryan, W. B.

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Greeley & Co., The E. S.
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Electrical Supply Co., The.

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Knapp Electrical Works.
Partrick & Carter Co.

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Beacon Vacuum Pump & Elec. Co.
Bryant Electric Co.
Central Electric Co.
Cutter, Geo.
Cutter Electrical & Mfg. Co.
Detroit Electrical Works.
d'Infreville, G.
Electric Appliance Co.
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Electrical Eng. & Supply Co., The.
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Knapp Electrical Works.
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International Okonite Co., The.
Johns Mfg. Co, H. W.
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Central Electric Co.
Crescent Ins. Wire & Cable Co.
Cushing, F. W.
Cutter, Geo.
Detroit Electrical Works.
Eastern Electric Cable Co.
Electric Appliance Co.
Electrical Supply Co., The.
Enterprise Electric Co.
General Electric Co.
Great Western Electric Supply Co.
Holmes, Booth & Haydens.
International Okonite Co., The.
India Rubber & Gutta Percha Insulating Co.
Knapp Electrical Works.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Roebling's Sons Co., J. A.
Shawmut Fuse Wire Co.
Sperry Elec. Mining Machine Co.
Waddell-Entz Company.
Washburn & Moen Mfg. Co.
Western Electric Co.

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American Electrical Mfg. Co.
Beacon Vacuum Pump & Elec. Co.
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Buckeye Electric Co.
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Electrical Eng. & Supply Co., The.
Electrical Manufacturing Co., The.
Electrical Supply Co., The.
General Electric Co.
Hood & Co., Wm.
Illinois Electric Lamp Co.
Knapp Electrical Works.
New York and Ohio Co.
Penn. Electric Engineering Co.
Redding Electric Co.
Sawyer-Man Electric Co.
Steuben Lamp Works.
Somoff, J. L.
Sunbeam Incandescent Lamp Co.

Lathes.
Bridgeport Machine Tool Works.

Lightning Arresters.
Van Nuis, C. S.

Magnet Wire.
(See Insulated Wires.)

Mechanical Machinery.
Ferracute Machine Co.
Bridgeport Machine Tool Works.

Medical Batteries.
Detroit Electrical Works.
Partrick & Carter Co.

Mica.
Bowers Bros.
Johns Mfg. Co., H. W.
Munsell & Co., Eugene.

Milling Machinery.
Becker Mfg. Co., John.

Miscellaneous, Electric.
Detroit Electrical Works.

Mining Apparatus, Electric.
General Electric Co.
Sperry Elec. Mining Machine Co.
Westinghouse Electric & Mfg. Co.

Model Making.
Midland Electrical Wks.

Motors.
Brush Electric Co.
Crocker-Wheeler Electric Co.
Detroit Electrical Works.
Electrical Eng. & Supply Co., The.
General Electric Co.
Great Western Electric Supply Co.
La Roche Electric Works.
Matner Electric Co.
Porter-Leavitt Electric Motor Co.
Siemens & Halske Electric Co.
Waddell-Entz Company.
Westinghouse Electric & Mfg Co.

Name Plates.
Becker Mfg. Co., John.

Office Furniture.
American Desk & Seating Co.
Andrews & Co., A. H.

Pins and Brackets.
Central Electric Co.
Electrical Supply Co.. The.
Hughes Bros. Mfg. Co.
Lefmann, Julius.
Lond, B. M. & Sons Lumber Co.
Railway Equipment Co.
Western Electric Co.

Platinum.
Siebert, G.

Poles.
Electrical Supply Co., The.
Lefmann, Julius.
Lond, H. M. & Sons' Lumber Co
Railway Equipment Co.

Porcelain.
Empire China Works.
Wannopee Pottery Co.

Publishers, Electrical.
Electrician Publishing Co.

Push Buttons.
Detroit Electrical Works.
Central Electric Co.
Electrical Supply Co., The.
Knapp Electrical Works.
Union Hardware Co.
Western Electric Co.

Railways, Electric.
(See electric railways.)

Regulating Sockets.
Ries Electric Specialty Co.

Rheostats.
Carpenter Enamel Rheostat Co.

Separators, Steam.
Hine Eliminator Co.

Silk Braid.
Boston Braid Mfg. Co.

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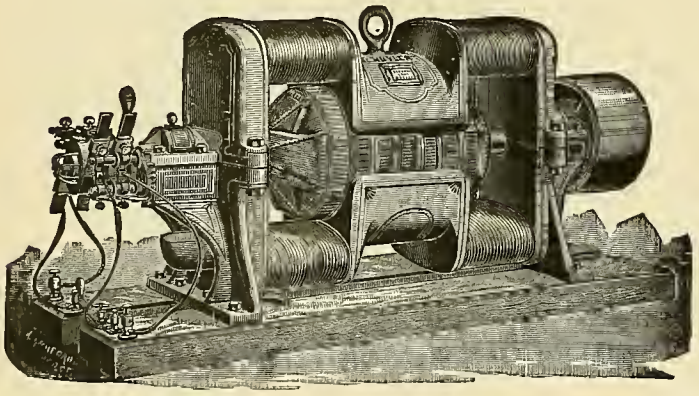

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A Pure White Steady Light.

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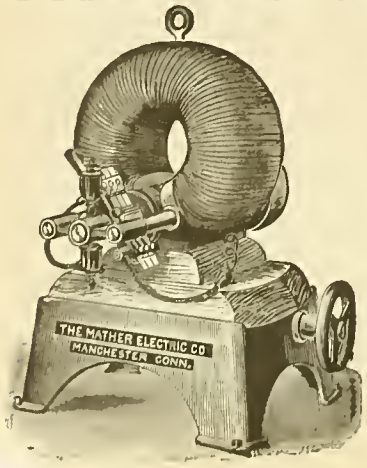

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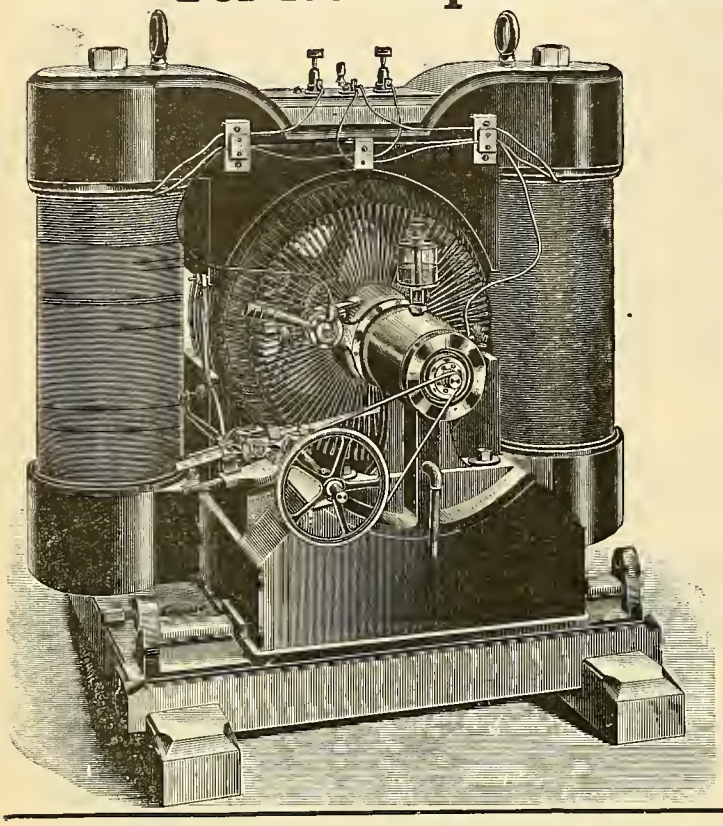

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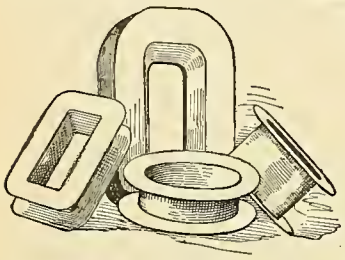

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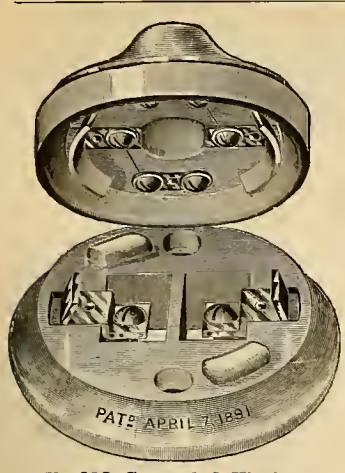

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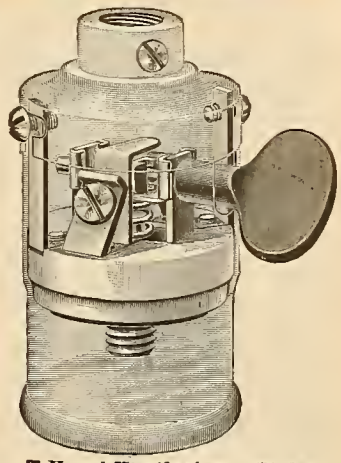
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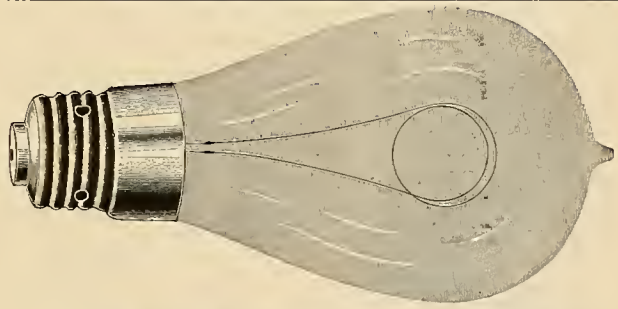

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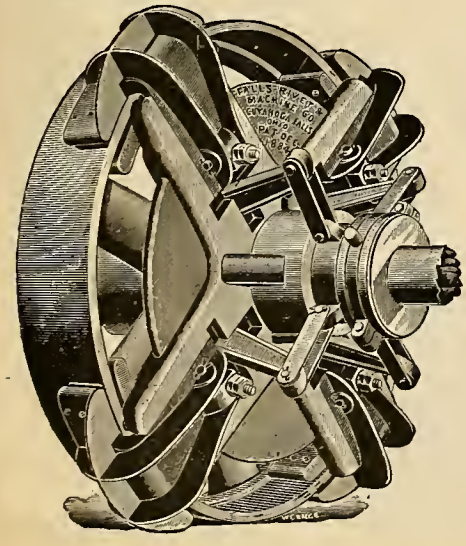

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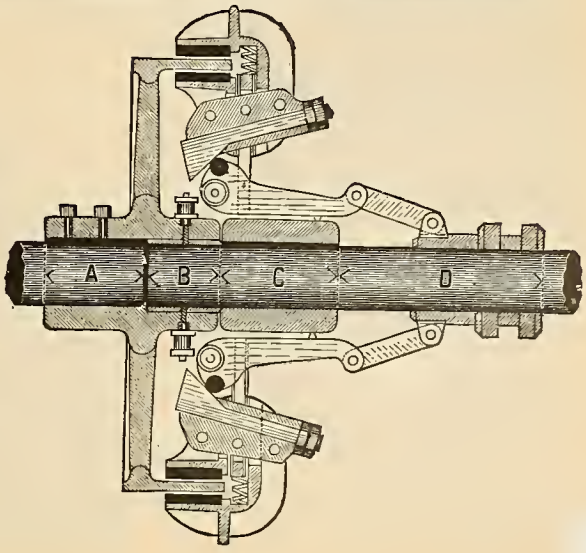

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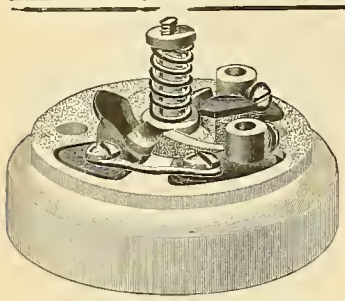

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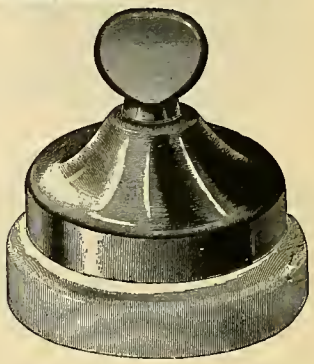

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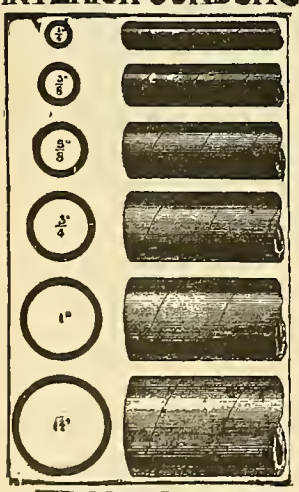

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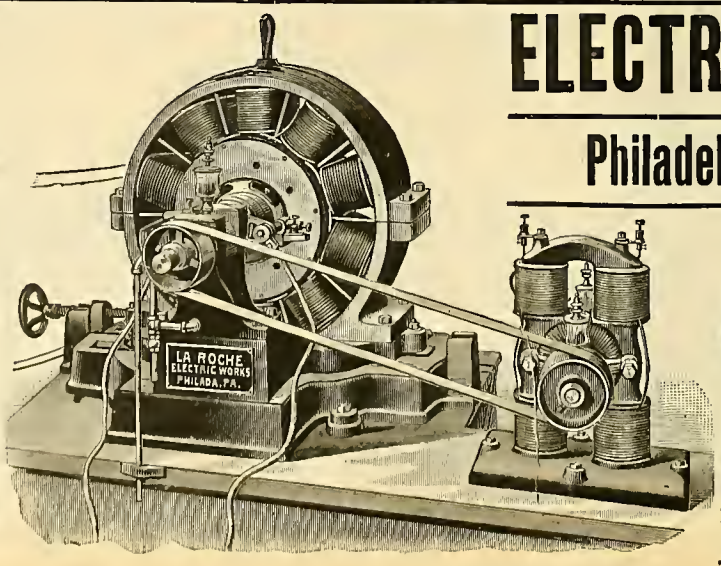

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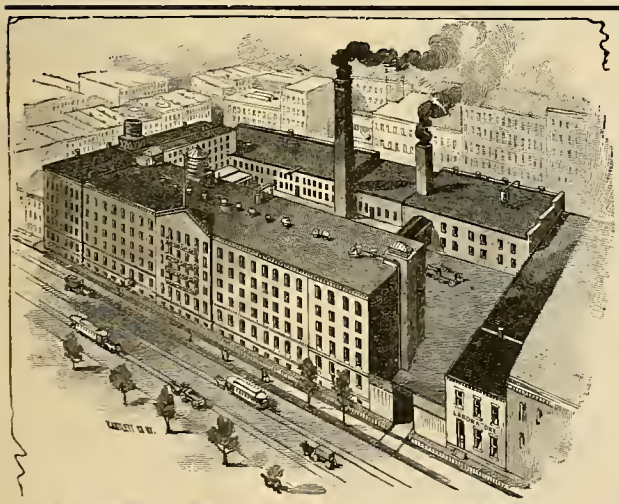

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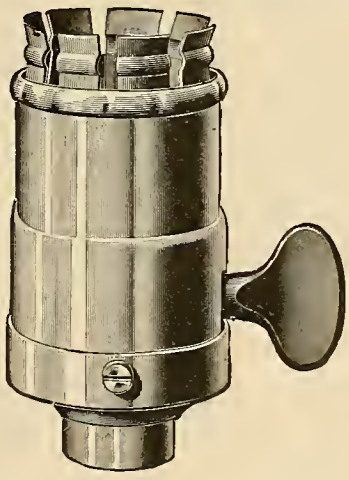

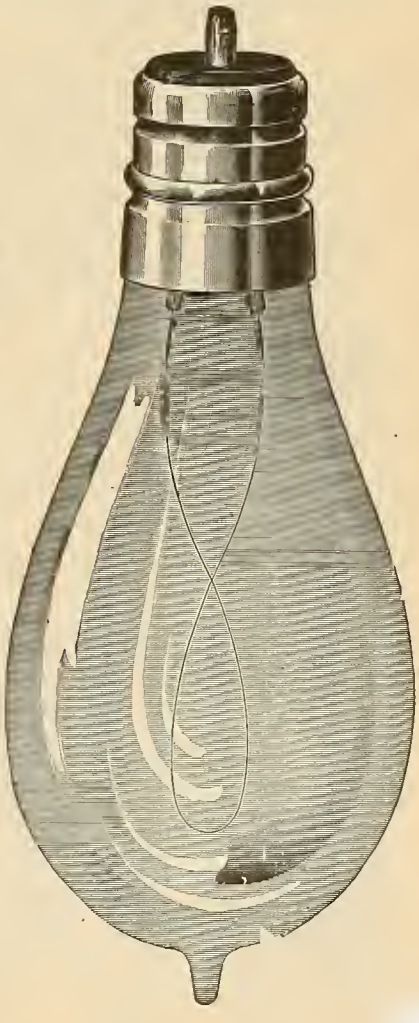

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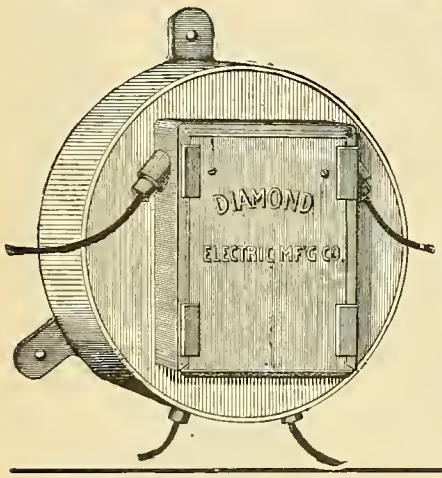

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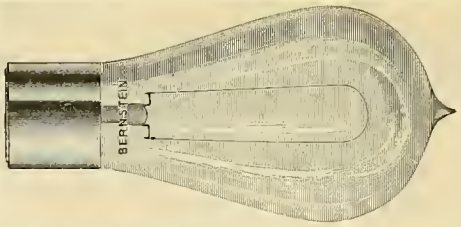

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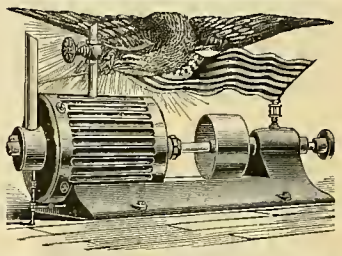

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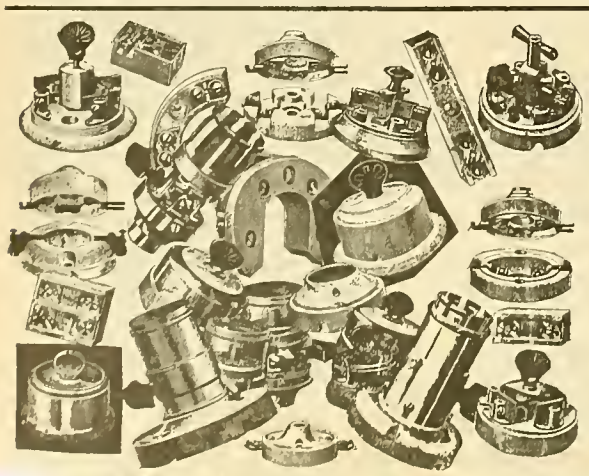

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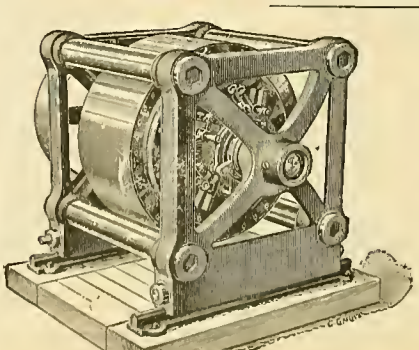

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EVERY SATURDAY.

Vol. XI. CHICAGO, OCTOBER 8, 1892. No. 15

Electricity at the World's Fair.

The accompanying illustration gives a view of machinery hall and annex at the World's Fair, the picture showing the southern front of the building, the side on which the electrical service plant will be located, as indicated on the plan published in the WESTERN ELECTRICIAN last week. The pumping station is shown on the right, and the boiler house can be plainly seen. The iron stack visible at the western end of the boiler house is connected with the battery of Babcock & Wilcox boilers, the first on the ground. An idea of the magnitude of the building may be had by comparison with the freight cars standing in front of it. The building will probably be completed in a month or six weeks.

For the temporary lighting of the manufactures building for the inauguration ceremonies about 250 arc lamps will be installed. Most of the wiring for these will be of temporary character, but as much as possible will be retained for the permanent lighting. It is probable, also, that the transportation, mines, electricity and machinery annex buildings will be temporarily lighted by arc lamps on the grounds and to place the larger one on some tall building down town—say the Auditorium or the Masonic Temple—and direct the light on the World's Fair buildings, seven miles distant.

Proposals for furnishing police and fire alarm telegraph wire and telephone conductors are being sought by the exposition authorities. An equivalent of 100 miles of the former is being advertised for, while 150 miles of metallic circuits are needed for the local telephone exchange. It will cost the World's Fair people about $100 to install each telephone furnished by the Chicago Telephone company.

Two 80 kilowatt C. & C. generators, wound for 220 volts, will be installed in machinery hall to furnish current for the eight electric elevators in the administration building, the motors of which are wound for 220 volt circuits. The other power generators are wound for 500 volts.

The electrical engineering department has received notice to wire the building for the Baker Chocolate company for 180 lights.

The Westinghouse company, through the New York Insulated Wire company, has now nearly finished the wiring of the administration, art, Connecticut, New Hampshire, Massachusetts, Wisconsin, Pennsylvania and Indiana buildings. All the wiring is accessible, there being no concealed work. Alluding to the controversy over the wiring of the state buildings, referred to in the issue of this paper for September 24th, Thomas G. Grier writes to the WESTERN ELECTRICIAN as follows:

The wiring is executed according to specifications of the most rigid and absolute character. The object and purpose of these specifications are not to handicap the work, but to insure a standard of installation the excellence of which will be above any other in the country, with the danger from fire or accident entirely eliminated. A maximum loss not to exceed 2 per cent. is the rule for determining the size of the wires. The converters are located outside of the buildings and necessarily the wire required for the work is both large in size and quantity. All appliances are of a capacity largely in excess of the amount of current they are required to carry, and the work is done in the most thorough and workmanlike manner. All work is watched as it progresses by capable engineers working in the interest of the exposition and exhibitors. The price paid for the wiring and service which will be rendered during the exposition is not fair, but extremely low.

The Houston Heights Railway company, of Houston, Tex., has been chartered with O. M. Carter president, to build an electric railroad to Houston Heights. The capital stock is $100,000.

New Auditorium Plant.

Reference was made last week in this paper to eight new electric lighting plants in Chicago of unusually large size, but since then the contract has been let for a private installation in this city more than three times as large as the largest of those enumerated at that time. This is the great Auditorium plant, which will have a capacity of 17,000 lamps.

On the southern corner of Michigan avenue and Congress street a new ten story hotel—the Congress—is building. Although the corporation erecting it is a distinct company, the stockholders are virtually the same as those of the Auditorium company, and the ownership and management are almost identical. In fact, the Congress, which is directly across the street from the vast bulk of the Auditorium, is practically an addition to the hotel part of the latter institution, and the two will probably be connected by a tunnel under Congress street. The exterior appearance of the buildings will be very similar, and the principal difference will be that the owners will conduct the new hotel on the European plan exclusively, while the Auditorium will be on the American plan.

ELECTRICITY AT THE WORLD'S FAIR.

The consulting architects for the new building are Adler & Sullivan, who designed the old one. In considering the question of light and power they came to the conclusion that operating expenses could be reduced and the smoke nuisance considerably abated by having only one plant for the two buildings. It was decided to build a power house to the south of the new Congress, fronting 55 feet on the alley between Michigan and Wabash avenues, and 90 feet deep. In this will be installed a boiler, engine and dynamo plant capable of a maximum output of 1,300 kilowatts, although it is estimated that the greatest load will never exceed 800 kilowatts. The two buildings will be wired for about 17,000 lamps, and in addition a number of fan and other motors will be on the circuits.

There will be five engines in the installation, of the compound, non-condensing type. Each of these will be directly connected to a Siemens & Halske multipolar dynamo, as the entire contract for the electrical equipment has been awarded to the Siemens & Halske Electric company of America. One of the engines will be of 800 horse power, two of 350 power each and two of 150 horse power each.

In the old building there are three switch-boards, and these will be retained as centers of distribution connected with the mains from the station. There will also be a

at the time of the dedication for use as barracks for the soldiers attending the ceremonies. A temporary plant will be installed in machinery hall for the manufactures building and machinery annex. It will consist, probably, of eight Standard arc dynamos of 50 lights capacity each and three Ball & Wood engines, each of 150 horse power. Two of these engines, which are the first on the ground, will be used to drive the dynamos and the other will be held in reserve. These engines will operate Brush dynamos in the permanent plant. The temporary lighting of the transportation, mines and electricity buildings will be done from the temporary station now used for lighting purposes. It is also proposed to install in machinery hall two 4,000 light Westinghouse alternators, now on the way from Pittsburg, for temporary incandescent lighting at the dedication. These machines will be placed in the largest Westinghouse section—their permanent position—and will be driven by two Westinghouse engines, each with cylinders 18 by 30 inches and 16 inch stroke.

The two projectors that are to be used during the inaugural display are now on the grounds, in charge of F. W. Tischendoerfer, a representative of Schuckert & Co. of Nuremberg, the manufacturers. One of the projectors takes up 150 amperes of current at 60 volts, and the other is a 90 ampere lamp at the same voltage. It is now proposed to mount the smaller on the transportation building

station switch-board, of course. The old dynamos and engines will be taken out. The details of the new plant have yet to be perfected. A feature, however, will be the tall stack, 200 feet high. This will probably be built of iron, with a diameter of eight or nine feet. It is proposed to inclose this in another pipe, the outer space to act as a ventilating shaft, by which it is expected to carry all the heat and odors of the plant far above the roof of the hotel.

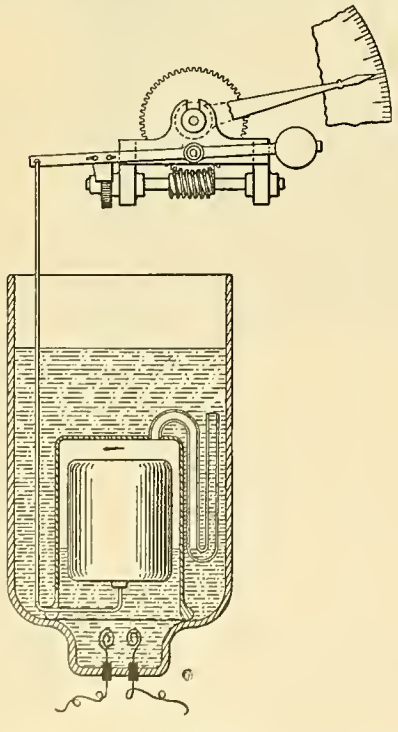
With its 1,800 horse power and 17,000 lamps the plant will be undoubtedly the largest private installation in the country, and probably in the world.

Electric Meter.

The accompanying cut shows a form of electric meter devised by A. G. Waterhouse. In this meter gas is collected in a reservoir, which has within itself the elements for discharging the gas after a certain amount of gas has been collected, and means are provided for registering the number of times the gas has been collected and discharged. In other words the device might be termed an electrolytic gas meter adapted for measuring gas produced by an electric current.

Referring to the cut, it will be seen that there is provided an electrolytic cell containing a fluid electrolyte. At the bottom of the cell are two electrodes, between which an electric current passes, and in doing so producing gases which correspond in volume to the work of the current. In order to measure this gas there is set inside the outside jar a gas collector placed over the electrodes, or either one of them, so that the gas which arises will be collected. In connection with the collector there is a self-discharging inverted siphon tube, which is capable of discharging the gas from the collector after a certain amount of gas has accumulated in it.

In order to register each time the collector has been filled with gas and discharged, a float is placed inside of the collector and connected, as indicated, to the simple registering mechanism. As the collector is filled with fluid the float is buoyed up, and it raises the lever. As the collector is filled with gas the float moves down by gravitation and causes the lever to swing down with it, so that each time the collector is filled with gas and emptied it causes the lever to move once each way. To the spindle of the worm wheel of the indicating mechanism there is attached a pointer, which revolves with the worm wheel and points on a dial (not shown) to figures which show the



ELECTRIC METER.

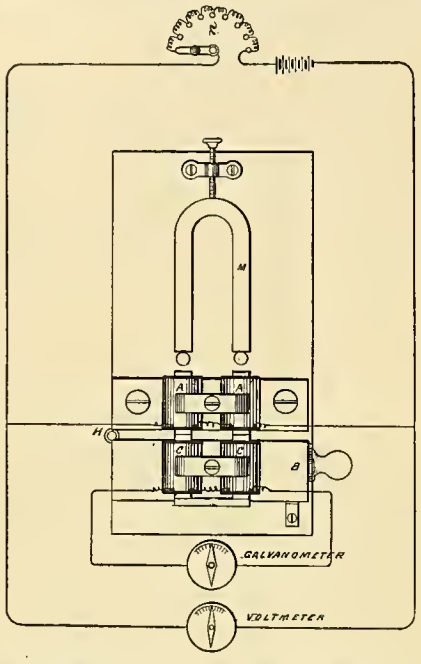
movement of the pointer and consequently record the number of times that the collector has been filled with gas and emptied, thereby registering the quantity of gas that has passed, indicating the electrical energy expended in producing the recorded amount of gas.

The electric light company at Lee, Mass., has broken ground for a brick building on Canal street, and will move its works from East Lee to the village. The power will be furnished by a new 250 horse power engine. Two new Thomson-Houston dynamos will be put in.

Rudd's Method of Measuring the Strength of Magnets.

This method, which was devised by Charles H. Rudd, of Evanston, Ill., consists in balancing the inductive effect of the magnet to be measured upon an iron core by a magnetic field of known or calculable value, and in determining when the magnetic induction of the permanent magnet is exactly balanced.

In practicing this method a bar of soft iron is arranged so as to complete or continue the magnetic circuit of the magnet whose strength of magnetization is to be measured. Surrounding this bar are two coils, one of which is in circuit with a battery and means for measuring and varying the current, and the other of which is a circuit with a galvanometer. The first coil may be described as the "balancing coil" and the second as the "test coil." By adjusting the current in the balancing coil a field is created about the soft iron bar of such strength as to bring the induction through the bar to an amount just sufficient to balance the induction due to the magnetization to be measured. This point of balance is determined by interrupting the magnetic continuity of the soft iron bar, when, if the induction due to either the magnetism of the magnet or the field of the balancing coil predominates, a current will be induced in the coil depending in volume upon the magnitude of the difference between the two forces and in direction upon the resultant direction of the induction through the system, and this induced current will be indicated by the galvanometer. When by successive trials the two magnetizing forces acting upon the soft iron bar have been brought to equal amounts, the strength of the current in the balancing coil may be measured. The value of the balancing current furnishes a basis for calculating the value of the magnet tested.



RUDD'S METHOD OF MEASURING THE STRENGTH OF MAGNETS.

If the number of turns in the balancing coil be known and the permeability of the entire magnetic circuit, the absolute value of the magnetization of the tested magnet may be calculated; but in practice it is not usually necessary to have more than a comparative value in terms of some standard magnet. In this case the magnetizations of two magnets of similar form and equal weights would be to each other as the currents required to balance them respectively.

In the accompanying cut there is shown a form of apparatus for carrying out the Rudd method, as employed in measuring the strength of a permanent horseshoe magnet.

In the illustration *A A* are helices, which together may be called the "balancing coil." They are firmly clamped to the base.

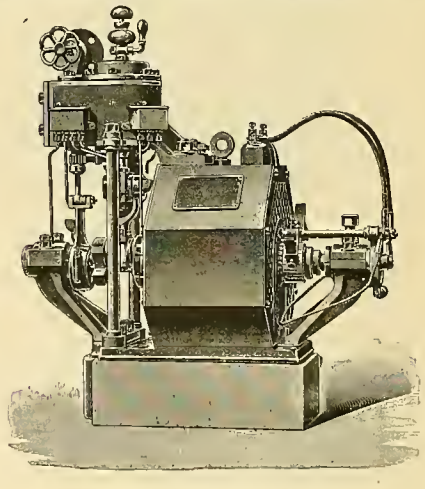
C C are the helices of the testing coil, rigidly clamped to a block *B*, which is hinged at *H* and is movable in respect to the base. The helices of the balancing coil and of the testing coil are provided with soft iron cores respectively. The cores abut upon each other as indicated, and the adjacent ends are smoothly finished to insure good magnetic contact. The free ends of the cores of the testing coil are joined together by a soft iron yoke. Thus when the apparatus is in the position shown the magnetic circuit is practically continuous through the two sets of cores and the yoke.

The magnet *M* to be tested is placed upon the base with its poles opposite and near to the free ends of the cores, and is secured firmly in a definite position relatively to the testing and balancing coils, by being clamped against stops by a set screw. The balancing coil is connected in circuit with a source of electricity and an adjustable resistance. A voltmeter is connected in shunt to the balancing coil, whereby, since the resistance of this coil is constant and known, the current through it may readily be determined. A galvanometer is connected in circuit with the testing coil. With the apparatus thus arranged the magnetic circuit is repeatedly broken and made by striking slight blows upon block *B*, and carrying the testing coil so as to disengage one set of cores from the other, while the variable resistance is adjusted until no deflection of the needle of the galvanometer occurs, when the magnetic circuit is completed or interrupted. The magnetizing force of the balancing coil is then balanced against, and hence equal to, that of the magnet *M*. The value of the current in the balancing coil, as deduced from the voltmeter reading, is then compared with the value of a current necessary to balance a standard magnet under the same conditions. The ratio thus obtained is the ratio of the inductions or numbers of lines of force through the two magnets. Mr. Rudd explains, though, that the practical value of magnets may not always be proportional to the values thus obtained. Thus, since the tractive strength of a magnet acting upon an armature in contact with its poles is proportional to the square of the number of lines of force traversing the magnet, the value of a magnet designed to act under such a condition would be proportional to the square of the current balancing it, or to the energy consumed in the balancing coil. Again, the practical value of a magnet, designed as a field magnet for a magneto machine, would be as the square of the current required to balance it, since with a given armature revolving at a constant speed the output in watts of the armature will be proportional to the square of the total number of lines of force set up by a given field magnet, for the given field magnet will generate an electromotive force in direct proportion to its number of lines of force, which, since the resistance of the armature circuit remains constant, would increase the current of the armature in the same proportion.

The value of magnets designed for other uses may be deduced from the total induction through the iron as measured by this method by well-known formulæ to suit different cases.

Small Steam Dynamo.

The usual practice in designing a direct driven dynamo is to couple an ordinary engine to an ordinary dynamo, but this produces a rather clumsy result. More recently the engine has been made with a prolonged or altered bed-plate, so that the dynamo can be mounted on it. The



SMALL STEAM DYNAMO.

dynamo thus becomes a sort of attachment to the engine. In the steam dynamo herewith illustrated, the reverse practice has been followed—the engine is a mere attachment to the dynamo. It will be observed that the dynamo has its bed-plate carried out a few inches farther than usual, and the bearing bracket projects out. The thrust of the engine is taken by two light wrought-iron pillars, and the cylinder is cast with a bracket, which is bolted to the field magnets. The floor space required is no larger than if the dynamo had a pulley for belt driving. The little engine is specially designed for ship lighting. The dynamo itself presents no remarkable features, being a four-pole machine of a type that is very common in Germany. The cut is reproduced from London *Industries*.

Mammoth Dynamos for the World's Fair.

A distinguishing characteristic of the Westinghouse Electric & Manufacturing company's exhibit at the World's Columbian Exposition will be the great size of the alternating current incandescent dynamos employed. These machines will form a portion of the service plant of the exposition, and ten or eleven of them will furnish nearly all the current for incandescent lighting at the World's Fair. They will have a capacity of 10,000 lights each, and will be the largest dynamos ever built in the United States.

Both direct connected and belted machines will be used. The former type is shown in Fig. 1 and the latter in Fig. 2. The combination of engine and dynamo, represented in Fig. 1, covers a space about 30 feet long and 14 feet wide, and the engine is 19 feet high. The dynamos are set four feet below the floor line and extend ten feet above it. As shown in the illustration, the machines are multipolar. Each one has two sets of field magnets and two armatures on one shaft. The collector rings are on either side of the two armatures. The machines are designed to run at 200 revolutions per minute, and at this speed the output will be 350 amperes at a potential of about 2,200 volts.

The belt connected machines will cover almost as much floor space, although not nearly so high. The figures are 22 by 14 feet. Much of this space will be taken up by the monster pulley, Fig. 2, which will transmit the 1,000 horse power from the belt to the armature shaft. This wheel will be nine feet in diameter, and have a six-foot face.

The current from these great machines will be carried from the central station to the multitude of converters in about sixty primary circuits, about half of which will be laid in subways and half on the elevated railway structure. About 150 miles of cable will be needed, mostly No. 4 B. & S. gauge.

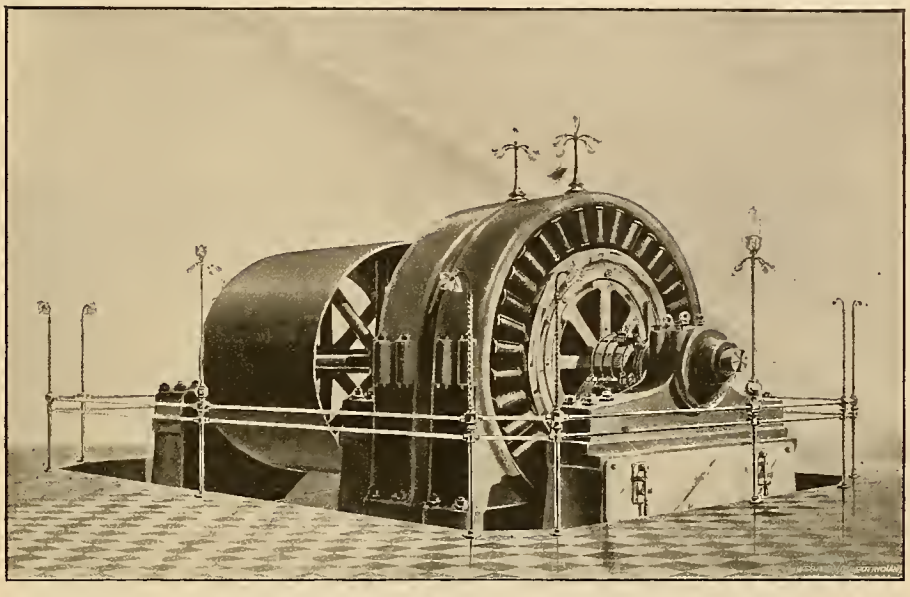


FIG. 2. MAMMOTH DYNAMOS FOR THE WORLD'S FAIR.

Electricity, Light and Fire.[1]

By C. C. Haskins.

An eminent writer tells us that "electricity has come to be understood as intimately related in its nature and actions to that necessary something called universal ether, filling all space, and permeating the most solid object." A beam of light is assumed to be an electrical phenomenon, and the rate of motion of the two is the same. An intimate relation exists also between electricity, magnetism, heat and chemical action. Electricity is without inertia, and therefore not matter; it is intangible and imperceptible, save when disturbed; capable of exerting most powerful energy to destroy or consume when uncontrolled; potent for good in the hands of the physician and surgeon to relieve distressed humanity; a power in the industrial arts, and a glowing luminary within the reach of all, its rays rivaling those of the sun itself for purity and excellence. What this mysterious agent, so potent for good or ill, is, is a question still unanswered. Yet the same is true of other great mysteries in nature—heat, light, gravity and magnetism, and that peculiar attraction which carries sap to the tops of the tallest trees to feed the leaves, or lifts the moisture to the top of a lump of sugar when but the lower portion is dipped in water setting the law of gravity at defiance. We only know that these are but so many manifestations of that fundamental law of nature which controls all life and growth—animal, vegetable and cosmical—the universal law of vibrations.

This mystery, which authorities tell us is neither matter nor energy, and yet resembles both in that it can neither be created nor destroyed, has become so intimately interwoven with our daily life that we are amazed when we stop to think what a yawning chasm would be apparent in the business, the social and the domestic world, were we suddenly deprived of this necessary adjunct to our every-day life, hourly becoming more useful as a servant, or more dangerous as a master, in proportion as it is guarded or neglected.

While electricity has neither mass, solidity, nor any known property pertaining to substance, it is capable of motion, has the attribute of quantity, may be measured both as to its pressure and rate of flow, and may be obstructed in its progress. We know its capacity for developing heat, its capability of inducing magnetism, and its action in aiding chemical effects by means of which electroplating is accomplished.

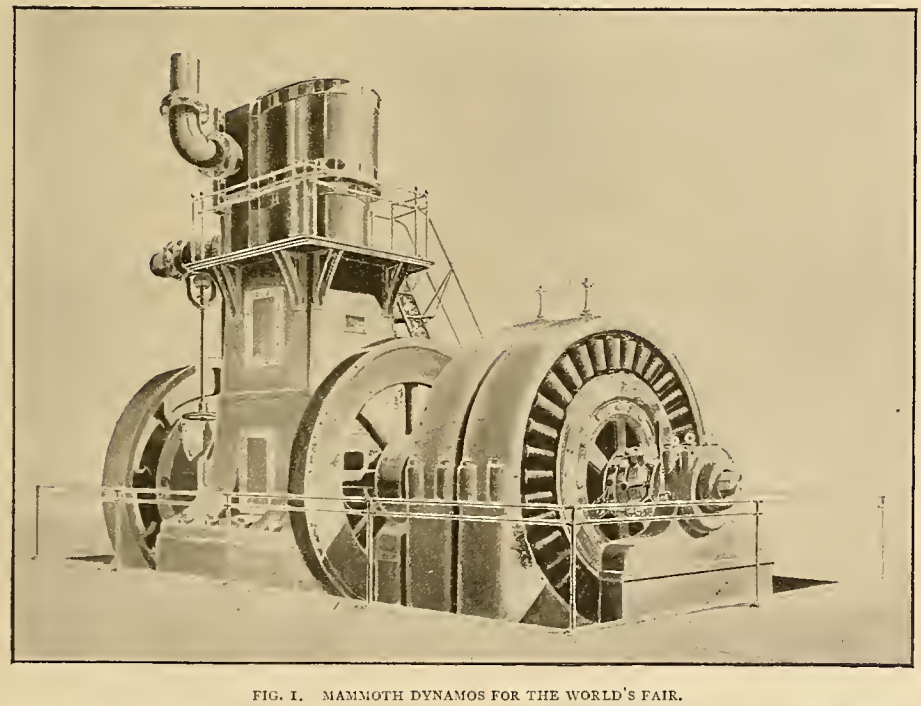


FIG. 1. MAMMOTH DYNAMOS FOR THE WORLD'S FAIR.

The movement of the electrical current is rather difficult of explanation. Perhaps it would be more explicit to say an effect traverses the circuit. Some writers speak of it as comparable to the movement of water through a tube, assuming the dynamo to be a pump capable of forcing water out through the tube which leads back to the dynamo, and so pumping in and out a constant stream. It has been called a molecular effect, and has been compared to the action produced on a row of billiard balls touching each other. When the first is struck, the last one alone moves. If these could be arranged in a circle, and some internal action produce a constant hammering in one direction within the first ball, the hammering would go through all the balls and back to the source. Another illustration: Hold a rope, one end in each hand, twist it with both hands from you. Watch the strands, which will seem to move along the rope, yet we know they are only turning round. Perhaps from all these attempts you may be able to select one explanation of how current passes from the dynamo to line and back again.

One application of current of interest to the underwriter is that which pertains to the motor. The motor fills a place in commercial economy which is all its own. Capable, as we have seen, of deriving its power from afar, miles away, where power may be had almost for the taking, it has a decided advantage over steam, in that it is noiseless, cool, clean, and in no way objectionable to the smoke authorities or the street commissioner, while doing the work of a little giant as a miller, a printer, or a car horse, exerting the energy of a whole stable of these, and a score of small steam engines thrown in. In smaller local installations, the motor is creeping in everywhere, and the desk fan, the passenger and freight elevator, the custom coffee-mill at the retail grocer's, and the moving racks of stockings or neckties in the windows of drygoods houses, are more and more, day by day, actuated by the mysterious agent we call electricity. The stationary engine, with its heat and grime, is bowing before its supremacy.

When the motor was in its infancy, it was a matter of considerable doubt whether it was worthy of hearty encouragement, because of the fact that it was placed on high potential circuits, and the protection which could be given it was hardly ample. An arc lamp, hung overhead, never touched save by the trimmer, is safe; but a motor, handled several times a day, cannot be suspended, like Mahomet's coffin, in mid-air, and the oftener it is handled of course the greater the chances of mistake, with a couple of thousand volts to emphasize the punishment. Electricity is like a hook—no mistakes are rectified. The incandescent motor fortunately has forced the arc machine to take a back seat. It is much safer, and fully as efficient. It never oversteps the bounds of propriety and plays the roll of slugger in case of accidental contact. The current used for the majority of motors, save those for railroad use, is seldom over 220 volts, and 500 volts for railroad currents is the usual pressure. Regular power circuits are rated about the same.

The direct enemy of the electrical engineer is water, moisture, dampness in any of its forms. The best interests of the electric light man are constantly threatened by this indefatigable mischief-maker. Even the temperance advocates must admit that the fluid to which they pin their faith so solidly may stand in the way of light.

It may sound a little paradoxical to say that cold water will sometimes cause fire, but if we drop a bit of potassium on water it will burst at once into a fierce flame. Cold water poured into cold sulphuric acid will make the bottle too hot to hold, and you all know what water will do with quicklime.

But water acts somewhat differently in aiding electricity to produce fire. Water—unless chemically pure—is a conductor of electricity, and when moisture makes a path for the current, the expense account sometimes finds its way to the underwriter for liquidation.

In order to keep our current within due bounds and send it in the track we have laid for it, two things are necessary for the most complete success:

First—To give it such a roadway as shall be easy for its passage; and

Second—To hem it in with every practical appliance, to keep it from going astray.

The disposition of the electric current is to take short cuts across lots, and get back by the quickest possible route to the dynamo.

To make the road easy, we furnish the best available metal, copper, as nearly pure as possible. Only silver is a better conductor than copper. Having provided the current with the best practical conductor, then the next move is to surround it with the best practical insulator, and guard against possible contacts with anything which might aid in forming a path for it to the earth. We constantly hear of grounding a line. The term is a technical one, which I find is not thoroughly understood by the underwriters. A wire in contact with a stay wire, which leads

1. Abstract of paper read before the Fire Underwriters' Association of the Northwest at Chicago, September 28, 1892.

to earth, would be grounded. So, too, it might be grounded on an iron roof if gas or water, or any conductor of whatever nature in contact with the roof, reach to the earth. A brick wall might ground a plant, and so might a wet clothes-line.

Now, while a single ground can do no possible harm when the rest of a plant or line is perfectly insulated, there may be material danger to life or property should a second ground develop while the first is on.

One of Franklin's proverbs was: "Take care of the pence and the pounds will take care of themselves." If we take care of the first ground the rest will take care of themselves.

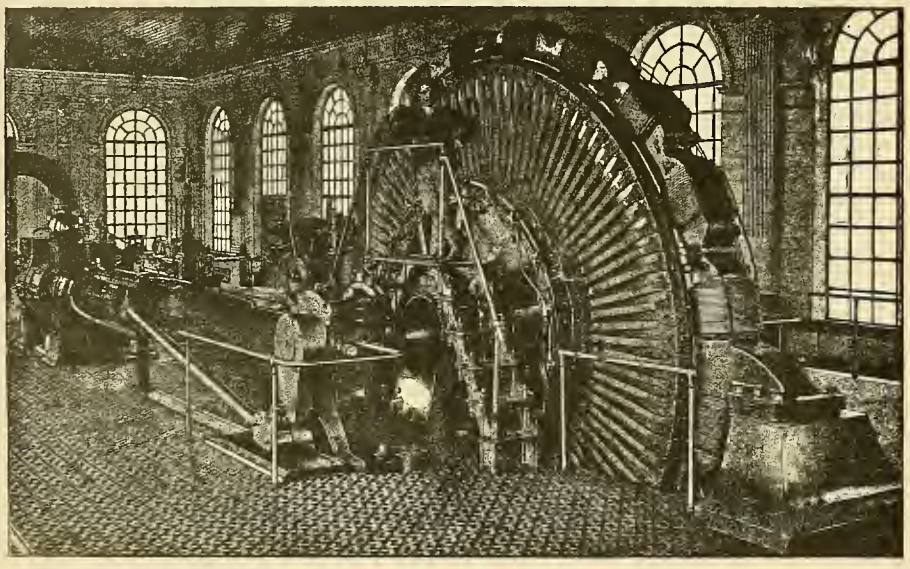
In the infancy of electric lighting an insulated wire was demanded, which should be fire-proof—or at least one, the insulating cover of which should be incapable of maintaining combustion. Experience soon showed that the weakness of carrying fire when ignited was more than compensated for by the strength of insulation possessed by several of the vegetable gums, notably gutta percha and India rubber. Fire-proof is not one-half, not an hundredth part as valuable for protection as electrical-proof. Fire-proof covering was not water-proof, nor damp-proof nor moisture-proof, and the moment the least moisture attacted the fire-proof covering its insulating properties vanished, and the wire now was simply covered with a wet braid, little, if any, better than a naked wire. Of course this all applies to out-of-door work. Indoors, where everything is constantly dry and unhandled, such a wire might do good service.

There was a time within the memory of man when any old barn, wood-shed or cow-house was plenty good enough for an electric light plant. A wheezy, rickety engine was hunted up somewhere, patched up, and put in service. Two, possibly three, boys were set to run the machine, and ten chances to one the whole outfit soon went up in smoke, or down through the sheriff's hands to the unhappy creditors. Is it any wonder that underwriters were chary of electric light plants, and property through which wires were run helter-skelter by men who knew little of electrical laws, to be inspected by those who knew less? No wonder that the smoke from electric fires blackened the eyes of electrical enterprise, and made the underwriter wince with dread. The novices, the schemers, the speculators who crowded the ranks, the half-baked electrician who talked of "computators," and presented you his business card, with "electrical engineer" engraved upon it; these are nearly all gone, and the business has fallen into legitimate, competent hands. Station houses are better built, wires are more carefully selected, greater pains are taken in construction, the entire enterprise is settling down to business and scientific bases, and in all the larger cities careful supervision of plants has been inaugurated by the underwriters, or by municipal authority, or both.

This examination is still far from perfection. The underwriter should join hands and purposes throughout the land, from Bedloe's Island to the Golden Gate, and from New Brunswick to the mouth of the Rio Grande, and demand a proper installation or refuse a risk on property wherever the hum or the light of electricity is known.

I have before suggested, and I now repeat, that the underwriter and the fire department should work together for the general good. In every district there should be within easy reach some competent person to whom the electrical inspection of an installation might be confided. It makes a wonderful difference when a plant is in prospect whether an inspection is to follow the installation or not. Without mentioning names or locality, I may say that I know of a case in a town where there was no inspector and two plants were erected by the same constructors. The contract for one of these called for an inspection by an electrical expert; the other did not. The first was passed high and dry, with many complimentary remarks. The parties owning the second plant, accidentally learning that an inspector was present, pressed him to go over their plant. The result was that the second plant was utterly condemned, and the wires had to be removed from the building.

The National Code, adopted by the National Electro-Insurance Bureau, in August of 1891, forms an excellent guide for your inspectors. Armed with this, taking one section at a time and going through a plant or an installation with this code as a basis for criticism, an inspector should be able to detect the faults of construction, and demand their correction where there is no regular electrical inspector. He will find an occasional stumbling-block, but I believe much good can be accomplished in the outlying districts in this way. The day is not far distant when every union and association of underwriters will have competent electrical ability to guard its interests. I am firm in the belief that the electrical advancement for the past twenty years is to be eclipsed in the score of years to come. The steam engine with its fumes and noise and grease, its oily waste that does so dislike to get into the can, will be relegated to safer localities than the printing office, the paint mill, the box factory, the cotton mill, and substituted by the safer, when properly placed and operated, new order of generator. Electricity will light and run the iron mill and the welding shop, drive the ponderous hammers, and planers, and saws of our factories and shops. That most abject slave, who eats or goes famished, drinks or suffers thirst at the will of an unfeeling master—the horse—will soon be relieved from his most arduous labors, and cease to be a care and worry for the Humane society. The harnessed waterfalls are already toiling in the underground depths, and the thunder of Niagara will ere long sing the song of homely labor, rather than the hum of stupendous, idle grandeur. In the household there will be everywhere appliances for heating and for cooking, for ironing, for cooling the air in summer and warming it in winter. I see no valid reason why the toil of the husbandman may not in a great measure be relieved by the aid of the same mysterious agent, electricity. Is this extravagant? It certainly is no farther in the dark of the future unknown than were the telephone, the electric light and the phonograph, even the Atlantic cable, when Professor Morse went almost on bended knees through the streets of the national capital begging for aid to construct a telegraph line from Washington to Baltimore.



FIVE HUNDRED HORSE POWER DYNAMO.

Five Hundred Horse Power Dynamo.

With scarcely an exception the larger types of dynamos now constructed in Europe are designed for direct connection with the engine shaft. A tendency in the same direction is noticeable on this side of the water, and several plants with machines of this design are in course of construction. A recent machine of this type built by the International Electrical company of Liege, Belgium, is illustrated by the accompanying cut. The dynamo, connected to a compound condensing engine, is of 500 horse power, and it is installed in the national armory at Herstal, near Liege, where it generates current for supplying motors used for operating machinery employed in the manufacture of arms. The installation is the most important plant for supplying motors in the country, and it is predicted that it will serve as a model for manufactories in Belgium, as the advantages attending the electrical distribution of power are better appreciated.

The machine is multipolar and the armature is of the Gramme ring type. As the illustration shows, the field magnets form a ring made up of ten sections joined by heavy bolts. There are 20 projections of the pole pieces extending to within 6 millimeters of the armature. In constructing the armature, the diameter of which is about 19 feet, special devices have been employed to insure absolute rigidity of the hub on the shaft. The core, which is made of sheet iron 15 inches in width wound on, with paper separating the successive layers, has a thickness of a little over 5 inches. The sheet iron is tightly held by bolts extending from the periphery to the hub. The armature wire is flat (4 mm. by 5 mm.) and is insulated by cotton covering and shellac. There are two commutators, each about 8 feet in diameter. Current is collected by 80 metallic brushes which may be moved simultaneously. The output of the machine is 2,440 amperes at a pressure of 125 volts. The current is carried by four underground cables, two for each commutator, to an ordinary switch-board. The efficiency of the dynamo is said to be 90 per cent.

The proper metal for the field magnets was decided upon only after a number of tests. Forgings cost too much; cast iron did not possess proper magnetic qualities; but extra soft steel made in the Angleur steel works was found desirable, as its magnetic permeability equaled that of the best commercial soft iron and it could be cast. The following data of weights are given: Weight of steel in the magnets, 10 tons; iron in the armature, 6 tons; base plates, 8 tons; copper in the field coils, 5,340 pounds; copper in armature winding, 1,602 pounds.

The cut is reproduced from *L'Electricien*.

Cost of Diplomatic Telegraphing.

In an interesting article on the use of the telegraph by the state department of the United States government, written by George Grantham Bain, Chief Clerk Brown, when asked about the cost of state department telegrams, is reported to have said:

"An attack of cholera or a diplomatic episode with Chile will double our expenses in a very few weeks. And then we may go on for months without having any extraordinary expenses. We could not possibly average the cost of telegraphing. It is like the fund for the relief of disabled seamen abroad. Some years we may not need to use much of it, and other years we may have a call for more than we have on hand. Some years ago almost the entire American whaling fleet in the Pacific was disabled in a storm. Many of the sailors were taken to Honolulu, and there were cared for and returned to the United States by our representatives. Our duty was imperative; but extending this relief exhausted our relief fund and took $10,000 more. When the fund was exhausted, the bankers who held the drafts on the state department for the additional $10,000 had to wait for Congress to make a special appropriation for their relief. And Congress kept them waiting two or three years for it. During a foreign epidemic or any other emergency like the present, our telegraph bills are very heavy; but it would be impossible to approximate them.

"State department messages have precedence of other business. I remember some years ago taking a long cable message to a cable company here and offering it for transmission. It would have been worth $150 to the company. While the operator was sending it, some one broke in with a commercial message. I took the department message away and filed it with the other cable company. It was just $150 out of the first company's pocket. They thought it over and came to the conclusion that it would pay to handle the business of the department promptly. So our messages are given precedence now."

The greater part of the foreign telegraphing done by the state department costs the government 15½ cents a word. The cable companies make a concession of 50 per cent. on government business. That concession applies from New York. The regular rate from New York to Great Britain, Ireland, France and Germany is 25 cents a word. The government pays for this service 12½ cents a word, and the Western Union Telegraph company charges three cents a word additional for handling the message between Washington and New York. This heavy charge is made because of the care needed in transmitting such important matter and the necessity for repeating it as a precaution against error. When the message is to go beyond the four countries named above, the government is placed on an equality with the individual. The concession does not extend to continental rates. The full rate must be added to the rate to London, and sometimes this rate is very high. To Queensland, for example, the rate from London is $2 31 a word or $3.16 if sent via Siberia. To Formosa, China, the rate from London is $2.14 a word. The Queensland rate is charged to Corea. When the Chinese or Corean ministers send messages to their governments they run up a pretty bill of expense.

The state department cables are sent from an office in the state department building. The operator there is familiar with the work and is less likely to make mistakes than another operator would be. The messages go over a special cable wire to the Wall street office of the Western Union company in New York. So they do not come in conflict with the domestic business of the telegraph company. The Western Union company handles cable messages constantly from the legations here. Most of them are in cipher, and as only figures are used, there is no difficulty in sending them anywhere.

Fred H. Whipple Arrested.

Fred H. Whipple has been arrested on the charge of obtaining money under false pretences. Last week Whipple was arraigned in the district court at Pittsfield, Mass., on the charge of securing $100 on a worthless draft. Bail was placed at $1,000, but the prisoner was unable to secure it and was obliged to go to jail. Many other charges of a similar character have since been filed, mostly by electrical concerns. Whipple will be remembered as the publisher of "Whipple's Reports" and "Whipple's Directory." Both of these publications have passed out of his hands, yet he has, it is charged, been obtaining money on drafts made on the Fred. H. Whipple Publishing company.

Siemens & Halske Electrical Machinery.

Considerable interest will be manifested, no doubt, in the machine illustrated in the following cut, inasmuch as it shows the type of direct current dynamo which will be placed on the American market by the Siemens & Halske Electric company of America. This company, convinced that the large dynamo coupled directly to the steam engine shaft, running at a comparatively low rate of speed, thereby saving the expense of belting, with its corresponding loss of power through friction, slipping, etc., is bound to be the machine of the future, has turned its attention to the designing and construction of such machines and has gone from 500 horse power, to 1,000 horse power, thence to 1,500 horse power, and now 2,000 horse power. The wisdom of building large dynamos was questioned by electrical engineers. Sylvanus P. Thompson, in his recent work, "Dynamo-Electric Machinery," states that he has been of the opinion for years past that large dynamos are preferable, not because he has any admiration for mere bigness, but because in dyamos, as in steam engines, the large machines may be made more efficient than the small in porportion to their cost. The mechanical, electrical and financial results achieved by the Siemens & Halske large dynamos warrant the belief of those who advocate such large machines.

The machine illustrated in the cut is of the inside pole ring type, with four to twelve poles, which are placed in the form of a star inside the rotating armature. The brushes, which are always of the same number as the field magnets, take off the current from the outside of the armature winding. The armature itself consists of an iron core wound with copper segments. The special machine herewith illustrated has ten poles and is designed for an output of 746,000 watts. This machine can be built without special commutator from 100 to 700 volts, and can be used for lighting and power. The loss of pressure in the armature is only 2 per cent. with maximum load. For exciting the field magnets, only 1½ per cent. is required. The electrical efficiency of this machine is claimed to be 96½ per cent. It is shunt wound and has surface velocity of 50 feet per second.

The works of the Siemens & Halske Electric company of America are located in Chicago. The American branch receives all drawings from Berlin, and will duplicate the construction that has resulted from the vast experience gained by Siemens & Halske during the half century of their existence.

Telephone Contracts.

Telephone companies will be interested in the opinion handed down in the case of the Martinsburg Deposit Bank against the Central Pennsylvania Telephone & Supply company, where an important point in the construction and enforcement of contracts was raised.

Where the authorized agent of a telephone company agrees to furnish telephone service at a certain rate for a specified time and at regular rates after that time, if the contract, when reduced to writing, through the mutual mistake of both parties is closed without expressing their original agreement, a court of equity will reform the contract and enjoin removal of the telephone until the original contract is performed. It is the person's duty who signs a contract to know, or, if he does not know, to ascertain, whether the written contract contains the proper terms. Signing upon mere supposition, without knowledge or inquiry, comes dangerously near negligence, and the mistake to be relieved against in equity must be one that is mutual, material, and not induced by negligence. As to what would be regular rates it may be said that, *prima facie*, the term is to be construed with reference to rates paid by others at the same time, in the same place, and for the same service. They are not necessarily the same for different places, even though in the same vicinity. The distance from the central office, the nature of the country between affecting the cost of construction and maintenance, the number of customers, and the kind of service supplied, are all elements to be considered in fixing a remunerative, and yet reasonable rate. But while, therefore, there is no presumption that regular rates for one place are the same as for another, even though near at hand, yet what is meant by the use of the words in an unwritten contract is always a question of fact in the particular case.

Edison Lamp Patent Sustained.

A telegram to the WESTERN ELECTRICIAN from New York announces that the incandescent lamp case has been decided, the Edison patents being sustained.

The German telegraph service has adopted copper-bronze wires and is replacing all its iron and steel wires by the new metal, which weighs 180 pounds to the mile.

The Effects of Alternating Currents on the Human Body.[1]

By Chas. Proteus Steinmetz.

In No. 32 of the *Zeitschrift* appeared an article by Engineer Kortals, wherein he explained by the capacity of the human body the harmlessness of an alternating current of 70,000 volts and very high alternations when subjected to the familiar Tesla experiments. This explanation does not agree with Tesla's statement that this immunity from danger exists only at a certain adjustment of the primary circuit. On the contrary, the secondary discharging current, by variously adjusting it, varies considerably in its character and becomes no longer harmless. Furthermore, if we grant the truth of Kortals' statement, then must be the oscillating discharge of a Leyden jar, which has a much higher difference of potential, be imperceptible. The reason for this harmlessness seems to me to be much more simple and clearer. That the human body in this experiment of Tesla is subjected to a voltage of 70,000 to 100,000 volts is no hing more than the experimenter's figure of speech.

I had the pleasure of being present at one of the first exhibitions of this experiment. The experimenter connected himself in the secondary circuit of the induction apparatus in series with an air space one foot in length, and, as the resistance of his body was infinitesimal compared with that of a foot long air space, the experimenter received only an infinitesimal part of the whole of the 70,000 volts. Had the experimenter touched both secondary contacts directly, then the secondary voltage of 70,000 would have ceased to exist, and the secondary coil, short circuited through his body, would be without a difference of potential, as in every spark inductor.

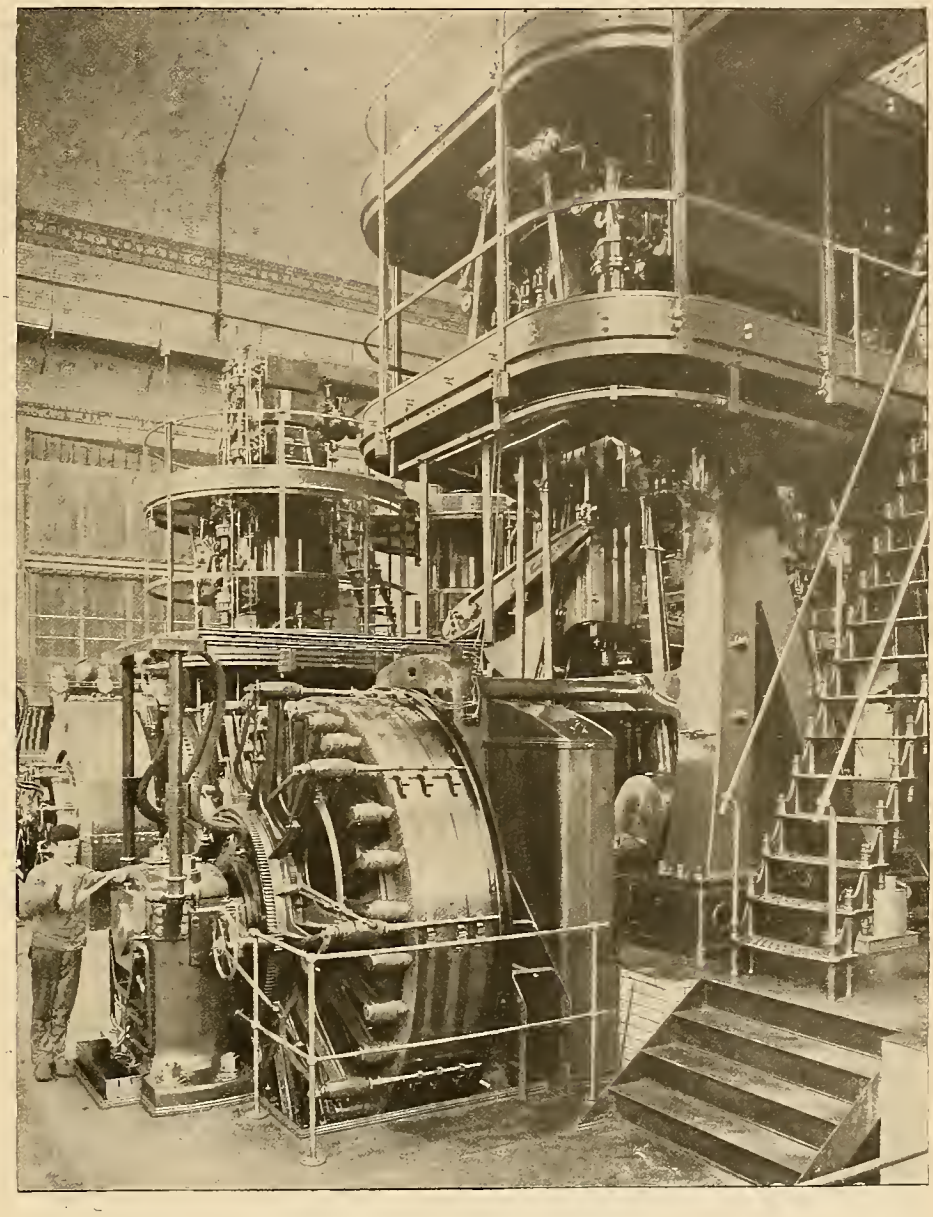
The error in the conclusions following these experiments lies simply in comparing them with the conditions present in touching an ordinary alternating current dynamo of constant potential, because in the experiments the voltage was absolutely not constant, but depended on the resistance of the circuit. The experiment, however, is analogous to the conditions in a frictional machine. A well-built friction machine of medium size can easily induce a potential of 100,000 volts, and yet the sparks taken directly from the collector are not only harmless, but scarcely perceptible.

I have taken from the driving belts of dynamos pretty lively sparks at a distance of two feet from the belt, representing an enormous voltage, yet they were scarcely felt, the current following through the body and also the difference of potential in the body is infinitesimally small, while the voltage outside of the body is consumed in sparks and is consequently harmless. The number of alternations has nothing to do with this phenomenon, and is only indirectly a factor as regards its influence of the self-induction of the circuit. A dynamo such as Tesla used has a very high self-induction. In addition to this must be counted the self-induction of the induction machine; consequently the exciting circuit is highly self-regulating for constant current, and the dynamo current, as in the Westinghouse arc dynamo, cannot rise above a certain maximum.

If we take 10 horse power as the power of a steam engine, the dynamo can deliver at the most 10 amperes at 500 volts. Transforming this to 70 000 volts at 50 per cent. efficiency—higher than it is in reality—will give 1-30 ampere in the secondary. With a body whose resistance is 2,000 ohms, this will give no more than 2¼ watts and will be scarcely perceptible. The apparatus for electrical execution, on the other hand, had a voltage of 1,500 from hand to hand and a current of 3 amperes; that is, 4,500 watts, or an effect 2,000 times as great as from touching the "70,000 volt circuit." In this apparatus, the 4,500 watts were not instantaneously fatal, and the connections were changed so that the circuit was made between the head and leg of the criminal. Under these conditions 7 amperes and 1,500 volts produced instant death.

Therefore it is clear that unusually high voltages are harmless if they are accompanied by small currents, producing as a consequence little effect on the body. If 70,000 volts had really passed between the hands of the experimenter, he would have been receiving 140 amperes, that is, over 10,000,000 watts. In other words, instantaneous explosion and breaking down of the tissues would have resulted, as from a heavy lightning stroke.

1. From the *Elektrotechnische Zeitschrift*.



SIEMENS & HALSKE ELECTRICAL MACHINERY.

The Baltimore, Md., Traction company contemplates extending its Pikesville branch to Arlington.

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CORRESPONDENCE relating to electricity, or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

	PAGE.
Electricity at the World's Fair. Illustrated.	181
New Auditorium Plant	181, 182
Electric Meter. Illustrated	182
Rudd's Method of Measuring the Strength of Magnets. Illustrated	182
Small Steam Dynamo. Illustrated	182
Mammoth Dynamos for the World's Fair. Illustrated	183
Electricity, Light and Fire. By C. C. Haskins. (Fire Underwriters' Association of the Northwest)	183, 184
Five Hundred Horse Power Dynamo. Illustrated	184
Cost of Diplomatic Telegraphing	184
Fred H. Whipple Arrested	184
Siemens & Halske Electrical Machinery. Illustrated	185
Telephone Contracts	185
Edison Lamp Patent Sustained	185
Effects of Alternating Currents on the Human Body. By Chas. P. Steinmetz	185
Editorial	186
American Institute of Electrical Engineers	187
The Washington Illumination. Illustrated	187
Chicago & St. Louis Electric Railway	187
Shocks from Old Neptune	187, 188
New Railway Line Specialties. Illustrated	188
New Horizontal Engine. Illustrated	188
Hurtel & Manger Electric Bell. Illustrated	188
Lane & Bodley Shafting Stand. Illustrated	188
Flowers Sent by Telegraph	188
Electric Railways in Chicago	188
Insurance Rules and Electrical Installations	189
Governmental Control of the Belgium Telephone System	189

DEPARTMENTS.

Correspondence	189, 190
New Incorporations	191
Electric Lighting	191
Electric Railways	191
Electric Mining	191
Telegraph	191
Telephone	191
Miscellaneous	191
Trade News	192
Business	192
Electrical Patents	192

THE *Electrical Review* of London has taken upon itself the creditable work of exposing the quackery of a device that seems to have an extensive sale in England and which is known as "Harness' electropathic belt." Our contemporary asserts what all persons who have an intelligent understanding of the principles of electrical action will believe to be true, that these belts can generate but an infinitesimal current of electricity at best, and that their sale for medical purposes is a swindle on the public. The "Medical Battery company," which is the proprietor of the belt in question, does not relish this, and has, through its solicitor, given newsdealers handling the *Review* notice that they will be held responsible for selling copies of the paper containing such "malicious libels." The *Review* has retorted by assuring the dealers that it will undertake to save them harmless in any suits that may be brought, and stating, furthermore, that it is taking direct legal proceeding to defend its interests and that of the trade. We wish the *Review* every success in its good work, and hope that the issue may be clearly joined in the courts. We have no doubt of the outcome, and it is possible that the decision will be of value as a precedent in the United States.

HERETOFORE the largest dynamos have been manufactured abroad, and England, France and Germany have each surpassed the United States in this respect. At the World's Fair, however, there will be shown ten or eleven incandescent machines of American production that will rank well up toward the topmost notch of European practice. These dynamos will be of 750 kilowatts capacity each, and many of the castings have already been made. While these machines do not attain the size of the great Ferranti dynamos at Deptford, in England, and perhaps of some machines of German manufacture, they are nevertheless sufficiently near the maximum to entitle them to rank easily among the great dynamos of the world. This fact is gratifying, as showing the ability of American electricians to produce generators of great capacity, although the superior utility of huge machines of this character has not yet been conclusively demonstrated. It is worthy of note also, that a great German electrical house is preparing to manufacture 1,000 horse power dynamos in this country.

IT is not customary to place a stable boy in charge of a machine shop, a flagman in charge of a locomotive, or an unskilled laborer of any sort in charge of complicated machinery—excepting electrical apparatus, which is supposed by some people to require no special care. On many of the electric railways in this country drivers of horse cars have been given charge of electric cars without any special instruction as to the requirements of electric motors. President Beckley of the Street Railway association of New York, in his annual address, which was presented in the WESTERN ELECTRICIAN last week, called attention to the necessity of instructing men engaged in handling electrical apparatus. He said that his company found that it required men of higher capacity to serve as motormen and conductors of electric cars than seemed necessary under the old system. In Rochester, N. Y., Mr. Beckley says, they have detailed a man as instructor, who rides with the motormen, advises them as to the best methods for handling their cars, gives them detailed instructions what to do in case of a break-down or any other trouble. The company finds that its repair bills are much smaller, that there are fewer interruptions in the service, less cause for complaint on the part of the patrons of the road, and consequently considers itself well repaid for the trouble and expense involved in instructing its men in handling electrical apparatus.

On the other hand there are companies, and they can be found in every part of the country, which do not consider it necessary to inform their motor men of the type of machine in use. Mr. Beckley is authority for the statement that he met a motorman in another state, who, when questioned about his equipment, professed the most profound ignorance. He did not know whether the motors were Thomson-Houston, Westinghouse, Edison or Short. He did not know whether they were double or single reduction. He did not even know whether he had under his car body one or two motors. When asked what he did in case of trouble on the line, he said: "If the motor don't work I wait until another car comes along, and pushes me in." This motorman had been for nearly nine months in regular service as motorman in that city. This motorman knew enough to turn on and off the current and to set and loosen the brakes, but his knowledge did not extend much farther.

It is on lines which employ such men as this that operating expenses exceed the income of the road. Of well regulated roads, conducted upon business principles, where intelligent men are employed, a different story can be told.

INSURANCE rates on property in which electric light or power is used form a subject of general interest, and the discussion on this question has done much to call attention to faulty construction and bring about the adoption of improved methods. That the insurance companies are not yet satisfied with the advancement in this department is shown by the eagerness with which they discuss the subject and solicit suggestions from practical electrical engineers. The latest instance in this line is found in the proceedings of the last meeting of the Fire Underwriters' Association of the Northwest, which was held at Chicago last week. A comprehensive paper on the installation of an electric plant was read at this meeting by C. C. Haskins. An abstract of this paper is presented in this issue. Touching on the progress that has been made in the methods of construction, Mr. Haskins calls attention to the fact that in the early days of electric lighting any old barn, wood shed or cow house was considered good enough for an electric light plant, and the two or three boys without any knowledge of electrical apparatus, or any other kind of machinery for that matter, were placed in charge as a rule. The engine selected for driving the dynamo was generally one that had been cast off as being unfit for any further use in the line for which it was designed. Under such conditions, and with such management, it is not at all surprising that electric lighting soon experienced setbacks. It is to be wondered that it survived the hard blows delivered by the "projectors" of these enterprises. Now, however, electrical enterprises are conducted upon legitimate lines, and, as Mr. Haskins remarks, "Station houses are better built, wires are more carefully selected, greater pains are taken in construction, the entire enterprise is settling down to business and scientific bases, and in all large cities careful supervision of plants has been inaugurated by the underwriters or the municipal authorities, or both." This is as it should be, and every friend of electrical enterprises will encourage all honest endeavors to further raise the standard of work. The interests of the electrical companies and the underwriters do not conflict, and wherever this fact is appreciated the insurance and electrical companies, by working in harmony, have been abundantly rewarded. It should be remembered that some of the blunders that have served to retard the advancement of electrical work have been made by the underwriters themselves. This, of course, was due to a lack of expert knowledge, but nowadays, with the assistance of competent engineers, underwriters should make no more serious mistakes. The electrical business has become too great to be treated lightly, and the interests involved should secure just consideration. Moreover, the field of electrical application is extending, and it behooves insurance men to study carefully the advances in all lines, that they may act intelligently.

TO judge from present indications it will not be a great while before New Yorkers will have an opportunity to judge for themselves of the merits of the trolley system. For some time it has been evident that the overhead system would eventually be found to be a necessity for the great city. But the old fogies did not awaken to a realization of how close upon them was the much-needed improvement until the Harlemites showed their progressive spirit and desire to be in line with the rest of the country, by granting permission for the introduction of overhead wires. Brooklyn had, to be sure, decided to employ the system some time ago; but it was when Harlem saw what a mistake it would be to further delay the advance of the most practicable scheme for rapid transit, that the poor, congested and jealous old city raised its greatest howl. And what a howl it has been all along! To any one who has watched the advance of the electric system and has noted the satisfaction that has almost invariably followed its introduction, the New York dailies, with their wild and irrational talk, appeared in a supremely ridiculous light. It has been plainly evident that the editors of these papers had made up their minds that they didn't want the trolley system and as a consequence it has been nothing but "deadly," "deadly," "deadly," until now intelligent people laugh at them, and "deadly" is beginning to sound about as ridiculous in its misuse as are the adjectives "awful" and "funny." New York felt badly, of course, when its much maligned Harlem submitted to improvement, but the great city's rage knew no bounds when last week, as one paper put it, New York was "betrayed," and the aldermen at a special meeting granted nine franchises to connect and extend the lines of the Metropolitan Traction and subordinate corporations. Of course, there has arisen a great wail, and corruption is its burden. But as "corruption" is the usual cry when extensive franchises are allowed, it is fair to presume matters would have been much the same had the question hinged upon any other sort of motive power.

In another column our eastern correspondent tells the story in detail. It is not certain that Mayor Grant will approve the council's proceedings, but the general feeling is that whether he does so or not the people will see the trolley wires go up on the streets of New York.

Without discussing the question as to whether the franchises were obtained honestly or otherwise, it is safe to say that when the road is once in operation the public will soon arrive at a correct understanding of how little is the real danger from railroad wires, and also how great and dense has been the ignorance of a set of newspaper men that the country thought knew better. Chicago is to have overhead wires upon its cross-town streets and this great city is glad of the change. But good and artistic construction should be the watchwords, and with the work carried out along these lines and in a thorough manner the nonsensical "deadly" will vanish in thin air.

American Institute of Electrical Engineers.

The first meeting of the season of the American Institute of Electrical Engineers was held at New York, Tuesday, September 27th. Charles Proteus Steinmetz read the paper of the evening. Its title was "On the Law of Hysteresis (Part II.) and Other Phenomena of the Magnetic Circuit." It was practically a continuation of the discussion on the same subject upon which Mr. Steinmetz presented a paper January 19th. At a meeting of the council on the same day the following named gentlemen were elected associate members: H. Fleetwood Albright, Western Electric company, Chicago, Ill.; Charles G. Armstrong, Chicago, Ill.; Romaine Callender, Brantford Electrical Laboratory, Brantford, Canada; Chester D. Crandall, Western Electric company, Chicago, Ill.; George E. Fisher, Commercial Electric company, Detroit, Mich.; Charles Flesch, Melbourne, Australia; J. P. Jackson, Pennsylvania State College; Frank E. Kinsman, Plainfield, N. J.; James P. Magenis, Adams, Mass.; Carl K. MacFadden, Chicago & Northwestern Railway company, Chicago, Ill.; James McBride, New York & Boston Dye Wood company, Brooklyn, N. Y.; Augustus Noll, New York Insulated Wire company, New York; William D. Ray, Northern Pacific Railroad company, Oak Park, Ill.; Howard S. Rodgers, Thomson-Houston Electric company, Lynn, Mass.; Robert A. Ross, Edison General Electric company, Peterborough, Ont.; Frank Stuart Smith, Westinghouse Electric & Manufacturing company, Pittsburg, Pa.

The Washington Illumination.

Reference has already been made in these columns to the elaborate electrical illuminations which formed so important a feature of the Grand Army celebration at Washington. Herewith are presented two illustrations showing characteristic features of this display.

The interest in the reunion centered about Pennsylvania avenue, stretching from the Capitol to the Treasury and the Executive Mansion, and it was determined that the electrical display should also be centered there.

Running from near the Pennsylvania railroad depot to the Treasury, pole lines were erected on both sides of the avenue. At short intervals along these two lines different corps badges were designed in incandescent lamps, each corps badge being repeated three times at various points on the avenue in the national colors of red, white and blue. Above each corps badge the name of some notable fight in which the corps took conspicuous part, or some well remembered sojourning place during the war, was presented in electric lamps. At rarer intervals the portraits in oil of the leading war generals were suspended, each surrounded by a double border, the inner one of very small lamps, the outer of lamps of a larger size and higher candle power.

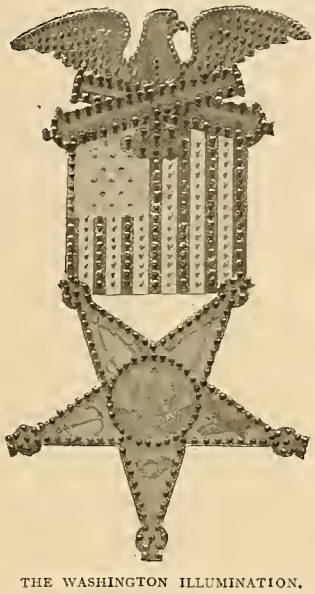
At the corner of Tenth street, in front of the *Washington Post* building was erected a splendid anchor, about twenty feet high. It was the most attractive set piece on the avenue. In front of the *Washington Star* offices twin stars of red and blue were placed, and a patriotic device gleamed from within the office window.

At the head of the avenue at the entrance to the White lot was erected the most conspicuous design of the occasion. It was a monster fac-simile of the G. A. R. badge, eighteen feet high, entirely made up of incandescent lamps. The eagle was outlined in white lamps, the cannon in blue, the stars and stripes in the regulation colors, and the pendant star in amber lamps. This piece was duplicated at the corner of Seventeenth street, below the White House. From the children's stand, at the head of the avenue, the name of Lincoln was represented in white lights.

The illumination of the Treasury building presented considerable difficulty. This was overcome by arranging along the cornice at the top of the fluted columns, a line of colored arc lamps, which stretched from the entrance to the White lot almost entirely around the building. The red, white and blue globes of the lamps lent themselves admirably to the colors of the flags with which the building was hung. Colored arc lights were also used to illuminate the camp on the White lot.

On the White House lawn, in front of the mansion, a most fairy-like effect was produced. Every bush, tree, fern and flower bed glistened with the light of innumerable miniature lamps, so suspended as to conceal all the mere practical details of installation. No less than ten revolving stars, each of different design, were also set up here, and, constantly changing in design and color, re-appearing and disappearing, obtained a well-merited meed of success. Over each entrance to the mansion was set a star of deep blue lamps.

A marvelous effect, and one never yet essayed to add to the brilliancy of an illumination, was obtained by the introduction of the search light. On the roof of the Washington Loan & Trust company's building were set four 24 inch projectors, three facing the capitol and one facing the monument. During the evening, the brilliant rays of light from these projectors shot the national colors on the clouds, or illuminated the surroundings of the city. The most marvelous effects were obtained, however, when the whole four were brought to bear on the capitol, or on the monument. The nights being without moonlight, the



THE WASHINGTON ILLUMINATION.

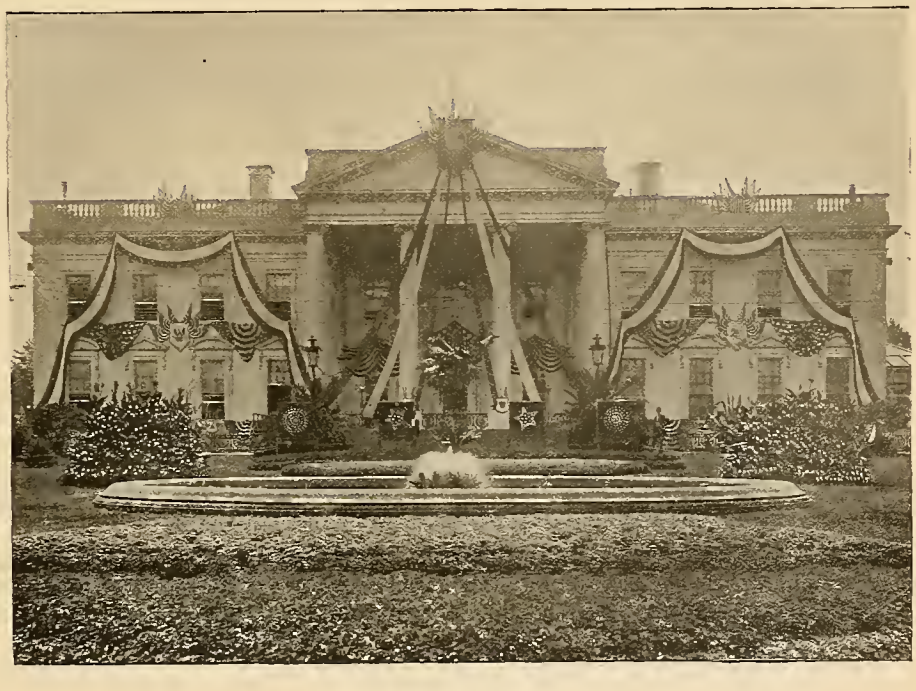
background was absolutely black, and when the lights were thrown on the capitol it appeared magnificent and awe inspiring beyond conception. The illuminated monument was none the less effective. The white stone shaft springing up straight into the blackness of night, seemed like a supernatural finger pointing heavenward.

All this remarkable display was not obtained without great effort. Less than thirty days elapsed between the commencement of the work and the illumination. Poles had to be erected, and a whole three-wire system installed, drawing current from every available dynamo, public or private in the city. In fact, not enough current could be procured.

Two G. A. R. badges, sixty-three corps badges, the same number of mottoes and names, special devices such as the anchor and stars, had to be designed and executed. The streets had to be skillfully wired and socketed, the revolving wheels to be conceived and constructed. Projectors had to be brought from the factory and erected. It was a great undertaking brought to a satisfactory termination. Some idea of the work can be gained from the fact that over 25,000 incandescent lamps were used in the illumination, as well as 100 arc lamps.

The projectors were built by the General Electric company and the entire illumination was designed and installed by the decorative lamp department of the General Electric company.

Credit for the success of the illumination is due to A. D. Page, to whom carte blanche had been given and to F. Clarke, the Washington representative, who were materially assisted by Mr. Fanshawe and Mr. McAllister, both skillful designers and versed in lamp requirements. The search lights were in charge of Mr. Gragg.



THE WASHINGTON ILLUMINATION.

The Chicago and St. Louis Electric Railway.

A dispatch from St. Louis, dated September 29th, says: At 10:30 this morning pedestrians on Olive street noticed a long train of wagons, plows, mules and horses wending its way slowly between cable cars, delivery wagons and stylish equipages. It would have looked like a traveling gypsy camp, but the instruments of toil were too numerous to allow that idea to prevail. Those who saw the first wagon go by stopped until the procession had finished. It had a peculiar interest for them. On either side of the wagon, which was filled to overflowing with cooking utensils, bedding and camp furniture, were two streamers bearing the legend: "For the St. Louis and Chicago Electric Railway." At Broadway and Olive streets stood Dr. Wellington Adams in natty fall attire, a gleam of triumph coming from behind his gold-rimmed eyeglasses. As the wagon train went by he explained its import: "That is the first gang of workmen going over to Edinburg, Ill., where we will commence operations on building our new road. This gang is under command of Andrew F. Burke, an old railroad contractor, and contains all the requisites for a railroad camp. We have mules, plows and camp utensils for 200 men. They are going overland and will reach Edinburg, which is eighty miles from here, on Monday. By Tuesday or Wednesday, perhaps, we will turn the first shovelful of dirt. Of course we will have appropriate ceremonies, speech-making, and all that. I have invited Mayor Noonan and Mayor Washburne, of Chicago, to be present. Work on the roadbed will be commenced at once. We have our power house built at Edinburg and equipped with enough machinery to operate the first section when it is built. The building of the road will be pushed in both directions. Our cars are now in process of construction, and the first section will be in operation quicker than people think. It is possible to have the road finished in time for the World's Fair, and if money can push it through we will have Chicago and St. Louis within three hours of each other. Our finances are in splendid shape," said the doctor, as the last wagon went by. "I made a deal on my last trip east that has put all worry about finances out of the way."

Shocks from Old Neptune.

Capt. H. S. Sieward of the schooner Dora Sieward met with a startling experience on his voyage from Copper Island, to Seattle, Wash. When north of Athka Island the schooner was suddenly lifted, as if a whale had struck her keel. Falling again into the trough of the sea, she experienced a succession of shocks, which cast everything loose about decks, the men being unable to keep their feet, and the mate, who was at the wheel, having to

cling to the spokes to keep her head to the wind. The weather was clear at the time and the surface of the sea betrayed no evidence of the subaqueous eruption which was taking place. The vessel humped along on her course for fully a minute, and when she had covered 500 yards, and after being shaken from stem to stern, the eruption ceased, and she sailed smoothly on. The mate at the wheel described the spokes as so many electric batteries, from which strong shocks tingled through his body till he could hardly keep his position.

New Railway Line Specialties.

The accompanying cuts illustrate several new electric railway fixtures that are being introduced by the Railway Equipment company, Chicago. Fig. 1 shows the com-

FIG. 1. NEW RAILWAY LINE SPECIALTIES.

pany's latest type of frog for right hand, left hand and "Y" turnouts. Fig. 2 shows the section insulator. In actual use the latter is covered with a hood. These devices were designed with a view of meeting the varying conditions of the different systems now in use The ease of adjustment to both span and trolley wire is a feature which the company thinks will commend both of these devices to practical street railroad men.

New Horizontal Engine.

The accompanying illustration shows the new horizontal engine built by the Racine Hardware Manufacturing company of Racine, Wis. This concern has until recently confined itself to producing vertical stationary and marine engines of a high grade. The company is a believer in the vertical type wherever it can be used. This

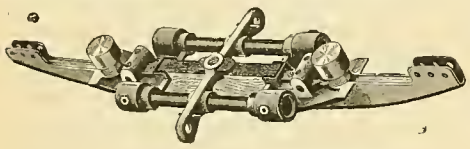
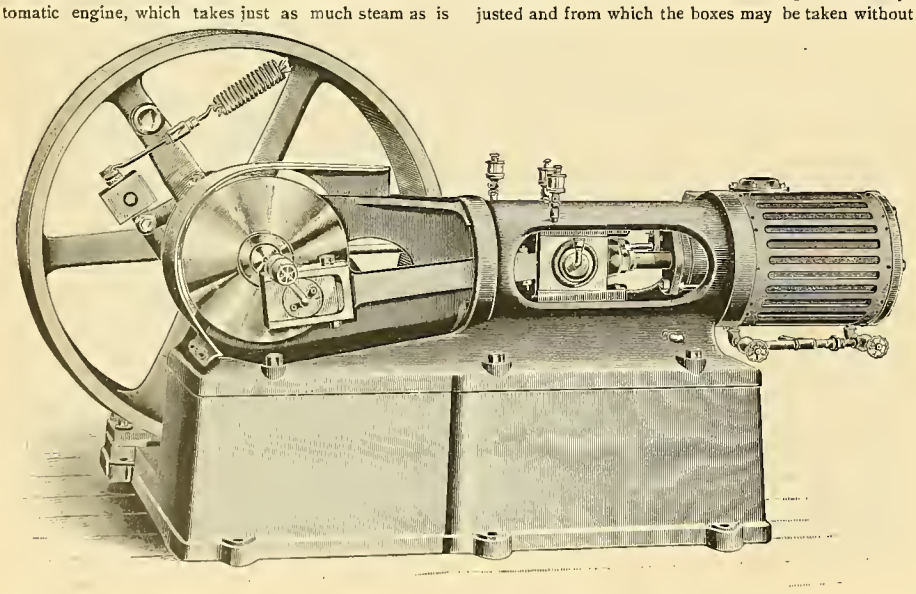


FIG. 2. NEW RAILWAY LINE SPECIALTIES.

company probably carries as large a stock of engines as any builder in the country, with a view to the immediate filling of orders. At this writing it has as many as 174 steam engines complete on the floor or in process. As the company makes 30 different numbers such a stock is necessary.

It is well understood by intelligent men that where fuel costs anything, no one can afford to use any other than an automatic engine, which takes just as much steam as is



NEW HORIZONTAL ENGINE.

neccessary to move its load, and no more. Steam represents fuel. Fuel represents money. In these days of locating power in basements, there are places where the height of a vertical engine is objectionable. This has induced the Racine company to commence building a line of horizontal engines from 35 to 100 horse power in which are embodied all that long experience has proved to be the best. These engines are what may be called reasonably high speed.

The engines are built to stand all the stress that their high rating demands, with broad margins for safety. It has come to be understood in engine construction that quality and not quantity of material should govern, which means the best material in the right place. Years ago this concern commenced building engines without outbearings, but after costly experimenting and years of experience, it has been decided that an outbearing is necessary to the life of an engine, thus securing, it is believed, the least wear and uniform wear; the least time lost in repairs and the least cost of repairs. A self-contained engine saves much cost in the setting, but there is not a full appreciation of the safety it secures against the shaft getting out of line from unsettling of foundation or other causes, with all the expense incident to such repairs. The nine hundred engines the Racine company has in operation throughout the country is an excellent testimonial for the Racine automatic engine.

Huebel & Manger Electric Bell.

The main feature of this bell, illustrated in Fig. 1, is the contact post, Fig. 2, which is so constructed that it cannot turn. Electric bells frequently become inoperative because the insulating bushings between the post and the base shrink, thereby loosening the connection of the post

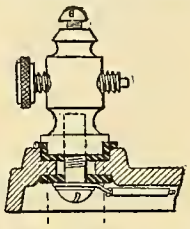


FIG. 2. HUEBEL & MANGER ELECTRIC BELL.

to the base, so that the post, on account of the continued vibrations, will turn to one side and no longer present the platinized end of the screw to the action of the contac spring.

The groove in the base is a little larger than the bottom of the post so as to admit a layer of insulation. The post is held from underneath by a fastening screw. It is claimed that is impossible for this post to turn or twist in any way. This bell is being placed on the market by Huebel & Manger, manufacturers of electrical and brass goods, Brooklyn, N. Y.

Lane & Bodley Shafting Stand.

The accompanying cut represents a new shafting stand which has been put on the market by its manufacturer, the Lane & Bodley company, Cincinnati, O. This stand was designed to meet the demands for a substantial stand with first-class self-oiling boxes easily adjusted and from which the boxes may be taken without removing the shaft even though a bearing or pulley hub be on both sides. The bearings are made in lengths four times the diameter of shaft and are lined with first quality bearing metal and supplied with a self-oiling chain feed.

Flowers Sent by Telegraph.

There is a sign over the door of a florist in New York which says: "Flowers by Telegraph to All Parts of the World." This sign seemed sufficiently extraordinary to warrant inquiry into its exact meaning, so the owner of the flower store was interviewed upon the subject, and he said:

"Yes, flowers by telegraph sounds strange, but it is nevertheless quite possible and done in a perfectly simple way. Here is how it is managed: We have arranged with one of the leading florists in every city in this country and Europe, so that when any of our customers come, write or telegraph to us and tell us to send flowers to some friend in another city we at once telegraph the order to our correspondent and have it filled immediately. We charge the cost of telegraphing or cabling to our customer. The scheme has only just been started, but its working has surprised and delighted both ourselves and our customers. My partner is in Europe now establishing new stations, and we hope to have a complete belt round the world soon.

"An amusing incident happened in Gibraltar. A young woman had sailed from New York on an Italian steamer and an admirer wanted a bunch of roses sent to the ship when she arrived off Gibraltar. Ten dollars was the amount he invested. I telegraphed my correspondent to

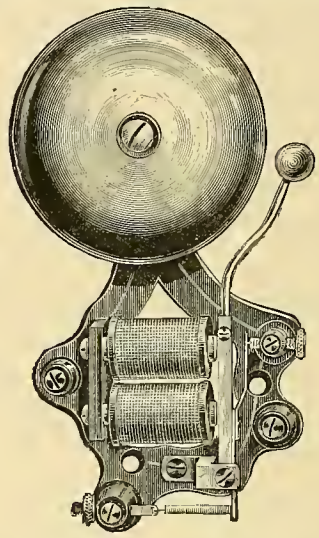
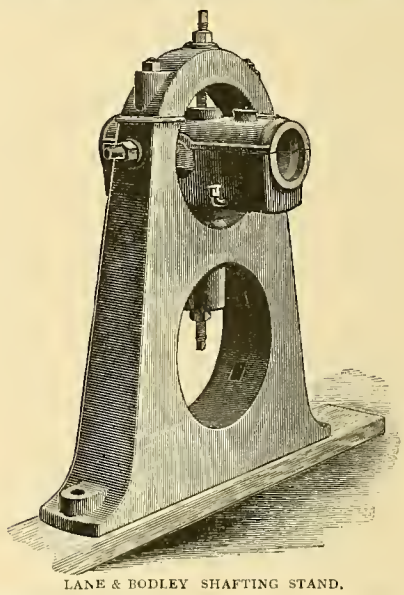


FIG. 1. HUEBEL & MANGER ELECTRIC BELL.

go out in a boat with the flowers and have them handed over the side of the ship. Now it seems that flowers are very abundant in Gibraltar, and the florist had never received so large an order before. I forget how many dozen roses were secured, but they almost filled the small rowboat, and the effect was as if a flower bed were floating out from the rock. The boat attracted great attention from the ship, and all the passengers flocked to the side to watch the flowers approach. Of course there was great curiosity to know whom all this floral display was for, and when the name of Miss Evans, I believe that was the young lady's name, was called out, she became uncomfortably conspicuous. Devotion represented by a boat load of flowers must be that of something more than a friend.



LANE & BODLEY SHAFTING STAND.

The young woman was an object of interest the rest of the voyage."

Electric Railways in Chicago.

On September 30th the Westinghouse Electric & Manufaturing company closed a contract with the Chicago City Railway company for four 700 horse power railway generators and 61 electric car equipments. The generators will be of the multipolar type. Forty-five of the sixty-one cars are to be fitted with the Westinghouse double motor equipment, the motors being each 25 horse power, single reduction. The remaining sixteen cars will be equipped with single motors. The apparatus must be delivered by

December 15th. In addition to the above mentioned machinery the City Railway company has contracted with the McGuire Manufacturing company, Chicago, for 61 of its "electric" trucks. The electric power house of the railway company will be located at Fifty-second street and Wabash avenue.

Insurance Rules and Electrical Installations.[1]

There is undoubtedly much inconvenience caused by the variety of rules which exist among fire insurance offices with reference to electric light installations. It is not that any one rule can be said to clash directly with another, but rather that the rules differ in stringency, so that, although if the most stringent rule be taken as a guide all offices will practically be satisfied, yet if the least stringent be adopted, the requirements of some office or offices would not be met. Opinions may differ as to whether the rules most widely adopted, namely, those of the Phœnix office, are the best; they certainly, however, fulfil most reasonable conditions, and would probably be still more generally accepted, were it not for the perhaps not unnatural feeling that every office must do something to show its originality by framing its own rules, which shall in some respects, at least, differ from those of every other office. In America, recently, an important meeting of electrical insurance experts was held for the purpose of discussing and adopting a uniform code of electrical insurance inspection rules and reporting the same to the various associations and companies for adoption. A draft scheme was prepared which was to be printed and circulated for further opinions, after the receipt of which a final set of rules will be drawn up and reported for adoption. It is not announced that there have been any dissentient voices on the matter, but we should hesitate to say that were a similar convention assembled in this country, such dissension would not arise. There are certainly many rules adopted by all the insurance companies which are practically the same, and as regards those rules which differ in respect of stringency, such, for instance, as the lowest limit to be allowed for the insulation of an installation, the most stringent should be adopted, for no limit can be too high, provided it is reasonably possible to work to it. When an apparently too stringent clause is inserted in a specification, the contractor at first asserts it is impossible to work to it, then (upon a refusal to relax the conditions) he finds that with considerable difficulty he may just be able to comply with it, and finally that after all it can be worked to without any trouble, the will to do it having developed a way; this we have known to be the case in more than one instance. So in framing a set of regulations one should not entirely be guided by what it has been found possible up to the present to effect, though, of course, existing practical experience must be a chief guide; this practical experience, however, being that of men of real authority and not that of contractors who wish to keep the standard low, so that they may put in inferior work.

Governmental Control of the Belgian Telephone System.

According to the Belgian newspapers consternation reigns in the telephone offices throughout the kingdom of Belgium. The operators are greatly disturbed by a civil service examination which their new employer, the state, is shaking at them. The newspapers are trying to console them, and the government organs are talking of the elevation of the public service, but the examination promises to be as unfair as it is ridiculous. All the telephones in Belgium were recently acquired by the government, but with the understanding that all the employes would be re-engaged after December 31st next, when their present contract expires. The operators are now informed that they will have to undergo an examination at the re-engagement, and a failure to pass means a loss of place. The girls naturally supposed the examination would simply be on matters concerned with the proper performance of the work required of them in the manipulation of the telephonic apparatus, and were not a bit afraid, being all well skilled in the work for which they are engaged and paid. But the official programme of the examinations recently arrived at the telephone offices, and created consternation. A thousand things will be required from telephone operators under state control which were not considered at all necessary by private companies, which have operated the systems with perfect success. In addition to the two national languages, French and Flemish, a thorough knowledge of German and English will be obligatory on the hello girls. They must be well up in geography, and submit a complete drawing of the map of Europe. Many other conditions of similar nature are to be imposed. And with all this salaries are to be largely reduced, in some cases 33 per cent. While it is conceded that it would be advantageous to have one or two operators in the large central offices possessing a knowledge of the four languages, it is considered absurd and oppressive that all operators should be required to know them. It is stated by the *Independance Belge* that many women who have been connected with the telephone service for from ten to fifteen years will be compelled to seek other employment after December 31st. Dozens of younger women will have to go, too, for it isimpossible to learn German and English in three months and answer "hellos" all day, too. The paper quoted says that the ministry "is being heartily cursed," and that efforts are being made to have the examination requirements sensibly modified.

The Rock Creek Railway company, of Washington, D. C., has opened for business 6¼ miles of new electric road, traversing an attractive suburb of the nation's capital.

1. From the London *Electrical Review*.

CORRESPONDENCE.

New York Notes.

NEW YORK, October 1.—During the last week New York city has been the scene of a great victory for the trolley system. But the people at large are very much exercised over what they believe was the too hasty action of the aldermen. This wholesale condemnation, though, of the board of aldermen's proceedings was to be expected after all the wild and silly newspaper talk against the "deadly trolley." It is most amusing to read the hopeless wails of the papers, which, by the way, in some cases do not stop with denouncing the system, but descend to personalities. Here is what a New Yorker telegraphed to a western paper. The dispatch sent last Thursday gives in a few words a good idea of the situation, but it should be explained that the writer is apparently unable to see why "deadly" isn't a good word to use when talking of the electric system: "New York has surrendered to the deadly trolley. Everything asked for by the Crimmins syndicate of street railways was granted by the board of aldermen at an extraordinary session this afternoon. Nine franchises to connect and extend the lines of the Metropolitan Traction and subordinate corporations were given away without compensation to the city. Four of them have to do with the continuous line of trolley wires, which it is intended to stretch between the Sixth and Ninth avenue structure from the Battery to One Hundred and Tenth street. Nothing now stands between the people and the deadly overhead device save the State railroad commissioners, whose consent to any new form of motive power must be secured before it can be put in operation."

New York's chief executive declines to give any intimation as to what action he is likely to take in the matter of the nine resolutions adopted by the board of aldermen Thursday.

The monument being built in Ireland to the memory of the late Cyrus W. Field and his wife, will be placed in the historic burial ground at Stockbridge, Mass., where members of the Field family have been interred for generations. Mr. Field was buried side by side with his wife, and the monument is to be erected at the head of the two graves. In design the monument is very plain, and, although massive in outline, its contour is simple. Made of a huge block of gray Irish limestone, it will bear but little sculptured work. On one face of the stone will be carved a Latin cross in high relief. This symbol rests at the intersection of two palm branches, also in strong relief, placed crosswise. Immediately below these will be deeply cut the following inscription:

CYRUS WEST FIELD.	MARY STONE FIELD.
Born Nov. 30, 1819.	Born Aug. 28, 1817.
Married Dec. 2, 1840.	
Died July 12, 1892.	Died Nov. 23, 1891.

At the base of the stone will be another inscription, "Love is Imperishable."

Staten Island will be well up with the times, for the residents will in all probability have a chance to attend races at night. Work is going on rapidly at the new Wiman-Corrigan track. It is understood that in connection with the enterprise electric light racing at night is to be tried. Ed. Corrigan is said to have reported favorably to Erastus Wiman in the matter of electric light racing at night as he saw it at the South Side track, St. Louis, and thinks it entirely practicable. The Chicago racing man is expected to go East to confer with Mr. Wiman about a plan for lighting the track.

The steamship El Sol, which arrived on Monday last from New Orleans, had an unusual experience in the Gulf of Mexico. On the night of September 22d, while off Tortugas, the captain reports that his vessel encountered an electrical storm such as is rarely witnessed by mariners. The ship was enveloped in a constant blaze of light. A bolt which struck the pilot house demagnetized both the steering and standard compasses. The storm was accompanied by much rain and wind. W. F. O.

St. Louis, Mo.

ST. LOUIS, Oct. 1.—The Smith-Davis Manufacturing company, St. Louis, has completed arrangements to put in a power installation composing a 100 horse power Ideal engine and a large electric generator. Power from this generator will be distributed by wires throughout the new factory building on Twentieth street and Lucas place. Individual motors will be located throughout the factory where needed and no shafting or belting will be used at all, except for very limited and special cases. Some other modern ideas, in the direction of higher steam pressure, etc., will also be introduced.

James I. Ayer, president of the National Electric Light association, states that he expects from 400 to 600 delegates at the annual convention which is to be held in this city in February next. It is expected that the convention will occupy the greater part of a week. Important papers bearing upon subjects of special interest will be presented, among them being contributions from Nikola Tesla and Prof. Elihu Thomson.

At the last meeting of the Municipal Assembly, the Southern Electric Railway company asked permission to extend its tracks and overhead wires, so as to reach a terminus nearer the heart of the city. To do so, it will be necessary to pass over the tracks of other companies.

H. H. Humphreys has tendered his resignation as manager of the St. Louis office of the General Electric company, and has accepted a similar position with the Western Electric company of Chicago, which has completed arrangements to open a branch office in St. Louis

The managers of the Clayton and Forest Park electric railway promise to have cars running before Christmas over the entire line. Work is now actively in progress at various points on the route.

The Wichita Gas & Electric Light & Power company of Wichita, Kan., is having two steel boilers built in St. Louis. They are to be 70 inches in diameter, 18 feet long, with 70 4-inch tubes.

Ex-Governor E. O. Stanard's residence on Lindell avenue is being wired and furnished with fixtures for 150 incandescent lights.

Owing to the resignation of Manager H. H. Humphreys, some important changes have been made in the local office of the General Electric company. The office of manager has been abolished, and each department will report directly to the general western office at Chicago. W. L. Arnold will continue in charge of the department of electric lighting, while the electrical railway work will be handled by a special representative. The supply business will be in charge of two gentlemen from the Chicago office.

T. C. White & Co., dealers in electrical supplies and other specialties, report a large and increasing business. This has necessitated more room, and they have therefore moved to larger quarters, at 904 Pine street.

The supervisor of city lighting and the special committee of the Board of Public Improvements on the same subject have recommended the erection of 36 additional 2,000 candle power arc lights, most of them located in the extreme western and northern districts of the city. All arc lights for city use are furnished by the Municipal Electric Light & Power company on a ten-year contract expiring in 1900.

The Denver Tramway company has purchased of D. E. Garrison of St. Louis 800 tons of 48 pound steel rails with all necessary fastenings, etc. The Denver company operates 86 miles of track.

The St. Louis office of the General Electric company reports the sale of a 30 light arc plant to the Pinckneyville Electric Light company; also two incandescent dynamos to the State Insane Asylum at Fulton, Mo., and an incandescent plant complete to the Keller & Tamm Manufacturing company of St. Louis.

It is reported that a New York syndicate has been figuring on the purchase of all the street car lines in Alton, Ill., with a view of equipping them electrically, and operating them all from one plant. The same men propose furnishing electric lights.

Contracts have been made at Savannah, Mo., for an electric light plant of a capacity of 40 arc lights and 500 incandescents.

That portion of the city south of Osage street is lighted by gas under an old contract not yet expired. The Southern Electric Railway company has had a number of serious accidents on South Broadway, which are attributed largely to insufficient lighting, and it now propose to its their lines at its own expense. Fifty arc lights will be required. B.

Northwestern Notations.

MINNEAPOLIS, Sept. 30.—The sale of the electric light company's plant and franchises at Missoula, Mont., to the Thomson-Houston company for $75,000 is regarded as important for Missoula. The new company is expected to put in a large power plant two miles above the city, and the negotiations are practically completed for acquiring the tracks and franchise of the Missoula street railway. An electric line well equipped is contemplated.

The Cooper-Hampton Electric company of Minneapolis has been reorganized on a permanent basis, after an experimental organization dating back a year and a half. At its office in the Edison building it has been perfecting its machines and appliances and the Business Union has finally taken hold of the enterprise. The new company will have $500,000 capital, and will manufacture electric pumps. The pump has reciprocating pistons of ad

justable stroke and is valveless, it is asserted. The incorporators are leading business men including J. S. Pillsbury, John Martin, Charles H. Chadbourn, Charles H. Woods, Loren Fletcher, S. C. Gale, P. B. McMillan, Charles H. Maxcy, W. K. Morrison, Edward M. Johnson, J. M. Shaw, C. P. Lovell, F. C. Barrows, P. B. Winston, C. M. Loring, William Cooper, George P. Hampton, A. C. Paul, J. F. Cooklin and F. N. Walcott.

Paul Martin, of St. Paul, has secured a five years franchise for an electric light plant at Redwood Falls, Minn., the city having privilege of purchase at the end of that time. He has incorporated a company with $10,000 stock.

Steps have been taken looking toward putting in an electric light plant at Tracy, Minn., planned after that at Sleepy Eye.

The breaking of the trolley wire caused a miniature panic on Washington avenue, Minneapolis, the other night. The wire fell on top of the car and the passengers in their rush to leave the car were considerably bruised, but the current did not do injury to any one.

It is reported (unofficially, however) that Thomas Lowry has a scheme in process whereby the running time between Minneapolis and St. Paul may be reduced to 30 minutes.

John Mather, general manager of the Water, Light & Power company of West Superior, has resigned. He will go to Seattle, Wash., where with R. C. Elliott of St. Paul, he has secured a controlling interest in the Seattle Water, Gas & Electric Plant.

Dr. W. S. Townsend, who has been commissioned by the Bates Electric Conduit company of Minneapolis, to sell franchises in Michigan, Ohio and Indiana, reports that he is about closing up a deal at Detroit, Mich.

A score of handsome vestibuled cars for the interurban line are expected daily from the American Car company's works at St. Louis. They will be 34 feet long and closely resemble vestibuled railroad coaches.

John Murphy has resigned the position of general superintendent of the St. Paul & White Bear Electric railway.

Fire in the wire storage box at the main power house of the Minneapolis Street railway system caused a stoppage of cars all over town for a short time.

The electric light station at Northfield, Minn., has been located, and numerous improvements in the service are promised, including possibly a day circuit.

The new electric light plant at Pipestone, Minn., is about ready to be started up. That at Luverne, Minn., is also ready.

The new electric line from St. Cloud to Sauk Rapids is about ready to begin business.

It has been discovered that the Minneapolis city fathers forgot to appropriate the $3,000 required to put the police telephone and telegraph wires under ground, and postponement to next season may be necessary.

The city of St. Paul has had notice served upon it that suit will be brought by M. G. Crane for alleged infringement of the Gamewell fire alarm system.

Work has been commenced on the electric light at Kalispell, Mont.

August Johnson secured a verdict for $3,000 against the Northwestern Telephone company for injuries due to a pole falling on him. H. C. C.

Kansas City, Mo.

KANSAS CITY, Mo., Oct. 1.—The hopes of the Missouri and Kansas Telephone company were rudely shattered last week by the upper house of the city council, and those of the consolidated gas and electric lighting companies were jostled to an equally disagreeable extent by the same body. Some weeks ago, the telephone company submitted to the council a proposition to lay all its wires within the city limits in conduits provided the city would grant the company a franchise for thirty years. This proposition was referred to the committee on public improvements. The committee has submitted an adverse report, which was adopted. The committee, in its written report, exercised no consideration for the feelings of the gentlemen who guide the destinies of the telephone enterprise, as will be seen by reference to the following abstract:

After the full discussion of this subject last spring and the decisive action of the mayor, supported by the urgent remonstrances of our citizens, we think the action of the company in again applying for the franchise is, to say the least, offensive to good taste.

It would seem they desire to have a trial of endurance between the guardians of public rights and the harpies of public benefits. Such persistence needs rebuke. The company comes before the city offering a boon and in return they ask a thirty year franchise. What do they offer? It is to place their wires under ground. They screen the fact that the city now has the power to make them put their wires under ground, and can compel them to do it at any time. They have no favor to confer upon the city, and if they had, it is not favor but justice we want.

Some time ago, the gas company and the electric light company agreed upon a plan of consolidation, and an ordinance was presented to the city council to carry the scheme into effect. The ordinance also provided for granting to the consolidated company a thirty-year franchise, and embraced a plan by which, it was contended, the city would share, in a measure, in the profits of the concern. This project was also referred to the committee on public improvements of the upper house, and the committee submitted an adverse report, which was adopted by a unanimous vote of the members present. The committee not only opposed granting the consolidated company the franchise asked for, but also reported in favor of the city owning and operating its own system of lighting, under the direction of the board of public works. The committe, in its report, declared that a plant with a capacity of 200 arc lights could be built for $35 000. This was based on reports received from other cities. But everybody knows that city councils sometimes change their minds, and the telephone company and the gas and electric lighting companies may both be happy yet.

Westport, which recently became big enough to be incorporated as a city of an inferior class, adjoins Kansas City on its southern border. Before the war Westport was *the* town in this neck o'-woods, and Kansas City was a struggling river settlement known as Westport Landing. After the late unpleasantness Westport went to sleep, and it is only now beginning to show signs of recovery from its Rip Van Winkle stupor. A couple of years ago Kansas City took Westport into its municipal fold, and was preparing to begin a series of public improvements in the ancient village, when the supreme court of the state knocked out all these plans by declaring that, on account of a technical irregularity in the election at which Westport was voted in, Westport was not legally a part of the city at all. Westport accordingly lapsed back into Westport, but the people had had a taste of city life, and they decided that the good work of public improvement should go on. They were all the more willing to saddle the town with a big debt, because they knew that Kansas City would have to pay for it, for everybody knows that sooner or later Westport will again be a part of the city, and this time the extension will probably stand. Among other improvements, the public improvements committee of the Westport council has under consideration an ordinance to vote $50,000 in bonds for the construction of an electric light plant, to be owned and operated by the city. The council recently voted a franchise to B. T. Whipple and others for an electric street railway in Westport, and a Cleveland, O., syndicate has asked the Westport council for a 20-year franchise for an electric light plant. S.

Denver, Colo.

DENVER, Oct. 1.—The enterprising city of Denver, with its fine location, wide streets and handsome buildings, is always an object of great interest to an eastern man. It is specially interesting to any one identified with the electric business, for the 150,000 people here probably use more electricity in proportion than any other city of the same dimensions.

The entire city is lighted by electricity. Arc lights are suspended over the center of street intersections in the heart of the city; at every other intersection farther out and incandescent lights are used in the outskirts.

The Denver Consolidated Electric company holds a monopoly of the electric lighting in the city. This company has about 60,000 incandescent lights installed, and 1,600 arc lights.

In addition to this I understand that there are about 30,000 incandescent and 250 arc lights used in isolated plants in Denver.

I walked pretty thoroughly over the business district of Denver on a recent evening, and not ten per cent. of the places illuminated were using gas, and even in these at least one-half used electric light as well as gas. I understand that the incandescent light is used very generally for house illumination.

The writer exploited the Edison light from Chicago in its early history and was often assured by his gas friends that the time would never come when the incandescent light would ever interfere with gas. To see gas so effectually squelched in a place the size of Denver within twelve years from the start of electric lighting is certainly a great victory.

I am not quite sure that the incandescent success is well deserved. The candle power of the lights did not appear uniform to me; one was low. The trouble may be due to changes in the central station while new apparatus is being added, but overloaded machines are not conducive to permanent prosperity, and it never does to tempt the public to rise in its might with a demand for competition.

Denver has nearly one hundred miles of electric street railway. I rode on all the lines, and the service is very satisfactory. I also patronized the cable lines and heard many remarks by the citizens detrimental to them, and in favor of the electric roads.

Capt. H. H. Brown, so long identified with the Thomson-Houston interests in Denver, now has charge of the mining department of the General Electric company, in this territory. He reports that owing to the low price of silver, miners are avoiding new investments. The use of electricity in mines is extending, however, and a fair amount of business is being secured, with large transactions in expectation.

F. H. Whiting, at one time superintendent of the Des Moines Edison station and later identified with the Thomson-Houston Welding company, is now located in Denver, as mechanical and electrical engineer of the Westminster University. The University is being erected on a most charming and commanding location about six miles north of Denver. It is part of the plan to connect the university and Denver with an electric road, which will be operated at a speed of forty miles an hour.

The Commonwealth Mining company, which operates the Little Mattie mine and mill on Chicago creek, near Idaho Springs, has a 100 light Edison machine, which lights both mill and mine.

Phillip Mixsell, an old-time telegrapher, who built the Rocky Mountain Telegraph lines, which were afterward absorbed by the Western Union Telegraph company, resides in Idaho Springs, and is a successful miner and mill owner.

The U. P. R mine, located near here, is largely owned by D. H. Louderback, F. G. Beach, Prof. Jos. P. Barrett and the estate of E. G. Lynch. It is considered a very promising property, and shows that electrical people have an eye open for good things outside of their regular line of business.

The telephone interests here are in a languishing condition, owing to a feud between the citizens and the telephone company. It furnishes quite a contrast to the prosperous condition of the electric light interest.

G. H. B.

New England Notes.

BOSTON, MASS., Oct. 1.—The Eastern Electrical Supply company, Boston, has made an assignment to Ira C. Hersey. The liabilities are $19,000, and the assets at face value aggregate $22,000.

The Piscataquis pulp and paper mills of Enfield, Me., are to use electric lights hereafter. A 250-light Westinghouse plant has been contracted for.

Among the largest contracts for electric lights recently closed in Boston are the following: Lally & Collins, 200 incandescents and 31 arc lamps; L. G. McIntosh & Co., 61 incandescents; Bradley Fertilizer company, 68 incandescents; C. H. Carruth, 58 lights; S. A. Beckhardt, 67 incandescents; John Cuckson and the Suffolk county court house, 287 incandescents.

General Manager C. L. Edgar of the Edison Illuminating company of this city has returned from a western trip. He says the new Edison plant in Chicago is to be a fac simile of the new Boston plant.

Wm. Lee Church, head of the Boston office of Westinghouse, Church, Kerr & Co., is enjoying a month's visit to Colorado looking after mining interests.

An electric road is to be constructed through the famous and beautiful Middlesex Fells region. It will run from Somerville through Wellington, Malden, Medford, and Stoneham to Reading.

The Conic, N. H., Manufacturing company will light its big woolen mill with electricity, and electric motors will also soon be introduced. J. C. E.

PERSONAL.

Fred Reckenzaun, who has been in Chicago for some months, returned to New York on Friday last.

General Eckert of New York, general manager of the Western Union Telegraph company, was in Chicago last week.

T. A. Pamperin, general manager of the Electric Manufacturing company, Oconto, Wis., passed through Chicago on Friday last, returning from a short trip to New York and other eastern points.

On Monday Prof. J. P. Barrett left for Louisville to attend the national convention of firemen. Chief Barrett will talk to the firemen about the World's Fair and the advantages of holding the national convention in Chicago next year in connection with the exposition. He will afterward visit several eastern cities to confer with electrical men on World's Fair matters. From this time on Professor Barrett will devote more of his time to the depart-

ment of electricity at the World's Fair, and his assistant, David M. Hyland, will take charge of the city telegraph and lighting departments until the fair is over.

Charles D. Shain, formerly district manager in New York for the Edison General Electric company, has been appointed eastern manager of the Siemens & Halske Electric company of America. Mr. Shain's office will be in the Electrical Exchange building, New York, and his territory will include thirteen eastern states. The newly appointed manager is one of the best known and most popular men in the electrical business, and his acquaintance and experience will prove of great value to the new company.

NEW INCORPORATIONS.

Electric Manufacturing company, Portland, Me.; capital stock, $25,000; to manufacture and deal in electrical appliances; Drummond & Drummond, Portland, Me.

Nevada Electric company, Nevada, Iowa; capital stock, $18,000; to build, equip and operate an electric light and power plant; Nevada Electric company, Nevada, Ia.

Schuylkill Traction company, Ashland, Pa.; capital stock, $10,000; operating passenger railways by cable, electrical or other means, etc.; MacHenry Wilhelm, Ashland, Pa.

Marion Electric Light & Street Railway company, Marion, Ill.; capital stock, $20,000; electric lighting and street railway work in Marion, Ill.; Wm. H. Wardner, Marion, Ill.

Cooper Hampton Electric company, Minneapolis, Minn.; capital stock, $500,000; to manufacture electrical and other machinery and devices; Paul & Merwin, Temple Court, Minneapolis, Minn.

Standard Electric company of Clinton, Wis., Clinton, Wis.; capital stock, $20,000; to manufacture and sell electric lamps, dynamos, etc., and furnish electric light; L. Lusk, Antigo, Wis.

Paterson & Passaic Electric Railway company, Paterson, N. J.; capital stock, $40,000; constructing, maintaining and operating a street railway; Barkalow, Pennington & Beam, Paterson, N. J.

Pittston, Jenkins & Avoca Street Railway company, Pittston, Pa.; capital stock, $75,000; constructing and operating an electric railway in Luzerne county, Pa.; C. F. Bohan, Wilkesbarre, Pa.

Commercial Electric company, Indianapolis, Ind.; capital stock, $20,000; to manufacture, use, sell and erect all classes of electric machinery and instruments, also engineering works and power plants.

Dawson Electric Light & Power company, Dawson, Pa.; capital stock, $20,000; supplying light, heat and power by means of electricity to Dawson, Fayette county, Pa.; M. M. Cochran, Uniontown, Pa.

Passaic, Rutherford & Carlstadt Electric Railway company, Paterson, N. J.; capital stock, $185,000; constructing, maintaining and operating a street railway; Barkalow, Pennington & Beam, Paterson, N. J.

Jefferson Electric Light & Power company, Punxsutawney, Pa.; capital stock, $6,000; supplying light, heat and power or any of them by electricity to the public in Punxsutawney, Pa.; A. J. Truitt, Punxsutawney, Pa.

River Valley Electric Railway company, Seattle, Wash.; capital stock, $250,000; construction and operation of electric and other railroads, telegraph, telephone and electric light plants; C. E. Bowman, Seattle, Wash.

Trenton Light & Power company, Trenton, N. J.; capital stock, $760,000; manufacture, production, use, sale, supply and distribution of electric currents or electricity for electric light, heat and power, etc.; Wm. B. Allen, Trenton, N. J.

People's Street Railway company, of Nanticoke and Newperte, Nanticoke, Pa.; capital stock, $60,000; constructing and operating an electric railway in Nanticoke and other burroughs in Luzerne county; John M. Gorman, Wilkesbarre, Pa.

Citizen's Passenger Railway company, Pottstown, Pa.; capital stock, $75,000; constructing and operating an electric railway from Douglasville, Berks county, to Pottstown, Montgomery county; W. W. Carr, 518 Walnut street, Philadelphia, Pa.

Cleveland General E'ectric company, Cleveland, O.; capital stock, $25,000; manufacturing and selling electricity for power, heat and light, manufacturing and dealing in electrical and other machinery, etc.; Squire, Sanders & Dempsey, Cleveland, O.

North Shore Traction company, Camden, N. J.; capital stock, $6,000,000; to construct, maintain and operate motors, cables and other mechanical or electrical appliances for the purpose of supplying motive power to passenger railways; R. C. Dale, 135 South Fourth street, Philadelphia, Pa.

Covington Light & Power company, Covington, Ind.; capital stock, $50,000; to construct, maintain and operate an electric plant and supply the city of Covington and its inhabitants and the vicinity with electricity for purposes of heat, light and power, and for all purposes to which the use of electricity may be adapted; Pierre Gray, Indianapolis, Ind.

ELECTRIC LIGHTING.

Clinton, Wis., has a new electric light plant.

An electric light plant is being erected at Ely, Minn.

Boone, Ia., is to have a combined electric lighting and railway plant.

It is claimed that Main street, Memphis, Tenn., which has a center row of arc lamps, is the best lighted street in the country.

The village trustees of Batavia, N. Y., are considering a project for installing a plant for electric lighting, to be owned by the corporation.

The Board of Public Affairs of Little Rock, Ark., has asked the city council for $50,000 to enlarge and improve the city electric light plant.

The city council of Roanoke, Va., invites proposals until October 16th for lighting Roanoke with not less than 50 nor more than 100 arc lights of 2,000 candle power each. J. E. Hough is chairman of the light committee.

The town of Salem, Va, has just purchased the Salem electric light plant, franchise, real estate, etc., which cost a year ago $30,000, for $19,000, the company taking town bonds at par to run from ten to twenty years, at the option of the town, and bearing 6 per cent. interest.

The fine new courthouse at Geneva, Ill., was recently lighted for the dedicatory exercises by 250 incandescent lamps supplied with current from the municipal station at St. Charles, several miles away. The courthouse seems to be the principal feature of the village of Geneva, for it has neither a gas company nor an electric plant.

Workmen of the Indianapolis Light & Power company began setting poles on the arsenal grounds recently for the plant which is to furnish the city lighting. Maj. Varney ordered the work stopped. His command was ignored and he called out a squad of United States regulars, who hustled the workmen from the grounds. The district attorney will decide the dispute.

Bids for furnishing electric lighting apparatus for Galesburg, Ill., have been submitted to the city council. The proposals ranged from $5,550 to $7,566, exclusive of the VanDepoele plant now in use, and were received from the Western Electric company, Fort Wayne Electric company, Standard Electric company and General Electric company. The matter was referred to a special committee.

The Parkersburg, W. Va., Electric Light company is arranging for the erection of an addition to its plant which will give it double the space now occupied. When this building is completed, machinery sufficient to give 2,000 additional lights will be installed. It is also stated that a power plant will be put in with sufficient capacity to furnish power to the electric street railway, which is to take the place of the horse road now in operation.

The Mutual Light & Power company of Montgomery, Ala., has secured the contract for lighting that city for five years at $19,890 per annum. The detailed cost is as follows: Fifty 2,000 candle power lights at $9 per month, or $108 per year of 365 nights, $5,400; 150 1,200 candle power lamps, at $7.25 per month, or $87 per year of 365 nights, $13,050; 150 incandescent lamps at eighty cents per lamp per month, or $960 per year of 365 nights, $1,440.

The Wilmington, N. C., Electric Light company is enlarging and extending its plant. The main building has been enlarged by the addition of a brick building 40x37 feet. This will give a building 100x37 feet, besides a commodious boiler room adjoining on the west. The new building has been erected for the purpose of enlarging the plant by the addition of another engine of 150 horse power and two dynamos, one with a capacity of fifty arc lights and the other for 1,000 incandescent lights.

Pending the erection of its large new station on the West Side, the Chicago Edison company has found it necessary to make an addition to its plant at the Adams street station. It has rented a space forty feet square in the basement of the old Rand-McNally building, at No 146 Monroe street, which is directly in the rear of the old station. In this space it will instal two 500 horse power engines and four 3,000 light Edison dynamos. The present boilers are sufficient, with the addition of one more, to furnish the steam required.

The question whether the city of Fort Dodge, Ia., should own an electric lighting plant has finally been decided in the negative. The question has been discussed for over a year and assumed many complicated phases. The city council has at last settled it for the present by granting the Thomson-Houston company a five years' contract for lighting the streets with arc lights, to burn from dusk to daylight, at the rate of $75 per lamp per year. The company is granted a 25 years' non-exclusive franchise. It has now dissolved the injunction preventing the city from taking its poles off the streets and will voluntarily remove them to the alleys.

ELECTRIC RAILWAYS.

A new power house will soon be built by the Ashland, Wis., Electric Railway company.

It is stated that the street railway of Corpus Christi, Tex., will be operated by electricity.

The Ashland and Cattletsburg, Ky., electric railway will be completed and in operation by December 1st.

The petition of P. O. Saunders, W. A. Bowen, and A. A. Gray, for authority to build an electric railway at San Antonio, Tex., has been granted. The gentlemen named will organize as the Mission Electric Street Car company, and intend constructing six miles of road.

The Capital Railway & Lighting company, of Baton Rouge, La., has been chartered to purchase the plants of the Baton Rouge street railway and the Citizens' Electric Light & Power company, and operate them. B. R. Mayer is president; O. B. Stelle, vice-president, and W. J. Knox, secretary and treasurer; capital stock, $150,000. Considerable new machinery will be put in the two plants.

The new power house of the West End railway at Pittsburg, is to be a three-story brick and iron structure 75x160 feet, with a brick boiler house in the rear, 35x80 feet. It is already being built on West Carson street. The first two stories are to be of brick, and the third of iron, insuring a fire-proof building. The builder ss the Schultz Bridge and Iron company, and it is to cost $30,000.

A motion was made in a special term of the supreme court at Rochester, N. Y., recently, to substitute the Central Trust company of New York as trustee of the mortgage against the Seneca Electric railway company. The road extends from Waterloo to Seneca Falls, N. Y., and a mortgage of $40,000 was made to the American Loan & Trust company, as trustee. The latter company became insolvent, and consequently this motion was made.

The equipment of the elevated electric road at Armour & Co 's establishment, Chicago, illustrated in the last issue of the WESTERN ELECTRICIAN, will shortly be increased. F. B. Badt, manager of the mining department of the General Electric company, who closed the contract for the original equipment, last week received an order for an additional locomotive. The new locomotive will be of an improved type and will be built under the supervision of E. C. Noe of the engineering department of the General Electric company.

Mather & Platt, of Salford, England, have recently constructed a heavy electric locomotive for use at some large iron works at Sweden. This locomotive is designed to work with an electromotive force of about 300 volts, and in external appearance is similar to those on the City and South London railway. The motors are of the double armature type, and are connected to the axles through 10 to 1 spur gearing. An overhead wire, 16 feet from the rails, furnishes the current, the collectors consisting of an iron bar at each end of the locomotive, carried on upright pipe pillars.

TELEPHONE.

A metallic circuit will be put up between Nebraska City, Neb., and Omaha, to replace the grounded circuit now in use, and a new line will also be built to Lincoln.

Fifty telephones are being placed in the great Tampa Bay, Fla., hotel. These useful instruments facilitate matters when guests under the same roof, but separated a quarter of a mile, wish to talk to one another.

A fire was caused in the telephone tower in Utica, N. Y., on the morning of September 26th by a telephone wire coming in contact with a trolley wire. A heavy wind broke a "dead" wire, which fell across the two and made a short circuit. As a result the cables, carrying about 1,100 connections, were burned or broken, and all the telephones in the city were rendered temporarily useless. The damage is not large, as the fire was discovered in time to prevent the flames from communicating with the switchboard or the building.

TELEGRAPH.

The Western Union company is considering the project of erecting a new building in Chicago. Several sites are under consideration.

A committee of operators and the officers of the Missouri Pacific Railroad company are conferring in relation to a new schedule of wages.

The strike of the telegraph operators on the Burlington, Cedar Rapids and Northern railway has not been settled, although such a report has been circulated. Chief Ramsay declares the railway company started the report. The company claims that the road is getting in better shape every day.

ELECTRIC MINING.

The organization for furnishing electric power for the mines of the Nevada and Grass Valley districts, California, is getting into shape, capital having been secured to carry through the enterprise, and the work will be commenced in a short time. The site of a dam on the South Yuba has been selected at a point about two miles above the Purdon bridge. The survey for this structure will be commenced in a few days. The location will be at a point where the river narrows, and will be upon a rock foundation, making a secure footing for a dam which cannot be carried away by any flood that may come into the river. When the dam is secured the canal will be commenced. This will be four miles in length. From the end of the canal the water will be dropped 380 feet to the bank of the river, where the dynamo plant will be set up, and from which the electric power will be transmitted. It is the expectation that the works will be completed and the electric power be ready for the use of the mines at an early date next spring.

MISCELLANEOUS.

John R. Fletcher has brought suit in the United States Circuit Court at Chicago against the Knapp Electrical Works, through his attorney, Francis W. Parker. Mr. Fletcher alleges that the defendants have manufactured and sold a pulley for arc lamps that is an infringement on a similar device invented and patented by him. Barton & Brown are the defendants' attorneys.

Supt. E. L. Bugbee of Washington, who has charge of the weather bureau telegraph service, visited Alpena, Mich., recently, looking over the ground preparatory to putting in cables lines to Thunder Bay and Middle Island life saving stations. The line to Thunder Bay Island will be over the land from the city to Troden's landing above North Point, a cable being laid from this point running north of Sugar Island to the north end of Thunder Bay

Island. Supt. Bugbee will recommend that telephones be used instead of telegraphic instruments. Also that the lines terminate in the weather bureau office, and that an arrangement be made by which connection may be made with the islands through the telephone exchange from any telephone. Supt. Bugbee estimates that the lines will be running in two months. The establishment of these lines will be a great benefit to the lake marine, as the storm signals will be displayed from the life saving stations on each island from the weather bureau. A large number of the vessels on the lakes pass within sight of Thunder Bay island every trip, and the display of storm signals both night and day will prevent many accidents. In case of wrecks, tugs can be secured much more promptly than formerly.

TRADE NEWS.

H. S. Kaliskie, treasurer of the Beacon Vacuum Pump company of Boston was in New York last week.

The Wilder Fire Alarm and Burglar Alarm company of Kansas City, is placing 500 messenger boxes in that city.

The Wilder Duplex Burglar Alarm and Messenger company of New York, is putting in a burglar alarm and messenger system, at Wichita, Kan.

Alfred F. Moore, of Philadelphia, reports an unusual demand for insulated wire and cables; to meet this rush of business the factory is being operated overtime.

"The Champion" is the name of a new dry battery which will be placed on the market next month by C. J. Hirlimann, of New York. Business in this line is beginning to pick up.

Baker & Co., of Newark, N. J., the well known platinum and gold refiners, report an increase of 50 per cent. over the preceding year in the use of platinum for electrical purposes.

The Safety Electrical Co., of Newark, N. J., is busy manufacturing small motors for battery and incandescent circuits. The company is also supplying the trade with its electric bells and other novelties.

W. E. Stow, well known to the electrical trade through his connection as New York representative of the *Electrical Engineer*, has accepted a position as electrical engineer for the Mather Electric company, with office at 97 Nassau street, New York.

F. G. Ross, New York agent for the Eddy Electric Manufacturing company, is sending out some very quaint but pointed postal cards calling attention to the apparatus of this well known company. He reports the outlook in his territory as being unusually good.

The C. McIntire company of Newark, N. J., is obliged to work overtime in response to the many large orders it has now on hand for the well known McIntire connectors. Last month this company shipped 26 000 of these connectors to the Bell Telephone company of Belgium.

General Manager C. E. Stump of the Novelty Electric company, Philadelphia, has received a very complimentary notice from Wm. McDevitt, inspector of the Philadelphia underwriters, regarding the company's new mica insulation which is used as a preventive against leakage of gas and fire This concern is filling large orders for this valuable article.

The Eddy Electric Manufacturing company of Windsor, Conn., is sending to the trade quite an odd little pamphlet entitled "The Chances Are." On each page in the upper left hand corner in a square are the words "The Chances Are," and in the lower right hand corner in the same sized space, the words "Eddy Electric Motor," the reading matter coming in between. The Eddy company has representatives in a number of the large cities throughout the country, and is kept busy making shipments.

During the last week the Electrical Supply company, Chicago, has given the public an interesting object lesson in electricity, as applied to household uses, by means of various appliances known as the Carpenter electric heaters. Crowds have gazed at the novel sight of a Chinese laundry, operated by three almond-eyed celestials, without the aid of that hitherto indispensable adjunct, the stove, the heat for these different operations being obtained from the same source as that used to light the building. The Chinamen were at first skeptical, if not a little superstitious, and were afraid to handle the irons that "just gettee hot flom no placee." But after it was explained how the heat came through the wires, and how comfortable they could be without a redhot stove for a neighbor, they considered them "much good, velly nice," and consented, for a consideration, to exhibit them for the Electrical Supply company. It will be no little glory to these antipodal sons of Confucius to hand down the fact that they were the first Chinamen to use electricity for cooking and ironing. They boiled rice, brewed tea, and ironed collars and cuffs, seeming to enjoy the novelty of the occasion fully as much as did the hundreds who gazed in upon them. Next week, in the same window, the Electrical Supply company will have a model kitchen, in which the cooks will be pretty young ladies, who will bake cookies, and pies and bread, and have flour dusted over their dimpled arms in a most bewitching way.

BUSINESS.

The Acme Storage Battery company of New York, is about to begin a test of its apparatus upon the Ninth avenue line. From the few trial trips made this battery gives promise of doing good work.

The H. W. Johns Manufacturing company of New York will be represented at the coming convention by the manager of its electrical department, W. F. D. Crane, who will make a large display of mica appliances for street line work.

F. L. DeRonde, of the Standard Paint company of New York, is receiving congratulations from his numerous friends for a large export order recently taken for P. & B. insulating compound which was given after this material had been subjected to a number of severe tests.

F. P. Little & Co. of Buffalo, N. Y., have closed a contract for equipping the Buffalo Furnace company's establishment with 31 arc and 250 incandescent lamps, furnishing one 50 horse power 9x16 Rice automatic engine, and one 30,000 watt Thomson Houston dynamo. This firm has also closed a contract for equipping the residence of George V. Foreman of Buffalo with a complete outfit of bells, speaking tubes, electric gas lighting fixtures and incandescent electric light wiring.

The manufacture of Day's Kerite insulated wires and cables for so many years carried on by A. G. Day and later by S. A. Day, has passed into the hands of W. R. Brixey. For fourteen years, Mr. Brixey was superintendent of a factory under A. G. Day. After the death of Mr. Day, he was given full control of the manufacturing of the different materials by S. A. Day, and later the management of the business, both manufacturing and selling. His experience, therefore, places him in a position to be fully competent to meet the demands of a trade requiring wires with a first-class insulation. The practical experience gained through his close connection in manufacturing cables, places Mr. Brixey to the front, thus enabling him to judge of the best manner of laying and covering both aerial and submarine cables for all manner of electrical purposes.

"Arc Lighting on Constant Potential Circuits" is the name of a very handsomely illustrated pamphlet, exquisite in every detail, coming from the press of Bartlett & Co, and now being distributed by the Electric Construction and Supply company of New York, to its many patrons and friends, The contents of this pamphlet are divided into ten chapters, treating upon the development and growth of the Ward arc lamp, and the evolution of the electric light. The ornamental Ward lamps are given considerable space and the company calls attention to the Ward street railway and alternating current lamps, also to those for photo-engraving, theatrical, stereopticon and ophthalmoscopic uses. The Ward search lights are constructed in three different sizes, the smaller size being used on small craft, especially steam yachts. The next size, known as the large Ward search light, is used principally for a bow or side light, and is of service when going into harbor, locating a buoy, landmark, ships, or following a crooked channel, etc. This lamp is placed upon the pilot house with shaft extending into the interior from whence it is operated. The largest size is of the special type for ocean steamers, the cylinder being made of extra heavy iron or brass, with copper trimmings. As it is waterproof, it can stand exposure to all kinds of weather. Mention is also made of the company's well known resistance coils which have met with such rapid sale since they were placed on the market, The memorandum of the cost of using the Ward arc and search lamps will be of interest to all those contemplating a purchase of this character. Under the heading of a few letters from customers, there is printed correspondence from leading firms in nearly every branch of business, letters from the telegraph departments of the larger railroads of the country being especially noticeable. The growth of the Electric Construction and Supply company has in many respects been phenomenal, having the advantage of apparatus perfected in detail. Promoted by General Manager R. B. Corey, a gentleman of large experience and wide reputation, it is very easy to predict the continued success of this prosperous company.

ELECTRICAL PATENTS.

Issued Sept. 27, 1892.

483,124. Electric Heater. Thomas Ahearn, Ottawa, Canada.

483,151. Time Stamp. Samuel H. Hoggson, St. Louis, Mo.

483,162. Automatic Coin Actuated Telephone. Franz Mueller, Berlin, Germany. Patented in Germany, March 30, 1891; in Switzerland, May 4, 1891, and in Italy, June 30, 1891.

483,168. Method of Measuring the Strength of Magnets. Charles H. Rudd, Evanston, Ill.

The method consists in balancing the magnetic field of the magnet by a counter magnetic field generated by an electric current, measuring the current, and comparing the value of the current with the current required to balance a standard magnet.

483,175. Test System for Multiple Switch-boards. Charles E. Scribner, Chicago, Ill.

One limb of a telephone is permanently connected with the springs of the switches of the line, and the other limb with the frames or test pieces of the same switches, the limbs being connected together at the central office by a wire including a condenser and an individual annunciator.

483,189 Electric Meter. Addison G. Waterhouse, Hartford, Conn.

The meter consists of a vessel adapted to hold a fluid electrolyte, and is provided with electrodes, a gas collector over the same, and a float placed within the gas collector and provided with connections, through which the movement of the float is imparted to a recording mechanism.

483,204. Electric Locomotive. Norman C. Bassett, Lynn, Mass.

The locomotive embodies a motor having its armature concentric with one of its axles, and having a field magnet with a single coil embracing the armature, a hollow shaft for the armature through which passes the axle, a yielding connection between the shaft and the wheel, and a yielding support for the motor from the frame of the locomotive.

483,231. Circuit Closer for Railroad Crossing Signal Mechanisms. Irvin W. Loy and Richard O'Toole, Mechanicstown, Md.

A track bar is located by the side of the railroad track with a lever pivot near it, one end of which protrudes beneath the track bar while the other operates a spring controlled fly wheel adapted when released to close an electric circuit through a bell or other signaling device.

483,235. Electric Cut Out and Switch Box. Llewellyn D. McMunn, Cromwell, N. D.

483,272. Means for Controlling the Operation of Mechanisms. Henry E. Vineing, Roseville, N. J.

483,285. Electric Cable. Theodore Guilleaume, Cologne, Germany.

A strip of non-conducting material is twisted about its own axis to form spiral grooves or air channels, in which the conductors may lie.

483 308. Watchman's Electric Time Recorder. Nelson H. Raymond, Buffalo, N. Y.

483,309. Electric Bell. Nelson H. Raymond, Buffalo, N. Y.

The bell is provided with a porcelain base, the electro-magnet being attached to a frame seated in a recess in the front of the base.

483,310. Electrical Annunciator. Nelson H. Raymond, Buffalo, N. Y.

483,316. Electric Snap Switch. Seth F. Alden, New Bedford, Mass.

483,327. Coupling for Underground Wires. John J. Purcel, Washington, D. C.

483,339. Thermostat. Ira F. Beers and Frederic C. Beers, Elmira, N. Y.

483 376. Electric Railway System. Andrew L. Riker, New York, N. Y.

The conductor is inclosed by a hollow rail of magnetic material, and rests normally on an insulated portion of the interior of the rail; magnets carried upon the vehicle are adapted to attract the conductor into electrical contact with the rails, and the current is collected from the rail by brushes carried upon the vehicle.

483,388. Trolley Track Hanger for Electric Railways. William Q Prewitt, Lexington, Ky.

The hanger is composed of two clamping members provided with an underlying flexible support, the members having a channel between their adjacent edges to receive the track.

483,423. Process of Electric Welding. Charles L. Coffin, Detroit, Mich.

The process consists in first heating the articles to be welded by passing an electric current through them, then up-setting each an appreciable distance back of the place of welding and not at the plane of junction, then pressing the articles together to form a weld, and finally completing the weld by hammering.

483,424. Electric Metal Working Device. Charles L. Coffin, Detroit, Mich.

The device consists of a clamp for holding the article to be worked and carrying a die, a movable conductor for applying pressure to the article to be worked when heated, and means for passing a heating current through the article.

483,425. Process of Electric Metal Welding. Charles L. Coffin, Detroit, Mich.

The process is adapted for filling a seam in a plate with molten metal, and consists in connecting the plate with one pole of a source of electricity, supporting over the seam a plate of metal with which the seam is to be filled at an angle with the first plate connecting the last named plate with the other pole of the electric generator and forming a voltaic arc between the plates.

483,426. Process of Electric Metal Heating. Charles L. Coffin, Detroit, Mich.

The process is adapted for electrically heating metal of varying cross sections, and consists in simultaneously subjecting the metal at different points to the action of separate voltaic arcs, whose heating powers vary in approximate proportion to the respective cross sections of the material at the points at which the arcs are applied.

483,427. Electric Metal Working. Charles L. Coffin, Detroit, Mich.

The process is used for electrically welding the ends of a continuous piece of metal, and consists in closing a gap in the secondary of a transformer or converter by the ends of the piece to be welded, the piece of metal lying parallel at all points to the secondary, passing suitable currents through the primary of the transformer, and pressing the ends of the piece together when raised to a welding heat.

483 428. Process of Electric Metal Working. Charles L. Coffin, Detroit, Mich.

The method consists in subjecting the opposite sides of the metal simultaneously to the action of voltaic arcs alternated in position.

483,431. Electric Motor. William M. Dresskell, Brainerd, Minn.

The motor consists of a cylindrical casing, a field magnet formed of circular segments having the cores and pole pieces with enlarged extremities formed integrally with the segments, the segments being provided with inwardly projecting ears for receiving one of the clamping bolts, a clamping ring for holding the circular segments in position, and insulation interposed between the clamping rings and the cylindrical casing.

483,494. Electric Railway Conductor. Rudolph M. Hunter, Philadelphia, Pa.

Claim 1 follows:
A suspended conductor arranged above a railway track and supported wholly from above, a source of electric energy supplying electricity to said conductor and railway track, a traveling car, a motor on said car to propel it, an upwardly extending arm projecting above the roof of the car, a grooved wheel journaled on the free end of the arm and running against the under side of the conductor, and a motor circuit including the motor, for conveying current from the conductor and returning it to the rails.

483,506. Test System for Multiple Switch-boards. Oro A. Bell, New York, N. Y.

A telephone line is combined with spring jacks having two line springs and two back contacts, one line spring and its back contact of each spring jack being included in each side of the line circuit and test pieces upon each spring jack are connected to the line circuit between the different back contacts of the last jack of the series; whereby the test pieces are disconnected from the line circuit when a plug is inserted into any jack.

WANTED.

By an experienced salesman, a position to travel. Has had eight years' experience in selling electrical apparatus. Good references. Address "E. M. F." care WESTERN ELECTRICIAN.

FOR SALE.

One 220 Volt, 150 Ampere Generator,
One 220 Volt, 200 Ampere Generator,

In perfect condition, suitable for power circuit or incandescent lighting. For sale at a big bargain.

A. L. IDE & SON, Springfield, Ill.

FOR SALE.

100 H. P. Ide Engine, 13x18, with 5-inch shaft 14 feet long, with four large driving pulleys and bearings.

Send for list of other good second-hand engines, including Reynolds, Corliss, Armington & Sims, Rice, Westinghouse, and other "Best" makes taken in exchange for Ideals, used a short time, in perfect order, and for sale at half price.

A. L. IDE & SON, Springfield, Ill.

WANTED.

Man to calibrate electrical instruments; one having some knowledge of drafting preferred.

Chicago Electric Mfg. Co.,
73 W. Jackson St., Chicago.

THE "CLARK" WIRE.

Insulation Guaranteed wherever used, Aerial, Underground or Submarine.

In a letter from the Inspector of the Boston Fire Underwriters' Union, under date of March 29, 1886, he says: "A thoroughly reliable and desirable Wire in every respect."

The rubber used in insulating our wires and cables is especially chemically prepared, and is guaranteed to be waterproof, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather and is not affected by heat. The insulation is protected from mechanical injury by one or more braids, and the whole slicked with Clark's Patent Compound, and special extra finish, which we have now adopted for all our solid wires as an extra weatherproof protection, and also preventing chafing and abrasion, which is water, acid, and to a very great extent fireproof. Our insulation will prove durable when all others fail. We are prepared to furnish Single Wires of all gauges and diameter of insulation for Telegraph and Electric Lights from stock. Cables made to order. We are now prepared to furnish our Clark Wire with a white ontside finish for ceiling cleat work as well as our standard color.

Clark Joint Gum should be used for making waterproof joints. This is put up in half-pound boxes, in strips about one foot long and five-eighths inch wide, and when wrapped about a joint and pressed firmly it makes a solid mass. **FOR RAILWAY and MOTOR** use, we make all sizes of stranded and flexible with Clark insulation.

WE GUARANTEE OUR INSULATION WHEREVER USED, AERIAL, UNDERGROUND OR SUBMARINE, and our net prices are as low, if not lower than any other first-class Insulated Wire. We shall be pleased to mail Catalogues with terms and discounts for quantities.

EASTERN ELECTRIC CABLE CO.,

61 to 65 Hampshire Street, BOSTON, MASS.

HENRY A. CLARK, Treasurer and Gen'l Manager.
HERBERT H. EUSTIS, President and Electrician.

A LONG FELT WANT SUPPLIED.

WRITE FOR PRICES AND SAMPLES OF

"Crescent" Overhead Line Wire. It will Surprise You.

THE CRESCENT INSULATED WIRE & CABLE CO.,

MANUFACTURERS OF ALL KINDS OF

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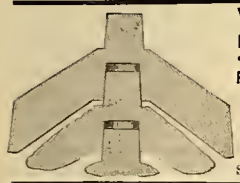
Write for Prices. Samples Free.



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Zinc
For Gravity Batteries.

G. d'Infreville,
Sole Patentee, Owner and Manufacturer,
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124 Mitchell St., Providence, R. I.

Battery Motors a Specialty.

FOUR REGULAR SIZES.

Suitable for running Sewing Machines, Dental Drills, Jewelers' Lathes and all kinds of light machinery.

No. 1, 2 Volts, 1 32 h. p., $3.00.
No. 2, 4 Volts, 1-16 h. p., $5.00.
No. 3 6 Volts, 1-12 h. p., $10 00.
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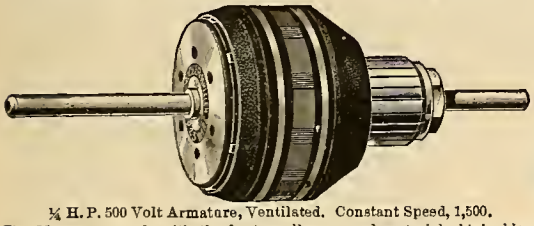
Send for Circular. Every Motor Guaranteed.

CROCKER-WHEELER ELECTRIC COMPANY,



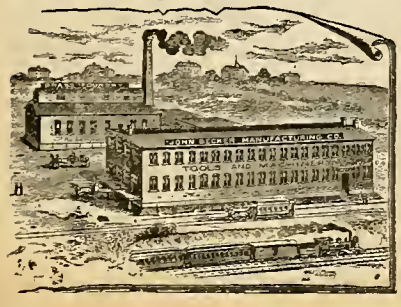
SLOW SPEED MOTORS.

¼ H. P. 500 Volt Armature, Ventilated. Constant Speed, 1,500.

The Motors are made with the best appliances and material obtainable, and embody every improvement of merit, with the intention that they shall be the Standard of their class.

430 West 14th Street. - - - - - NEW YORK.

THE BECKER VERTICAL MILLER, No. 3.



A Perfect Milling Machine.

For the various operations of milling with lace mills IT HAS NO EQUAL.

Well adapted for use in electrical machine shops.

Send for Circular.

JOHN BECKER MAN'F'G CO.,
FITCHBURG, MASS.

SEALED PROPOSALS.

BOARD OF PUBLIC WORKS,
MUSKEGON, MICH., September 15, 1892.

Bids will be received at this office until 6 o'clock p. m. Monday, October 17, 1892, for lighting the streets of the city of Muskegon with Electric Arc Lights. Proposals to be made on a basis of a 1,200 to 2,000 candle power light, and not less than 150 lights. Proposals should be made both for 365 nights a year, or moonlight nights excepted. Contract is to be made for a term of five years. Each bidder will be required to deposit a certified check of five hundred dollars. The right is reserved to reject any and all bids. All communications and proposals should be addressed to the office of the Board of Public Works.

JAMES GOW President
Board of Public Works.
J. KUPPENHEIMER, Secretary.

Second-Hand Dynamos

FOR SALE CHEAP.

We have a number of Dynamos and Motors nearly new, which we will sell at a low price, among the number being **two 650-light, 1,000 volt Alternators.**

WANTED TO BUY:
Second-hand machine, from 50 to 200 lights, 110 volt.

G. A. HARTER,
43 and 45 Franklin St., CHICAGO.

SAL AMMONIAC

(ELECTRIC BRAND)

For Electrical Purposes

Guaranteed 98/99% and free of lead and iron. If you want the best quality ask your dealer for this brand. Imported by

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FOR DIRECT CURRENTS.

"Magnetic Vane"

AMMETERS and VOLTMETERS.

The best switch-board instruments for constant use.

Adapted for central stations, isolated plants and marine installations. Give them a trial and you will not regret it.

Ask for descriptive circular No. 330.

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ESTABLISHED IN 1861.

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WHOLESALE AND RETAIL DEALER IN

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COMBINATION

GAS AND ELECTRIC FIXTURES.

ELECTRIC AND GAS GLOBES,

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171 E. ADAMS STREET,

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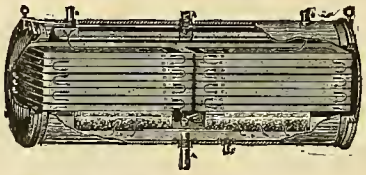
Stilwell's Patent Live Steam-Feed Water Purifier.



Removes all Impurities.

Entirely prevents SCALE in Steam Boilers. Catalogue on application.

STILWELL & BIERCE MFG. CO.,
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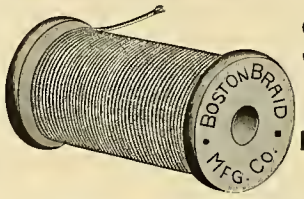

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For Incandescent Lamp Filaments.

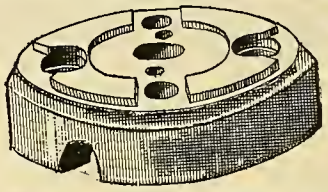
The greatest care taken in producing a uniform article. Samples and prices mailed free.

BOSTON BRAID MFG. CO.,
27 Beach Street, Boston, Mass.

Non-Conductive Blocks, Rosettes and Bases for Cut-Outs and Switches.

Also Insulators, Cleats, Lamp Trimmings and other Electrical Supplies.

Our production is a dense body. The glazing and body of our ware are of same composition, and are baked alike, which are the features of True Hard Porcelain.



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Consultations, Reports, Plans, Specifications for Central Station or Isolated Electric Lighting, and Electric Railways.
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A New Model Folding Kodak with the Barker Frictionless Shutter, automatic counter on roll holder and glass plate attachment.

$55 and $65.

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Bare and Insulated Wire.

Underwriters' Copper Electric Light Line Wire, Copper Magnet Wire, Flexible Silk, Cotton and Worsted Cords for Incandescent Lighting. Round and Flat Copper Bars for Station Work. Insulated Iron Pressure Wire.

TRADE MARK "K.K."

PATENT "K. K." LINE WIRE

TRADE MARK "K.K."

For Electric Light, Electric Railways, Motors, Telegraph and Telephone Use.

Agents for the Washington Carbon Company. Carbons for Arc Lighting.

THE GREAT WESTERN ELECTRIC SUPPLY COMPANY, CHICAGO, - - SELLING AGENTS.

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ELECTRIC LIGHT AND BATTERY CARBONS.

THE NATIONAL CARBON CO.

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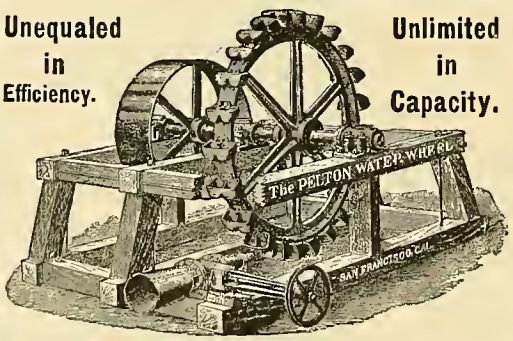
MOTOR BRUSHES.

THE PELTON WATER WHEEL

Gives the Highest Efficiency of any Wheel in the World. Over 2,000 in use.

Unequaled in Efficiency.



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Affords the most simple and reliable power for all mining and manufacturing machinery. Adapted to heads running from 20 up to 2,000 or more feet. From 20 to 30 per cent. better results guaranteed than can be produced from any other Wheel in the country.

ELECTRIC TRANSMISSION.

The advantages the Pelton Wheel affords in the way of a uniform and reliable power, close regulation and the facility of adaptation to varying conditions of speed and pressure, have brought it into special prominence and extensive use for this class of work. All applications should state amount and head of water power required, and for what purpose, with approximate length of pipe line. SEND FOR CATALOGUE.

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143 LIBERTY STREET, - - NEW YORK.

☞ It having come to our notice that our patent rights are being infringed upon, intending purchasers are hereby warned that all such infringements will be duly prosecuted.

PELTON WATER MOTORS. Varying from the fraction of 1 to 15 and 20 horse power, unequaled for all light running machinery. Warranted to develop a given amount of power with one-half the water required by any other. ☞ Send for Motor Circular. Address as above. Deliveries made from San Francisco or New York, as may afford the most favorable freight rates.

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Speaking Tube, Battery, Patterson Cable,
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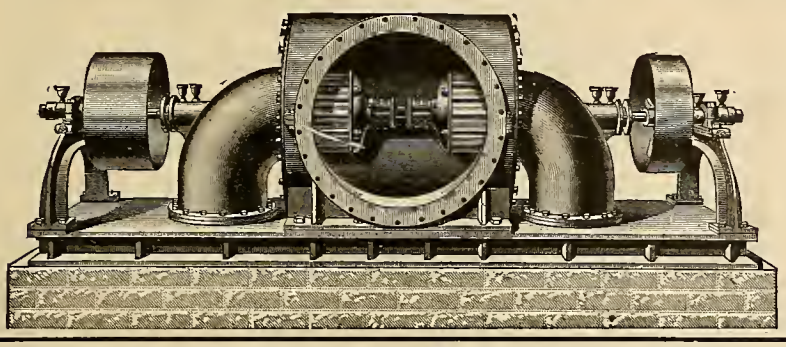
VICTOR TURBINE WATER WHEEL.



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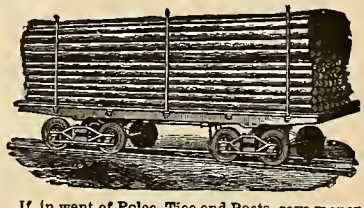

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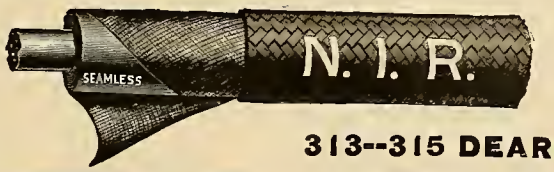

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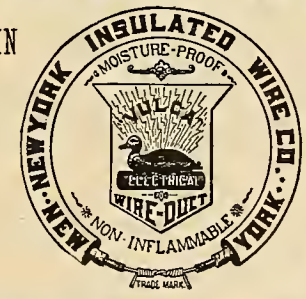

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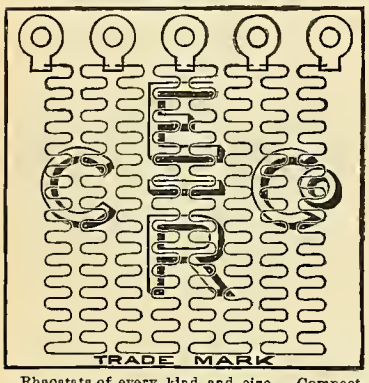

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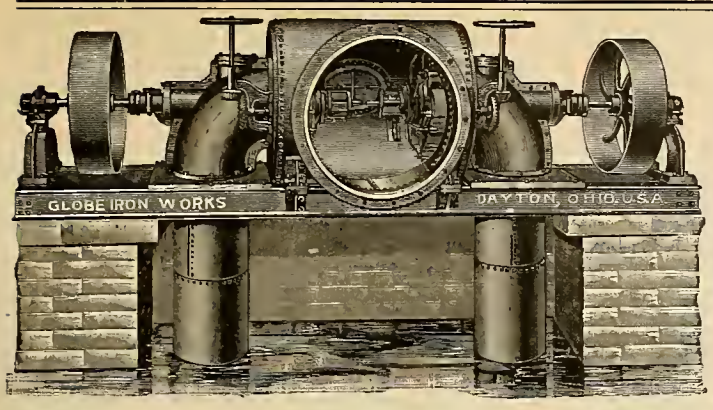

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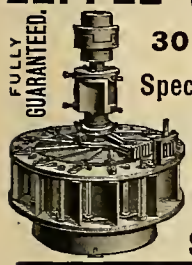

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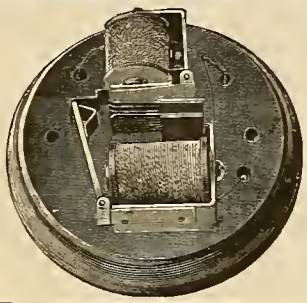

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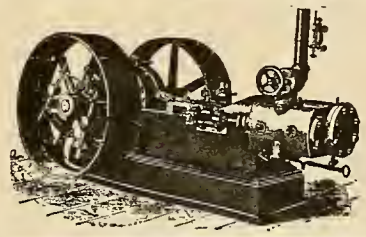

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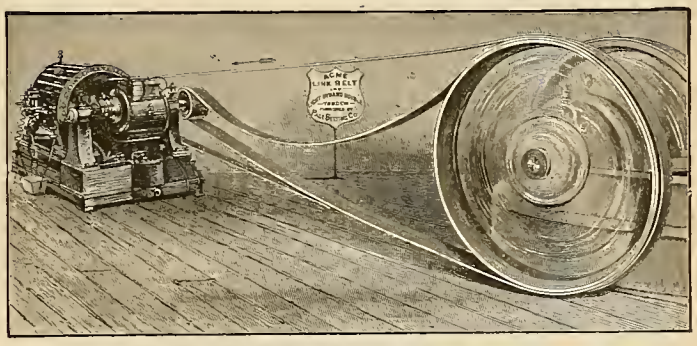

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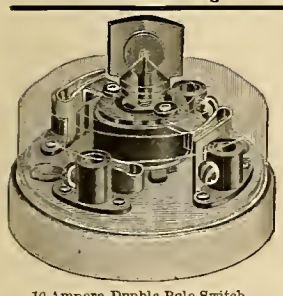

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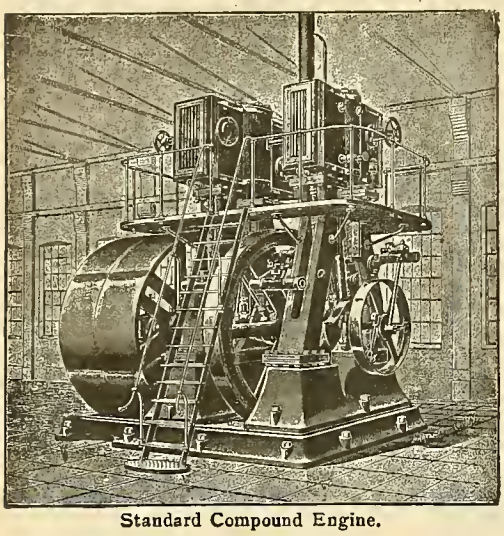

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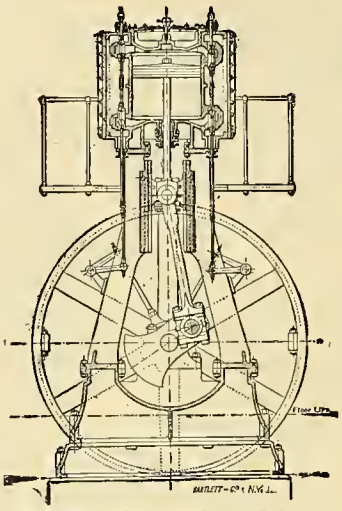

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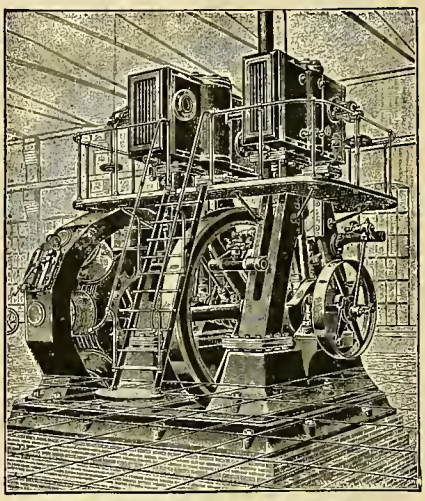

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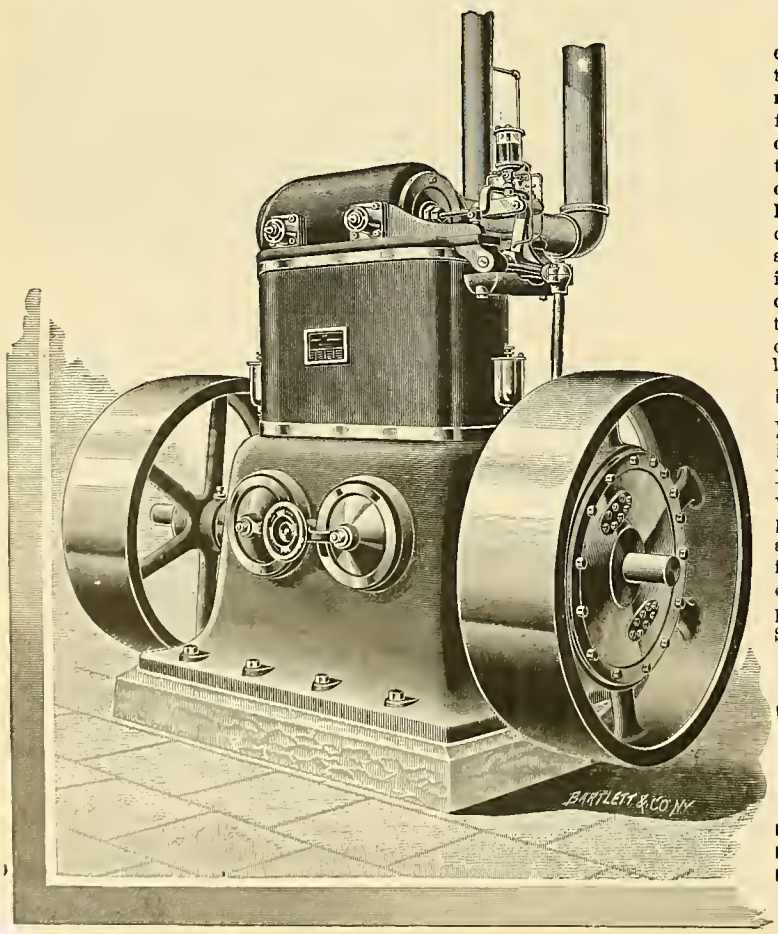

The Compound Engine, when non-condensing, so far from possessing an economy superior to the Simple Engine, has been decisively proven, "much to the disgust of the stockholder," to show normal economy only at or about its rated power, and to fall off in economy faster than a Simple Engine as the load falls off; moreover, very much faster under the extreme light loads that are common in Electrical Generation. This point is at last reluctantly admitted by the more candid builders of such engines, most of whom now advise against compounding for variable loads. The reason is in their inability to divide the load and range of temperature proportionately and automatically between the cylinders at all points of cut-off. Hence, the low-pressure cylinder expands its steam below atmosphere under a moderately early cut-off, thus converting itself into an Air Pump, and becoming a load upon the high-pressure cylinder instead of a co-laborer with it. This point was distinctly foreseen by the designers of the Westinghouse Compound Engine, and an entirely new principle was worked out, making expansion below atmosphere impossible under any load, however light. **For the first time in the history of Steam Engineering, either Simple or Compound, is built an Engine which maintains essentially uniform economy, irrespective of load,** and hence for the first time the Compound Non-condensing Engine has been made practicable. The results, demonstrated by test, show that where an ordinary Compound will range from 25 lbs. to 70 lbs. water per H. P per hour from full to quarter load, the Westinghouse Compound, between the same limits, will range from 23 lbs. to 29 lbs. We have not deceived ourselves in this matter, and propose that the facts shall be understood. To those interested in the nicer points involved, we will be pleased to send a reprint of the paper read by Mr. F. M. Rites on this subject at the late meeting of the American Society of Mechanical Engineers, at San Francisco.

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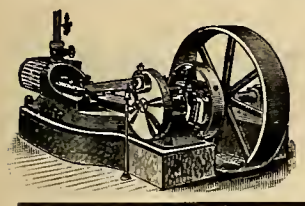

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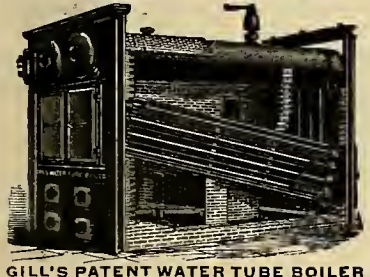

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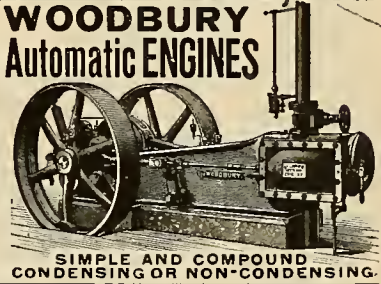

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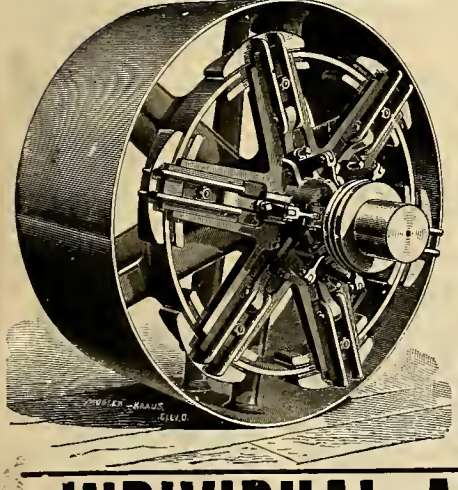

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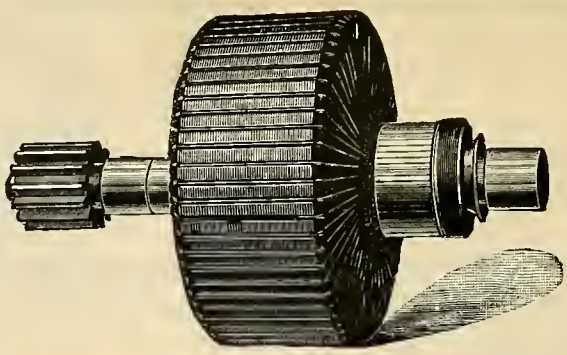

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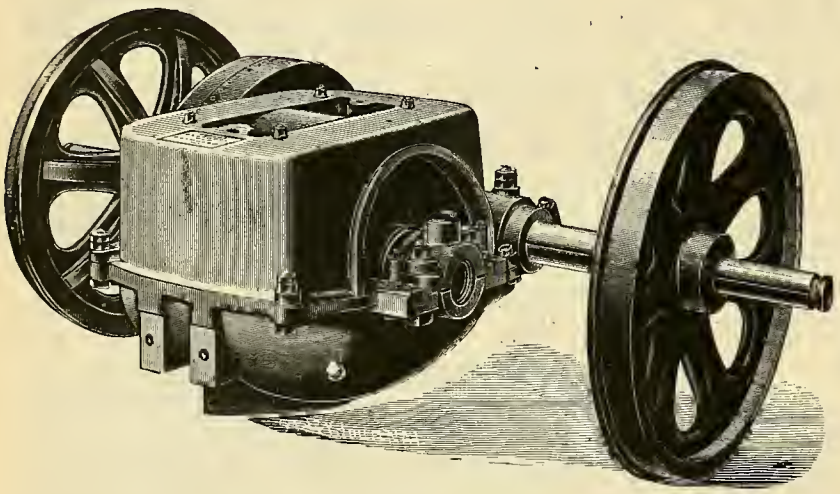

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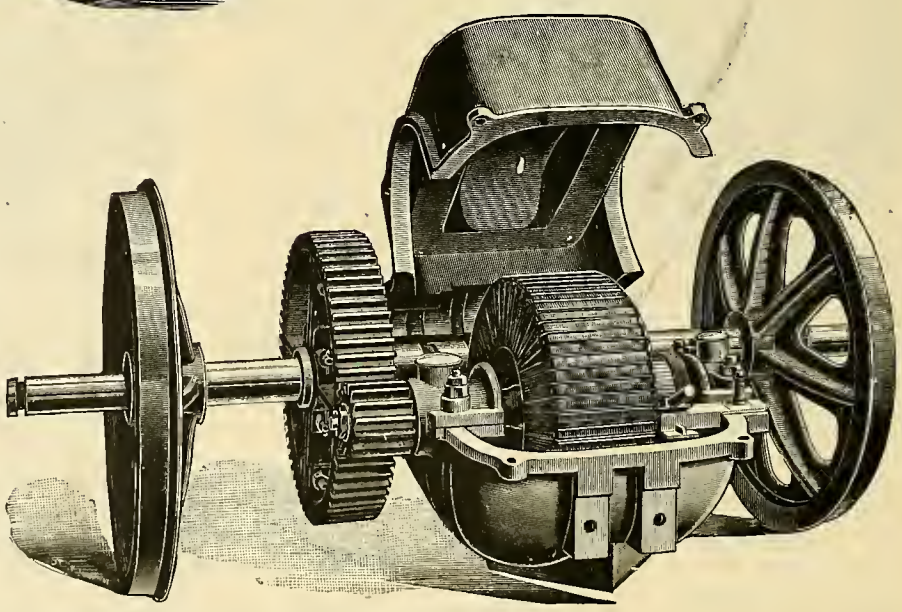

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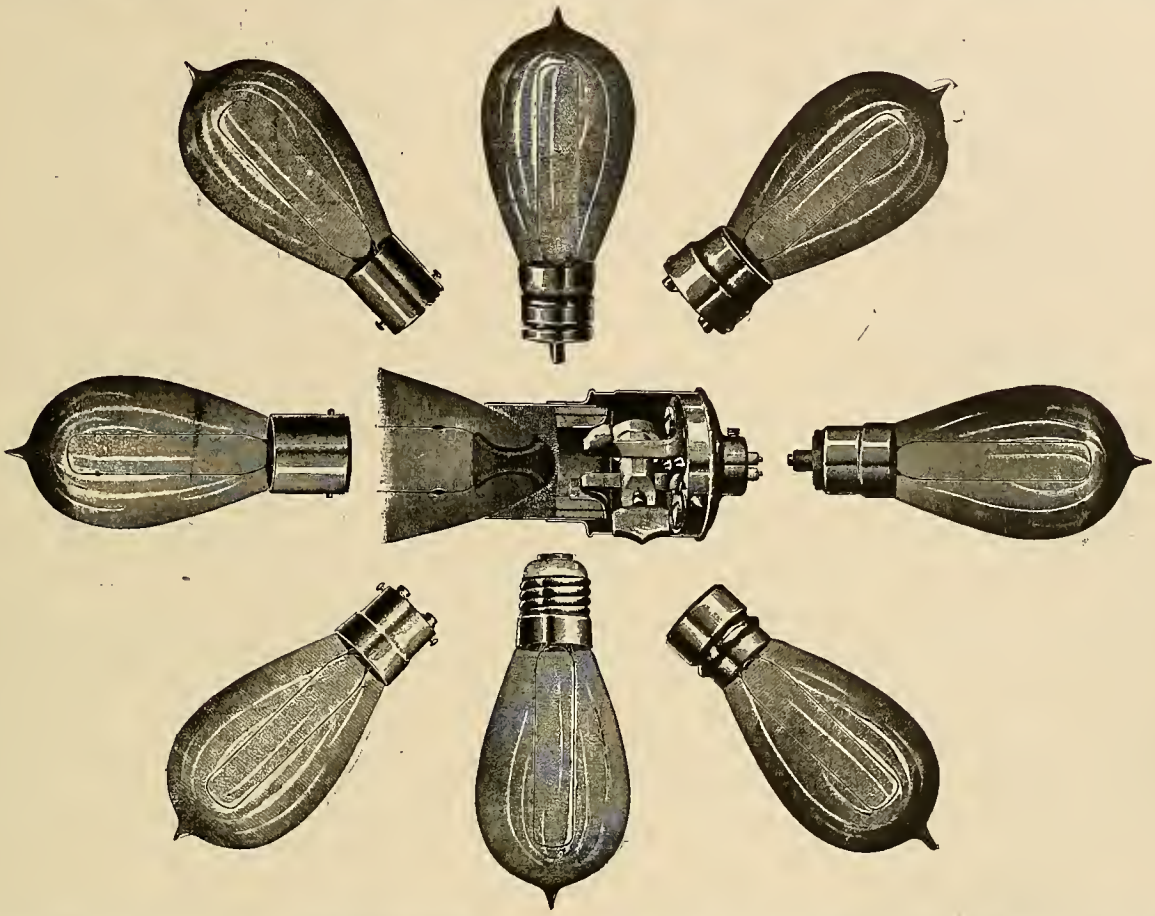

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Corner Randolph Street and Michigan Avenue,

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ANSONIA, CONN.

CRYSTALLIZED GINGER.

Now that the heated term of the political season draws near, the Funny Column does not think it inappropriate to repeat the following jokes of other days: as, for example this one of Horace Greeley, who was a candidate for President in 1872.

"Mr. Greeley was an extreme temperance leader, as pure as cool water, even in his blunders, but as much out of place as a Democratic nominee as Bishop Simpson in the Vatican. After he agreed to stand for that high office, the Southern politicians called on him at Chappaqua, his country-seat on the Harlem road, and he benevolently asked them to drink from his famous spring. They were surprised but submissive, until he offered them a second draught, at which Colonel Carter, of Virginia, somewhat testily declined, with the remark that that was a beverage he never internally applied. The legend runs that when the party left the white-haired editor, the Colonel sadly observed that *he had to drink several cocktails to keep the nomination down.*"

The Clergy used to run to politics very like their taste for "slumming" now, and manifested their likes and dislikes as distinctly as they could without calling names.

Father Taylor, the seamen's preacher of Boston, was, in his day, more outspoken. It is related that during an excited contest, he thus wrestled with the Lord in prayer:

"O Lord! give us good men to rule over us—pure men who fear Thee, religious men, temperate men, men whom we can trust, men who—Pshaw! O Lord! what's the use of veering and hauling and boxing round the compass?—give us George N. Briggs for Governor. Amen." And the prayer was answered.

Who has not heard of Tom Marshall's wit? Once when he was making a political speech in the open air from a platform, a fellow, quite tipsy, elbowed his way to the front of the platform below, looked up and, with thickened utterance, said to the speaker:

"I knowsh you Misher Marshall; you're nushin but—but a dema gogue!'

"That's all right," said Marshall. "If you had a wisp of straw around *your* neck, we couldn't tell you from a *demijohn*."

The following while not exactly of a political complexion is a good satire upon the custom that prevails in some of the states of bestowing a military title upon any person who can establish the remotest claim to it.

Some time ago I had the following conversation with a Virginian "colonel"—an elderly gentleman, belonging, of course, to one of the first families. He was a man of great intelligence, of a very jovial turn, and had withal such a keen sense of humor that he enjoyed a joke none the less because it happened to be at his own expense. I said to him:

"Colonel, did you see much service during the war?"

"Oh no; I was not in the army at all. I had passed the military age before the war began."

"Ah! then you served in 1812?"

"No, Sir; that time it was just the other way—I was too young then."

"I suppose then, you were a colonel of volunteers in the Mexican War?"

"You are wrong again, Sir. I never was in Mexico."

"Oh, I see now how it is—you were a militia colonel during the piping times of peace?"

"No, Sir; I never served in the militia."

"Well, then, will you please tell me how on earth you got your title of colonel?"

"Why, that's very easily explained. You see, there used to be, before the war, a law imposing a fine for not attending the militia musters. And they made me a colonel *on account of my promptness in paying the fine.*"

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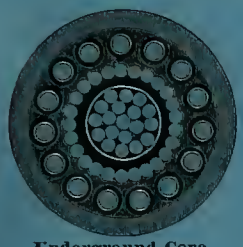
Underground Core.

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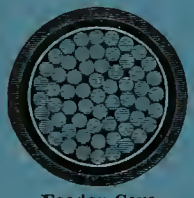
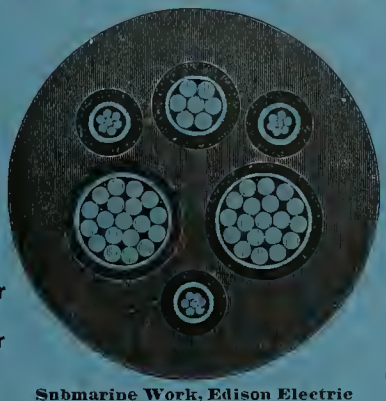

Feeder Core, Broadway Theater.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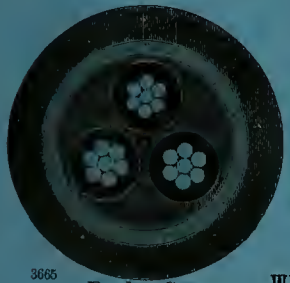
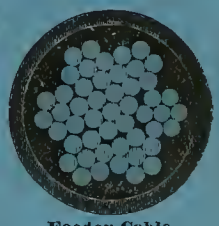

3665 Feeder Core.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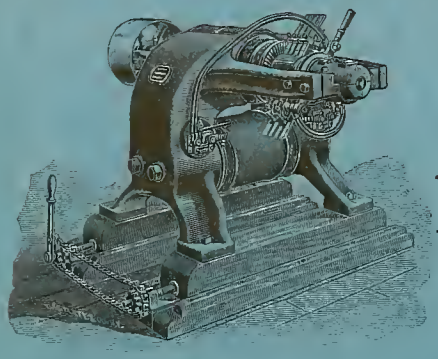

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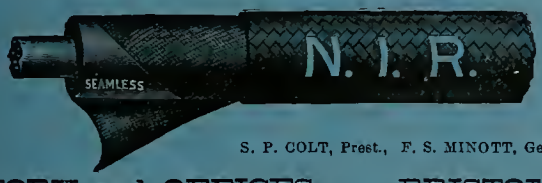

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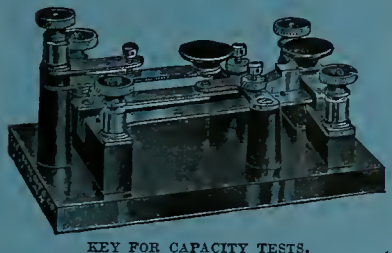

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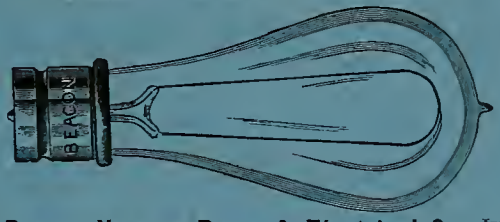

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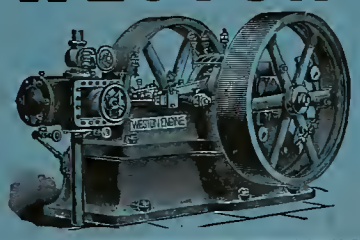

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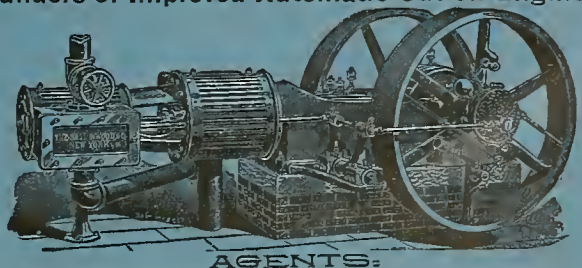

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INDEX AND CLASSIFICATION OF ADVERTISEMENTS.

ALPHABETICAL LIST.

American Battery Co..... ix
American Desk & Seating Co.. xiii
American Electrical Mfg. Co..——
American Engine Co..... xii
Andrews & Co., A. H..... xiii
Babcock & Wilcox Co., The.... i
Baggot, E..... xiv
Ball Engine Co..... xxi
Ball & Wood Co., The i
Beacon Vacuum Pump & Elec. Co.i
Becker Mfg. Co., John.....——
Beggs, J. E., Mch. & Supply Co. x
Bernstein Electric Co..... iv, xiii
Blanchard, Albert... xxi
Boston Braid Mfg. Co..... xxi
Bowers Bros..... xix
Bridgeport Mach. Tool Wks.. xii
Brookfield, Wm..... ... xii
Brush Electric Co xix
Bryan, W. H.. xiv
Bryant Electric Co.....——
Buckeye Electric Co , The..... ix
Carpenter Enamel Rheostat Co. xix
Central Electric Co..... ... v
Chicago Rawhide Mfg. Co..... vi
Columbia Inc. Lamp Co..... i
Crescent Ins. Wire & Cable Co. xiii
Crocker-Wheeler Elect ic Co.. xiii
Cushing, F. W..... vii
Cutter, Geo ....——
Cutter Electrical & Mfg. Co... vi
Dayton Globe Iron Works Co..xvii
Densmore Typewriter Co.....——
Detroit Electrical Works..... xxvi
Diamond Electric Mfg. Co....——
d'Infreville, G..... xiii
Dixon Crucible Co., Jos..... xv
Dudley & Co., W. W..... xix
Duplex Electric Co., Ltd..... xii
Eastern Electric Cable Co..... xiii
Eastman Kodak Co..... xiv
Electric Appliance Co..... xii
Electric Cons. & Supply Co... vi
Electric Engr'g & Supply Co..xvi
Electrical Mfg. Co , The xv
Electric Secret Service Co..... xxi
Electrician Pub Co..... xvi, xx
Electrical Construction Co. The. xii
Electrical Eng & Supply Co.The. v
Electrical Supply Co., The ...xxiv
Elektron Mfg. Co.....——
Empire China Works... xiv
Enterprise Electric Co..... xv
Falls Rivet & Machine Co..... ix
Ferracute Machine Co.....——
For Sale Advertisements x, xii, xiii
Fort Wayne Electric Co.....——
General Electric Co ..... ii, xxii
Great Western Elec. Supply Co..ix
Greeley & Co., The E. S.....l
Hart & Hegeman Mfg. Co.....——
Heisler Electric Co..... iv
Hill Clutch Works.....——
Hine Eliminator Co.... xii
Holmes, Booth & Haydens.... xiv
Hood & Co., Wm.... xv
Hughes Bros. Mfg Co..... xiii
Ide & Son, A. L xiii
Illinois Electric Lamp Co..... x
India Rubber & G. P. Ins. Co. xxv
Institute of Technology..... xiii
Interior Conduit & Insulation Co. x
International Okonite Co..... i
Jewell Belting Co..... i
Johns Mfg. Co., H. W.....——
Kartavert Mfg. Co..... xix
Klipstein, A..... xiii
Knapp Electrical Works..... xxiii
Lake, J H. & D., Co .....——
Lake Erie Engineering Works...vi
Lane & Bodley Co..... xxi
La Roche Electric Works..... xix
Lasell & Co., Edw..... xv
Leclanche Battery Co., The .. x
Lefmann, Julius xv
Leffel, & Co., Jas xvii
Link Belt Machinery Co..... xv
Loud, H. M. & Sons Lumber Co. xiv
Mather Electric Co iv
Midland Electrical Wks.....——
Moore, Alfred F..... i
Morse & Co., A. M..... .. xii
Mosher Electric Co..... viii
Munsell & Co., Eugene..... xii
National Carbon Co..... xiv
National Electric Mfg. Co.... v
National India Rubber Co.... i
New York Insulated Wire Co. xv
N. Y. Safety Steam Power Co. xxi
New York & Ohio Co..... i
Otto Gas Engine Works..... x
Ostrander & Co., W. R..... xiv
Page Belting Co.....——
Partrick & Carter Co.....——
Pearson & Co., W. B..... vi
Pelton Water Wheel Co..... xiv
Penn. Electric Engineering Co. x
Perkins Elec. Switch Mfg. Co.——
Phoenix Glass Co.....——
Porter-Leavitt Elec. Motor Co.——
Proposals for Elec. Ltg..... xiii
Queen & Co..... xiii
Racine Hardware Mfg. Co..... xii
Railway Equipment Co..... ix
Redding Electric Co..... xvii
Riee Electric Specialty Co..... x
Roebling's Sons Co., J. A ix
Rose Elec. Light Supply Co...——
Samson Cordage Works. xii
Sawyer-Man Electric Co..... xviii
Schuyler Electric Co..... iv
Sechrist, Albert..... xvii
Shawmut Fuse Wire Co..... x
Shultz Belting Co..... xvi
Siebert, G..... xii
Siemens & Halske Electric Co —
Sioux City Elec. Supply Co... xxi
Sioux City Engine Works.... xxi
Smith, A. T..... xvi
Smith, Thos. G. Jr..... xxi
Somoff, J. L..... xxi
Sperry Elec. Mining Mach. Co. xix
Standard Electric Co..... xxvi
Standard Paint Co x
Stanley Electric Mfg. Co.....——
Stearns Mfg. Co..... xxi
Steuben Lamp Works..... xiii
Sterling, W. C..... xv
Stilwell & Bierce Mfg. Co. xiv, xv
Sunbeam Incand. Lamp Co... xxv
Taylor Engine Co..... xvi
Union Hardware Co..... xiii
Utica Elec. Mfg. & Supply Co. x
Van Nuis C. S.....——
Vulcanized Fibre Co..... xv
Waddell-Entz Company..... xii
Wannopee Pottery Co..... x
Want Advertisements .....——
Washburn & Moen Mfg. Co..
Western Electric Co..... xiv
Westinghouse, Church, Kerr & Co..... xvii
Westinghouse Elec. and Mfg Co..... xi, xviii
Weston Engine Co..... i
Woodhouse & Rawson. Ltd....——
Worthington, Henry R.....——

CLASSIFIED LIST.

Annunciators.
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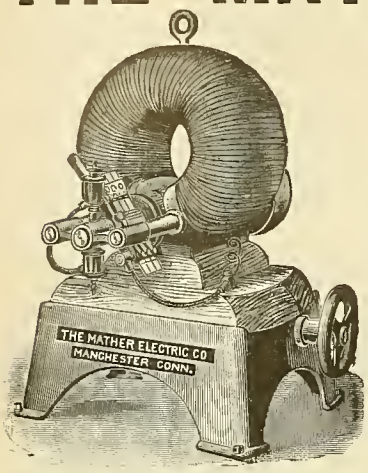

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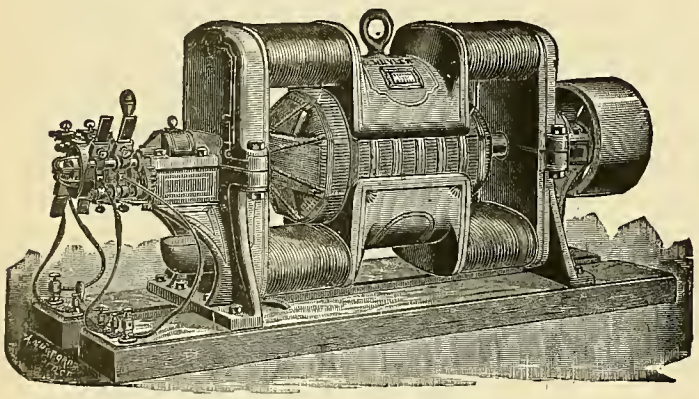

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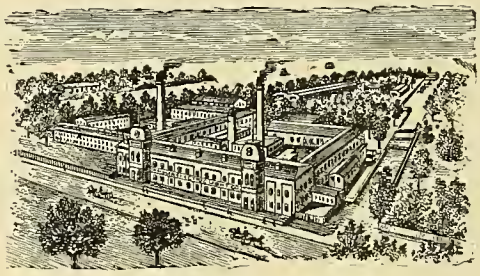

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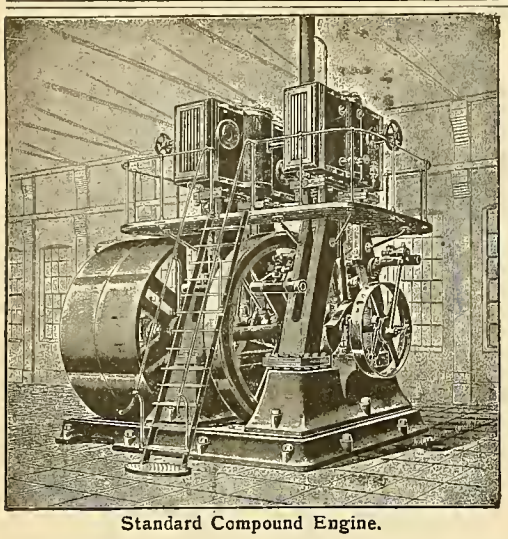

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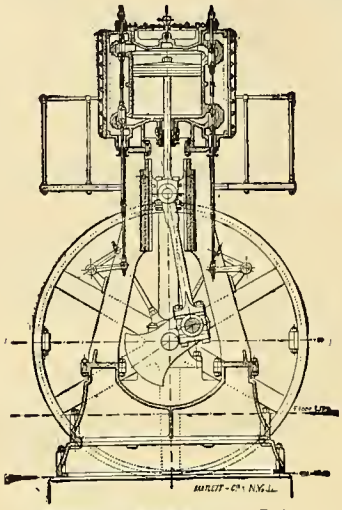

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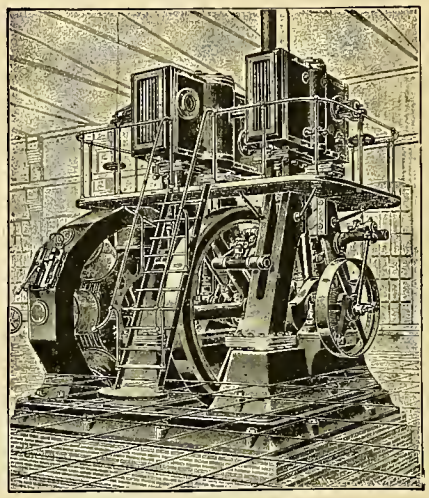

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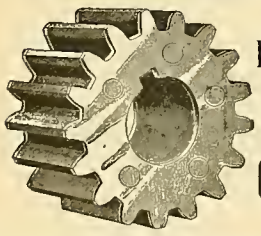

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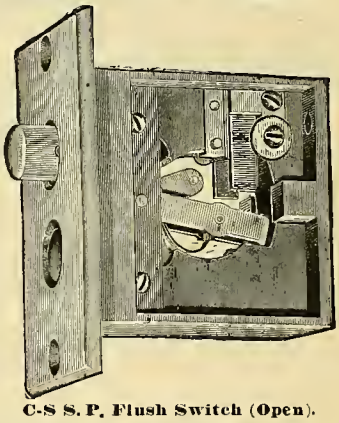

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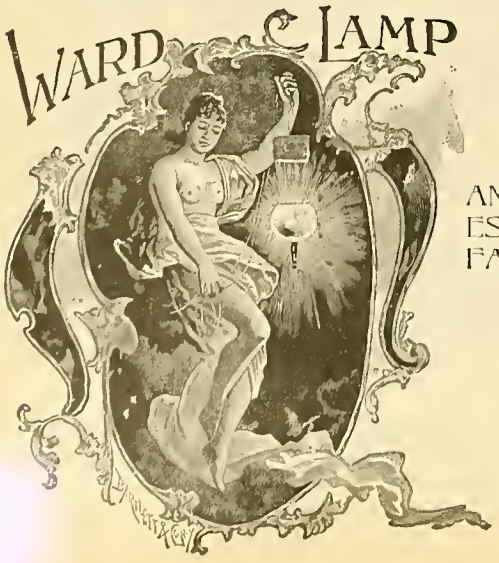

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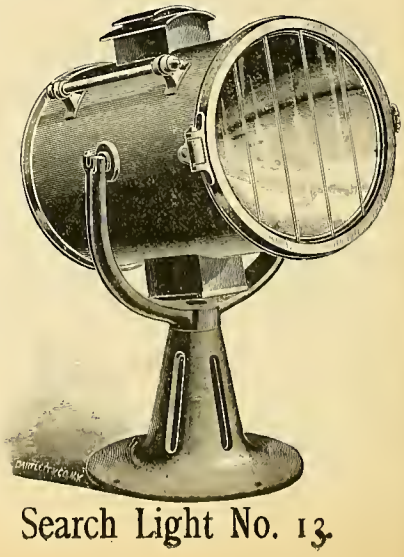

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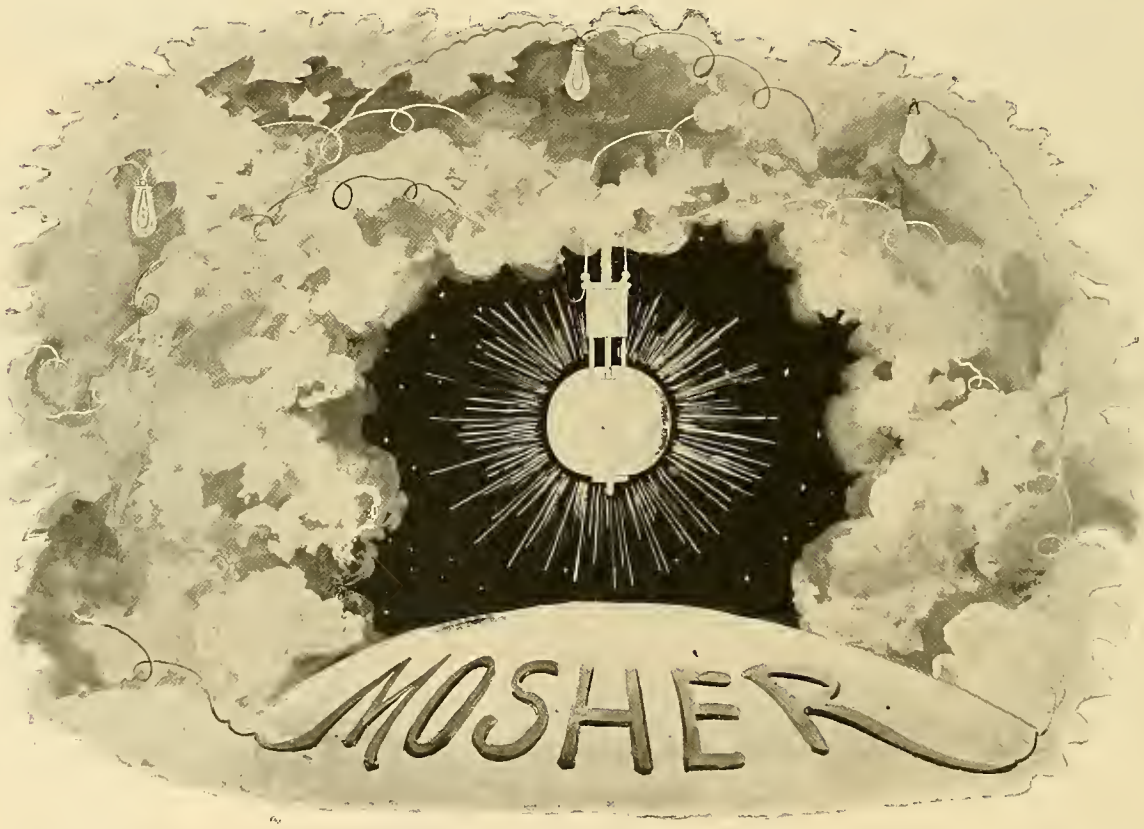

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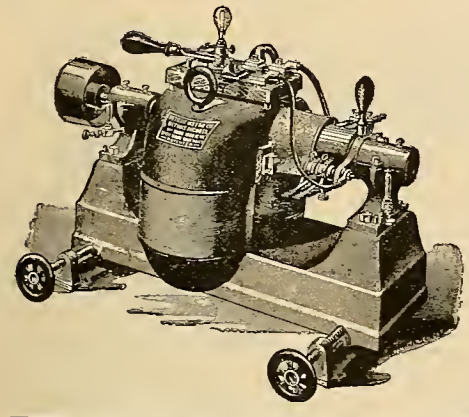

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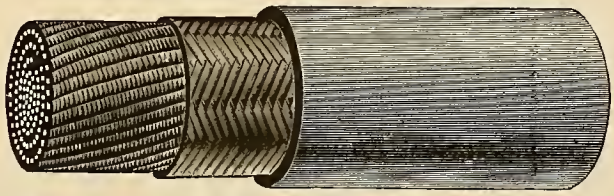

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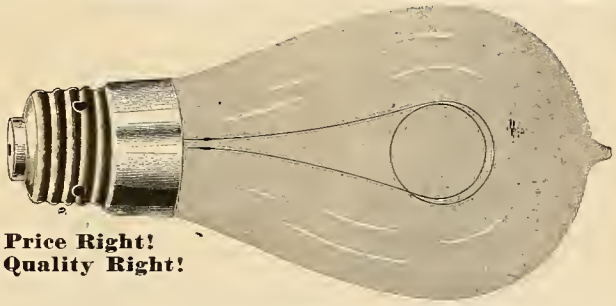

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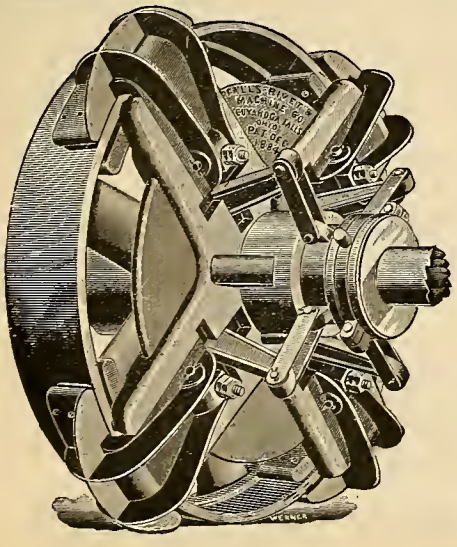

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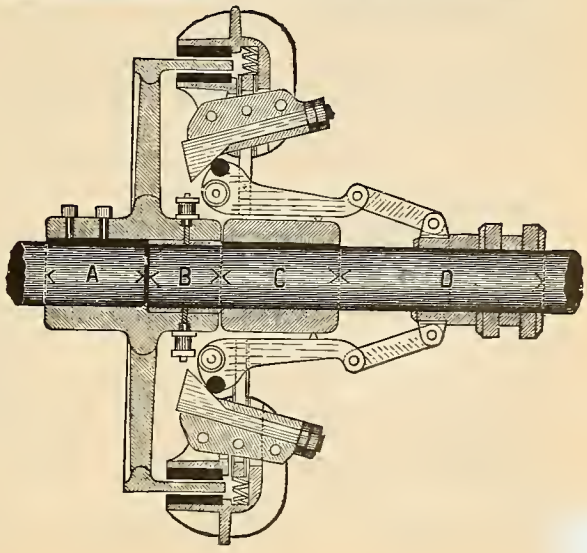

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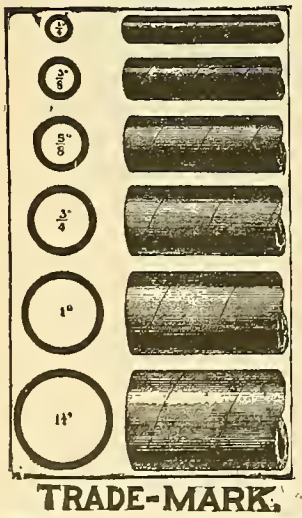

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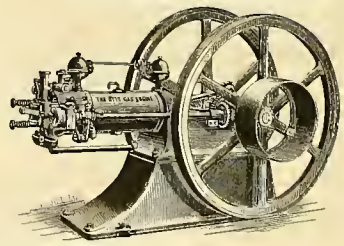

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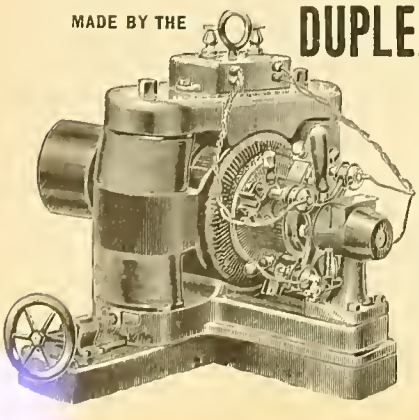

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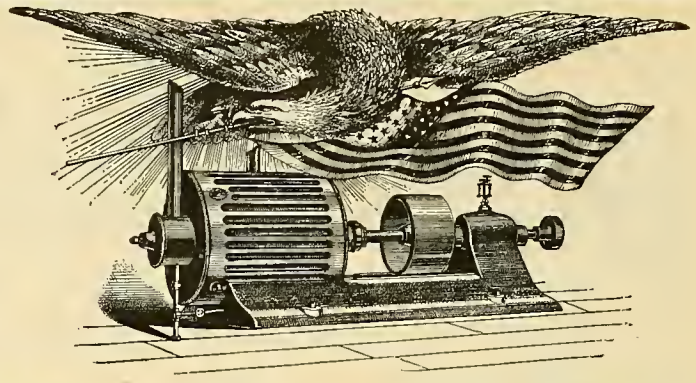

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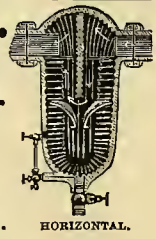

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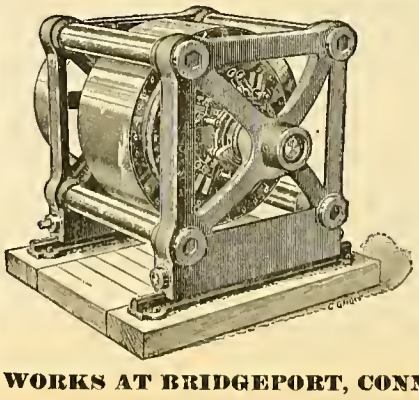

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Vol. XI. CHICAGO, OCTOBER 15, 1892. No. 16

Preparation for Electrically Utilizing the Power of Niagara.

No project of greater interest or importance to the electricians of the country is now engaging the attention of engineers than that of utilizing the immense power of Niagara Falls and of transmitting the greater part of this energy to the points where needed by the medium of electricity. The readers of the WESTERN ELECTRICIAN do not need to be assured that a carefully considered plan for this work has been devised and that the actual construction is well advanced toward completion. While the purpose of this article is mainly to describe the work thus far accomplished and now under way, a brief rehearsal of the general outlines of the plan will not be out of place.

It is proposed, then, to make use of the immense volume of water flowing through the Niagara River and of the difference of level of about 230 feet caused by the falls and the rapids immediately contiguous to them. This will be done by the use of turbine wheels in deep wheel-pits and a long tunnel to act as a tail-race in carrying the water away. The work is being done by the Cataract Construction company, which was organized for the purpose. At the falls the river, which before flows from east to west, takes a sharp turn to the north, and the principal works of the operating company on the American side will be located on the river over a mile east of this bend and about three-quarters of a mile from the center of the city of Niagara Falls, N. Y. Here also are the local offices of the construction company. At this point a canal is being built 200 feet wide, 12 feet deep and several hundred feet long. From this the water will be let into a smaller "service canal" through gates of heavy masonry, and from the latter, through huge iron pipes, down into the pit to the water-wheels. The wheel-pit, or "slot," as it is called, is an immense shaft in the earth 18 feet wide, 140 feet long and 180 feet deep. In this great excavation there will be installed three turbine wheels, each of 5,000 horse power capacity, making a total of 15,000 horse power for the plant as at present constructed. The canal will have a capacity of 100,000 horse power, however, and the output of the plant can be increased to that extent by digging new wheel-pits, installing additional turbines and making the proper connections.

The designing of the turbine wheels was recognized by the engineers in charge of the work as of the greatest importance, as heretofore, it is believed, no wheels of a greater capacity than 1,500 horse power have been built. The advice of water wheel builders and hydraulic engineers all over the world was sought, with the result that the designs of Faesch & Piccard of Geneva, Switzerland, were accepted, and this firm has prepared plans for the wheels. Each wheel will practically consist of two wheels, one above the other, the 2,500 horse power from each being realized on one shaft, which will extend to the surface and operate perhaps one or more dynamos. Each of the three double wheels will be operated by a column of water 7½ feet in diameter, and of 130 or 140 feet head.

The tunnel is a mile and a quarter long and extends in a northwesterly direction from the wheel-pit to the river below the falls, the portal being a short distance north of the small suspension bridge near the falls. It is horseshoe-shaped and is lined with brick. The interior dimensions are: Greatest height, 21 feet 4 inches; greatest breadth, 18 feet 10 inches. There is a fall of fifty feet in the tunnel and it has a capacity, when full, of 100,000 horse power, the same as the canal. Ultimately it is expected to utilize the entire capacity of the tunnel.

The engineers in charge of the work are: Coleman Sellers, Philadelphia, chairman board of engineers; Clemens Herschel, New York, hydraulic engineer; John

FIG. 1. PREPARATION FOR ELECTRICALLY UTILIZING THE POWER OF NIAGARA.

Bogart, New York, consulting civil engineer; Theodore Turretini, Geneva, Switzerland, foreign consulting engineer; George Forbes, London, electrical engineer; Albert H. Porter, Geo. B. Burbank, Niagara Falls, N. Y., resident engineers.

In a recent article on the subject Mr. Herschel said:

When it is considered that 100,000 horse power, available night and day, is equal to about five times the water power of Lowell, Lawrence and Holyoke combined, and that these cities have grown by means of their water power to their present combined population of some 150,000 people in about 45 years, and when it is further considered that freight rates to New York and to Boston are no greater from Niagara Falls than they are from the cities named, while to and from the South and West they are very much less for Niagara Falls than they are for the above New England cities; when all this is properly viewed, a prediction that the future city of Niagara Falls will have a million inhabitants within fifty years does not sound like a rash one. Such a view contemplates, however, only the use of the power generated at Niagara Falls in its immediate vicinity, and only refers to the use of some 150,000 or 200,000 horse power as representing five or six times the total power, water and steam, which has gone to build up the three named manufacturing cities. Beside this, it is more than likely that Buffalo and other distant points will get power from Niagara Falls; and to reassure those who fear that the supply of power may become exhausted, it is but necessary to state that Niagara Falls, used on 140 foot fall (the fall available on the works now in construction), represents over 3,000,000 effective and available horse power. The present works are therefore intended, ultimately, to utilize only about 3½ per cent. of the available power; and a city of a million inhabitants could be built up on utilizing less than 7 per cent. of the available power.

The part now building is the down-stream end of the main canal, between the river and Buffalo street. A floating boom to help keep out ice will cross the mouth of this canal, and the ice entering notwithstanding is to be discharged into the tunnel. At a later stage of the works the water is to enter that portion of the canal which runs parallel with Buffalo street from the up-stream end. A gate-house is projected at the present temporary end of the piece of canal now building, and another at the up stream end of the main canal. Works intended to run without intermission are to draw water outside of the gate-houses, while the main canal, between the two gate-houses, is to supply power to ordinary manufactories, and can be drawn off in the usual manner to facilitate repairs To run out ice, the down-stream gate-house is to be opened, giving a fall of some two feet on the length of the main canal for the purpose named. Ordinarily the down-stream gate-house will be shut, and the water will enter the lower reach of the main canal directly from the river, as it is to enter the portion of canal now building.

From many points of view the enterprise here described may be considered as one of the most notable of those undertaken in these closing years of the nineteenth century, itself notable for great undertakings. It is a credit to the men and to the nation that have conceived it and to those who are engaged in its development.

The main tunnel is now practically completed, and the wheel pit and connecting tunnel will be finished by January 1st. Workmen are now engaged in excavating and building the masonry walls for the main canal. A view of this work, reproduced from a photograph recently taken, is shown in Fig. 1. The river can be seen in the background, held back by a coffer dam. Two of the gates leading to the service canal are shown to the right. A nearer view of two of these gate openings is shown in the picture of another portion of the canal wall, Fig. 2. In excavating the great slot for the turbine wheels much difficulty has been caused by the inroads of water. An interesting example of this is shown in Fig. 3, which represents the interior of the shaft, many feet below the surface. A seam of water was struck, and the jets can be seen spouting from two sides of the earthen walls. It was found necessary to erect a dam in the shaft in order to continue the excavation below this seam of water. A little reservoir was created, as shown in the illustration, and from this the water was pumped to the surface. Figs. 4 and 5 are interior views of the great tunnel. The former shows the timber shoring and the latter the completed, brick-lined tunnel.

Readers of the WESTERN ELECTRICIAN will be particularly interested in the provisions for transmitting the power by electricity, but unfortunately there is little that can be told about this branch of the work as yet. The problem is entirely in the hands of Prof. Forbes, who is now working on it in London. It is proposed that each of the 5,000 horse power wheels shall be directly connected to an immense generator, and that all power sold in lots of 2,000 horse power or over shall be transmitted by electricity, but the details are not settled, nor has anything been accomplished in the way of electrical construction.

This article has so far dealt with the works on the American side, which are now under construction by the Cataract Construction company. But the Canadian side is to have a tunnel, too, although less has been said of this enterprise than of the other. A word about it is necessary, however, in order to attain a proper understanding of the power transmission scheme. The same company will develop the power on both sides of the river. It is expected that a tunnel 800 feet long on the Dominion bank will develop 100,000 horse power, while a boring of 6,700 feet was necessary on the American side. The British government will derive a revenue of $25,000 a year from the Canadian tunnel privilege, and the power, being generated in Queen Victoria's Park, must be transmitted to factories outside the park, as the building of no mills will be permitted in the park preserves. Work will be begun on the Canadian tunnel early next spring, and it is hoped that at least 20,000 horse power may be available a year from now. For several reasons the purpose is to transmit to Buffalo the power that is generated on the Canadian side. First, it is expected that all the power that is developed by the American tunnel will be utilized by manufactories that will locate near the falls; second, it is not expected that the Canadians will or can use anything like 100,000 horse power in factories on the Dominion riverside; third, the distance from the Canadian wheel pits to Buffalo will be several miles less than from the American wheel pits; fourth the tariff laws will not permit Americans profitably to locate factories across the river; while, according to rulings of the United States Treasury department, electrical power may be entered free of duty. If power can be transmitted to Buffalo without too costly diminution, the experiment will follow of conducting electrical energy to Hamilton, and perhaps even to Toronto. Undoubtedly several factories will be erected by English capital near the Canadian power tunnel, as already the agents of corporations are on the ground pricing land.

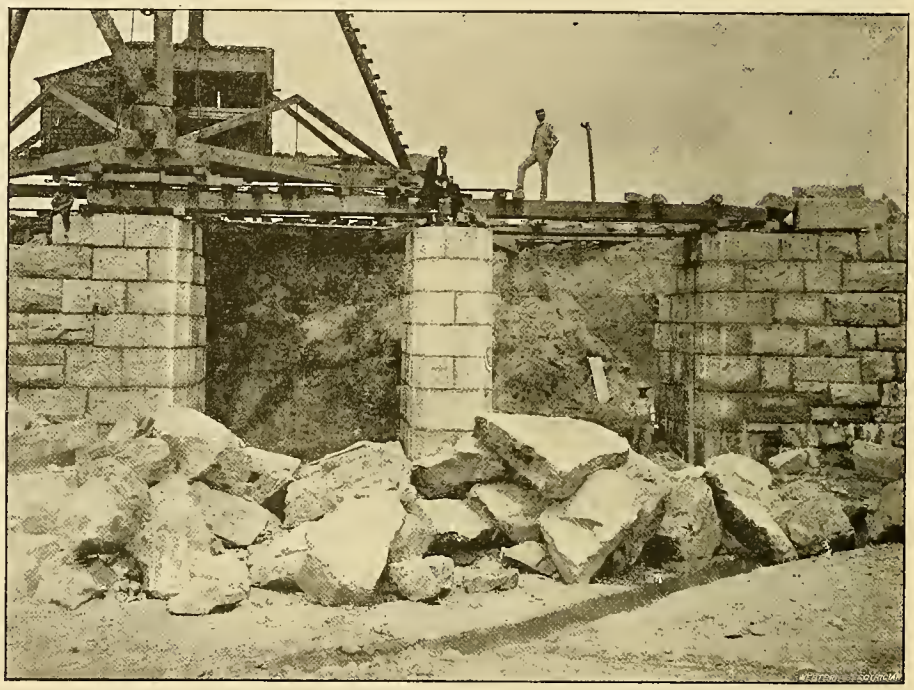

FIG. 2. PREPARATION FOR ELECTRICALLY UTILIZING THE POWER OF NIAGARA.

Prof. Forbes, while at Niagara Falls last month, accorded an interview to a reporter of the *Daily Cataract* of that city. The following extract will be read with interest by all electricians, although it is to be remembered that no plans have been definitely adopted:

"Yes," said the professor, "these are the greatest undertakings the world has ever seen thus far in electrical work. I have not yet entered into the details of the work, but know in a general way what the company desires. The tunnel and plant on the American side of the river will be used more for local purposes for building up of manufacturing plants. Dynamos capable of generating 5,000 horse power each will be put in the power house. The Canadian tunnel, while not nearly so long as the American one, will be capable of the same if not greater power. Work on this will not commence before next spring, as the company desires to complete the American plant before beginning this one. The power generated by this Canadian water power through the dynamos is designed to be transmitted, a great portion of it, to Buffalo for use in running factories, iron furnaces and foundries, for lighting purposes and for the various devices to which electricity can be put in this work-a-day world of you Americans."

"How will this electrical power be conducted to Buffalo?"

"Well, I have decided to use the underground conduit system. I will have the wires laid in conduits under the ground, but still where the linemen can readily inspect the wires and make any needed repairs. The pole system is too risky by far, as it is liable to accident by storm and too much waste of power is experienced with the wires strung in the air. The lines in conduits will follow the Canadian shore, as it is by far the shorter route to Buffalo. It will cross the river either on the bridge or by cable under the river. This is no experiment. We will deliver the power in Buffalo, and that with little loss. I can say that the loss between the turbines and dynamos will be between 3 and 4 per cent., while that in transmission will be less than 5 per cent. We have the most perfect system of insulation in the conduit contrivance. The total loss of power when delivered in Buffalo, you see, will be less than 10 per cent."

"How large will the dynamos be?"

"I can say they will be the largest that electricians have ever been called upon to design. The company has signified its intention of putting in dynamos capable of generating 10,000 horse power each. These monster machines will be constructed entirely from new and original plans. You see the centrifugal force in a dynamo to develop this amount of power will be immense, and to overcome this is one of the problems in the construction of these machines. I have received a large number of designs from prominent electricians, but find none that completely satisfy me. I shall probably construct the dynamo on plans of my own in which I have confidence."

"What current will be used?"

"Oh, there you have asked one of the most important questions in our whole talk. It will be the alternating current. I find that the best results have been obtained from this current, and it can be used in many more different ways. There is less force lost in transmission and the electrical power is received and handled with better results at the other end of the wire. So we shall use the alternating current"

The method of lighting the great American tunnel adopted during the work of construction is interesting. At first the contractors put in a plant of their own, employing direct current, but this attempt was unsuccessful, owing to the length of the line and other difficulties, and the work was entrusted to the Brush Electric Light company of Niagara Falls. This company of which Benjamin Rhodes is manager, has supplied the Cataract Construction company and the sub contractors on the great work with forty arc lights and about 700 incandescents for temporary use. The former are located about the main canal and at other points above ground (Fig. 1). The latter were installed in the big tunnel, nearly 200 feet below the surface of the ground. The Brush alternating system was used for the incandescent lights, groups of which are shown in Figs. 4 and 5. Two thousand volts pressure was used in the primary circuits, transformed down to 100 volts in the converters. On account of the wetness of the two shafts leading to the tunnel and of the portal in the river gorge, it was a grave question whether to locate the converters outside or to string the primary circuits down into the tunnel. The latter course was finally decided upon, however, on account of the distance to be covered—200 feet down each shaft and 1,300 feet on either side. No. 6 B. & S. wire was used for the primary circuits, and cut-outs were placed at the top of each shaft. The transformers, of 100 lights capacity each, were located at the bottom of the shafts. In descending the wires were fastened to the elevator structures by glass insulators; porcelain insulators were used for the secondary circuits. For the purpose of lighting the actual working operations twenty flexible, rubber covered cables 100 feet long, with a lamp every five feet, or twenty lamps to a cable, were supplied. These cables were equipped with plugs, and were inserted into the lamp circuits, which were, of course, extended as the work

progressed. The workmen could thus arrange the light as desired. In the finished tunnel lamps were left at intervals of fifty feet. Fuses were located every 300 feet, so that in case of a short circuit only a few lamps could go out, and the trouble could be easily located. This system was found to work well, and gave complete satisfaction. Current was supplied from two 600 light alternators in the company's station. This plant is operated by water power, with a rope drive of 100 feet from the water wheels.

It is expected that the company will be able to realize and offer for sale some of the power from this great plant some time next spring. The rates announced are

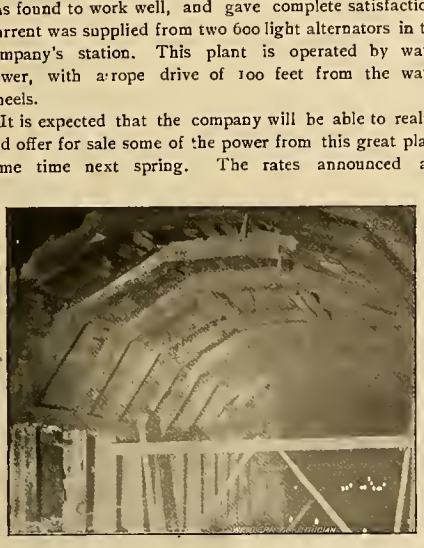

FIG. 4. PREPARATION FOR ELECTRICALLY UTILIZING THE POWER OF NIAGARA.

$10 per year per horse power, for twenty-four hours a day, in lots of 5,000 horse power and over, and from that up to $21 per year per horse power for 300 horse power.

Edison Lamp Litigation Ended.

As announced in the last issue of the WESTERN ELECTRICIAN the litigation over the incandescent lamp has been ended in a victory for Mr. Edison, whose patents are sustained. On October 4th Judges Lacombe and Shipman, of the United States Circuit Court of Appeals, handed down a decision in the case of the Edison Electric Light company against the United States Electric Lighting company. The suit was originally brought on three patents, No. 223,898, dated Jan. 27, 1880; No. 227,229, dated May 4, 1880; No. 265,777, dated Oct. 10, 1882. Before trial, however, the original bill was amended, the plaintiff withdrawing the last two patents. The cause was tried before Judge Wallace of the Circuit court, Southern district of New York, and his decision, which was handed down July 14, 1891, was published in the WESTERN ELECTRICIAN of July 25, 1891. Judge Wallace granted an injunction restraining the United States Electric Lighting Co. from manufacturing or using incandescent lamps, and at the same time ordered an accounting for damages and profits on lamps already made by that company. The case was appealed. The present decision sustains that of Judge Wallace. The following abstracts from the opinion, which was written by Judge Lacombe, cover the points involved in the controversy:

The patent sets forth that "the object of the invention is to produce electric lamps giving light by incandescence, which lamps shall have high resistance so as to allow of the practical subdivision of the electric light." By the phrase "sub-division of the electric light" is meant such a sub-division of the electric current that at several alternating foci supplied from the same source of electricity there shall be developed lights of moderate intensity—comparable to those given out by our ordinary gas jets—and the problem to be solved required a system and apparatus which would admit of the development of these moderate lights in sufficient number and at so low a cost as to be commercially useful.

Prior to 1879 experimenters seemed to have reached the conclusion that success was to be obtained, if at all, by modifications of the arc lamp, but up to that time no lamp, arc or incandescent, had been given to the public which, with the means then existing for generating and distributing the electric current, accomplished this result. Since the date of the patent in suit electric lighting by lights of moderate intensity has become a commercial success. Subsequent improvements in the lamps and in other parts of the system have undoubtedly contributed materially to its development, but the record abundantly shows that with lamps such as the patent describes, constructed with the skill then known to the art, and operated under the conditions admitted by the generating and conducting apparatus then existing, it became practical for one generator to operate a considerable number of lamps located at reasonable distances from it, and which at the same time were economical, durable and cheap enough to be commercially useful, and so simple and reliable that they could be manipulated by the public. In view of the utter failure of the prior art to produce any such subdivision of the electric light, a lamp of this kind which was capable of economical use in factories, large buildings, and in smaller buildings contiguous to each other—in other words, available for isolated lighting—should be considered commercially successful, though further development were needed to enable it to compete with gas for domestic lighting, on even approximately equal terms.

It is not necessary to enter into any elaborate discussion of the prior state of the art so far as it bears upon the question of patentable novelty of such embodiment of a number of high resistances and small radiating surface. Irrespective of all patents or publications of others, the philosophy of this method of producing light is undoubtedly found stated clearly and sufficiently, and applied to the production of an incandescent platinum burner in Edison's French Patent No. 130,910, taken out May 28, 1879. Whether under section 4887 of the Revised Statutes that patent, embodying as it does his own invention, is or is not sufficient, so far as Edison is concerned, a part of the prior art and to what extent in view of the prior art, that patent discloses patentable invention need not be determined upon this appeal, inasmuch as we are satisfied that there was invention in the substitution of the carbon of the patent in suit for the platinum of the French patent, even though all knowledge as to what should be the ratio of resistance to radiating surface were pointed out, either in the French patent or elsewhere in the art.

In his invention as described in the French patent Edison departed from the existing idea of burners of low resistance; declaring the commercial and scientific necessity of burners of high resistance, although they must be slender and presumably fragile, and attempted to find a method of protecting them from the effects of heat and of the atmosphere. It is said that the heretofore known laws of electricity should have taught every one that an electrical incandescent lamp must have a burner of small cross section and small radiating surface. The electrical laws had been known and had been recognized, but they did not tell how to protect the materials which would make efficient burners from the destructive effect of other sources than electricity to which they must be subjected; in other words, they did not tell how to construct a lamp. Edison, in his French specification, followed the principle of high resistance to an extreme, made platinum burners with a resistance of 200 to 300 ohms and described the method by which they were to be prevented from speedy deterioration "by destroying or intercepting the atmospheric action." He freed them from occluded gases by subjecting them to a high degree of electrical heat in a vacuum, and subsequently sealed them also in a vacuum. The platinum lamp, however, did not achieve success. Inasmuch as carbon has a specific resistance from 200 to 400 times that of platinum (hard, dense carbon having a lower resistance than

FIG. 3. PREPARATION FOR ELECTRICALLY UTILIZING THE POWER OF NIAGARA.

porous carbon), is practically infusible, had been long before suggested as a translating device and used as such in many of the lamps devised by the prior art, it might be supposed that when one skilled in that art was seeking a substitute for the platinum wire, something which would by reason of high resistance and small radiating surface apply the philosophy disclosed in the French patent, and yet admit of operation at higher temperature without melting, he would have turned to carbon, but the record in this case clearly established the converse of this proposition. Carbon when exposed to the air at a temperature sufficient to produce incandescence undergoes combustion. To remedy this difficulty, earlier inventors suggested inclosing the carbon burner in a glass globe from which air and moisture were to be excluded. Their globes were separable, to allow of replacement of the interior parts. We do not find in the words "suitably sealed," used in the King patent (British, 1845, No. 10,919) to describe a modification of his lamp for use under water, sufficient warrant for the contention that its structure was to be so radically changed as to substitute a light and compact all-glass globe with irremovable burner for the cumbrous apparatus with its column of mercury which he describes in detail.

Neither the inclosing chamber of Crookes, nor the Geissler tubes—though being all of glass with wires sealed in they would not leak—were used by the prior art to protect incandescent burners. By reason, in part, of that mode of construction with a separable chamber, the vacua which the earlier experimenters sought to secure could not be maintained. Though subsequent improvements in exhaust pumps might give their apparatus a higher initial vacuum, it would rapidly disappear in the leaking globe. It was against the oxygen or other carbon-consuming gases that all prior inventors sought to protect the burner, and later inventors tried to accomplish the result by fill-

FIG. 5. PREPARATION FOR ELECTRICALLY UTILIZING THE POWER OF NIAGARA.

ing the chamber with nitrogen or some other gas which was inert, *i. e.*, did not combine with the carbon; the carbons themselves were also subjected to processes for making them harder and more tenacious, and series of carbons were arranged to be brought in operation successively without opening the chamber, but one and all of these devices failed to secure stability in the carbon. A deterioration variously described as a "disintegration," "a wearing away," "a kind of evaporation," was soon fatal to the life of the burner. The record abundantly established the proposition that so far from turning to carbon for his first burner, which was to have so high a ratio of resistance to radiating surface, one skilled in the art would have been led by the teachings of that art to suppose that its instability would prove fatal to its use, irrespective of the size of the burner. Especially is it true that the use of small carbons in the attenuated or filamentary form which Edison had indicated in the platinum patent would not have been thought of. Nor do we find in the suggestions of Lane Fox either in his patents (British, Nos. 3 988, 4,043, 4,626, of 1878, 112, of 1879) or his other publications, any such appreciation of the cause of the disintegration of carbon or any such proposed method of preventing it as would controvert the conclusion that the art was looking elsewhere than to carbon for the burner, which should have a future. Certainly Lane-Fox himself seems to have looked for success rather to his metallic alloys and his compounds operated in nitrogen or other suitable gases than to carbon in a perfect vacuum. The literature of the art fully sustains the statement of Mr. Schwendler quoted in the *Telegraphic Journal* in 1879 that "we can scarcely expect that the principle of incandescence will be made use of for practical illumination," unless there be discovered a conductor without the defects of platinum, and "which does not combine at high temperature with oxygen."

In June, 1878, and January, 1879 (United States patents 205,144 and 211,262), Sawyer and Mao indicated one of the causes which operated to produce this disintegration of the carbon, viz., that "some oxygen or other element or compounds remained in the lamp," the carbon "occluding sufficient air or oxygen to render its consumption a mere question of time," as "the least quantity of oxygen in a sealed lamp is sufficient to combust an indefinite quantity of carbon."

This they sought to remedy by heating the carbon pencils immersed in a hydrocarbon liquid to an extremely high temperature, thus producing a hard and dense carbon (and one whose specific resistance was lowered by that very process). They also, while the globe was on the pump and nitrogen flowing in and out of it, heated the "carbon to incandescence, thus driving out all the impurities and occluded gases which are carried out of the lamp by the current of nitrogen." Believing that the deterioration of the carbon burner was due to the presence of occluded oxygen, which escaped into the sealed chamber and "promoted combustion," they sought to secure stability by substituting for the oxygen they had forced out by heating on the pump an atmosphere of nitrogen; that done they sealed their chamber, which seems to have been a separable one.

Edison had experimented with carbon before he devised the platinum lamp of his French patent. Subsequently to the date of that patent, apparently because that lamp did not seem to promise the success he hoped for, he again turned to carbon. In the course of his investigations he made a discovery as to the cause of "disintegration," of which he availed himself to devise a lamp, in which car

bon, even in the filamentary form required for a burner, whose ratio of resistance to radiating surface was such as to apply the philosophy pointed out in his French patent, could be maintained for a sufficient length of time to become a commercial success.

At the date of the application for the French patent he had apparently reached only the point that "pencils (not filaments)" "of carbon can also be freed from air in this manner and be brought to such a temperature that the carbon becomes pasty, and if it is then allowed to cool, it is very homogenous and hard." The knowledge that practical stability can be given to a carbon filament was not gained until October, 1879.

Edison's invention was practically made when he ascertained the heretofore unknown fact that carbon would stand a high temperature, even when very attenuated, if operated in a high vacuum, without the phenomenon of disintegration. This fact he utilized by the means which he has described, a lamp having a filamentary carbon burner in a nearly perfect vacuum. Although all glass globes with leading wires passing through the glass and sealed into it had been used before to preserve the condition of the interior of a chamber from the effects of leakage at the joints, and although the prior art, including the French patent, indicated that subdivision of the electric light was to be obtained by the use of burners of high resistance and small radiating surface; and although pencils of carbon had been tried in imperfect vacua—and found wanting—it was invention, in view of the teachings of the art as to the disintegration of carbon under the action of an electric current, to still select that substance as a suitable material from which to construct a burner, much more attenuated than had ever been used before—reduced in size to the filamentary form, in which economy of construction requires that it must be used in order to avail of the philosophy of high resistance and small radiating surface—and so to combine old elements, that the disintegration due to "air washing" should be practically eliminated, and the burner thus become commercially stable. It is true that carbon burners still break down, that the improvements, neither of Edison or other inventors, have made them absolutely stable, and in a sense it may be said that Edison only made them more stable than they were before—that it is a mere matter of degree. But the degree of difference between carbons that lasted an hour and carbons that lasted hundreds of hours seems to have been precisely the difference between failure and success, and the combination which first achieved the result "long desired, sometimes sought, and never before attained," is a patentable invention.

It is also true that the combination and manipulation, which secured a practically perfect vacuum by heating the burner, while the exhaust pump was at work, and subsequently sealing the globe without introducing a foreign gas, is set out by Edison in his French patent as the means of effecting such a change in the condition of platinum as would permit its being raised to higher temperatures, without rupture, cracking or diminution of weight, by volatilization. But the evidence shows that the platinum lamp did not achieve success, and we think there was manifest invention in the substitution of carbon, freed from occluded gases, and placed in the nearly perfect vacuum. The change of material involved a reorganization of the lamp, dispensing with the thermal-regulator, which was an essential part of the structure of the French patent; it developed new properties in the lamp by reason of the enormous differences between the resistance and the melting points of the two materials; it utilized the discovery of that cause ("air washing") of the instability of carbon, which seemed to preclude all hope of its future usefulness as an incandescent illuminant; finally and principally, by the substitution there was presented the complete combination of elements, which for the first time in the art produced a practical electric light. We are of the opinion that on principle and under the authorities such a substitution of material is invention.

The second claim of the patent is broad enough in its phraseology to cover the invention above set forth—at least when the burner is a carbon filament. This last word is not specifically defined in the patent, though therein it appears for the first time in the art. It was a common English word with a meaning sufficiently plain to indicate that the cross section of any article which it was used to qualify must be so small as to be threadlike, and we think a sufficient indication of what that size it would be afforded by an examination of the ordinary threads in common use.

An examination of the patent, however, indicates its dimensions with more exactness. It is to be fragile, so small in cross section that, compared with earlier carbon rods, its use is a "reversal of former practice." One of the substances suggested in the patent to be used as a burner is to be reduced to .007 of an inch in diameter Ordinary cotton thread, also suggested in the patent, has varying diameters, the largest commonly used being $\frac{1}{17}$ of an inch in diameter; the Patent Office model has a diameter of about $\frac{1}{16}$ of an inch. The evidence fails to satisfy us that the prior art furnished any burners less than twice this size.

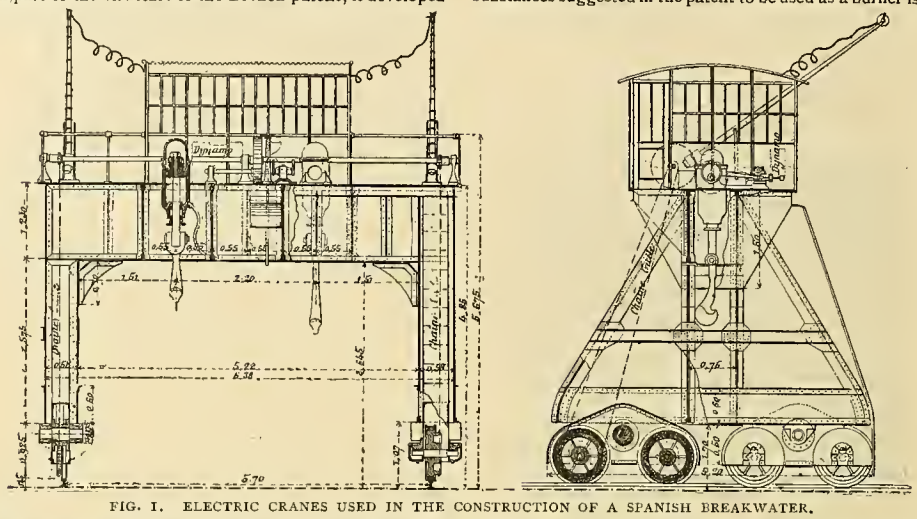

FIG. 1. ELECTRIC CRANES USED IN THE CONSTRUCTION OF A SPANISH BREAKWATER.

The second claim may be thus paraphrased:

The combination of carbon, filamentary or thread-like in size and properly carbonized, used as an illuminant in an incandescent electric lamp with a receiver made entirely of glass and conductors passing through the glass, and from which receivers the air has been exhausted to such an extent that disintegration of the carbon, due to the air washing action of surrounding gases or to any other cause, is so far reduced as to leave the carbon practically stable.

Defendant's lamps are plainly infringements of the second claim as thus construed.

Defendant further contends that the patent is invalid because it does not so describe the lamps as to enable a person skilled in the art at the date of the patent to make a practically useful structure. The evidence of the witness Howell seems to us a conclusive answer to this contention. He made, as he testified, according to the directions of the patent, and using only processes known to the art before its date, incandescent lamps such as the patent describes, which lasted 600 hours. Defendant criticises this evidence because the witness subjected the filaments made by him to the action of the electric current during the process of exhaustion. But the patent repeatedly directs that the vacuum shall be high and nearly perfect. Sawyer and Man had, prior to the date of the patent, shown that there were occluded in the carbon itself, and in the various internal parts of lamp chambers, gases and impurities, which are set free by the passage of the current. Manifestly, if they were not removed before sealing, the nearly perfect vacuum would soon disappear. Edison's French patent also details a process for forcing them out of platinum and removing them while exhausting is going on, and a person who was sufficiently skilled in the art to know of these earlier publications, and was carefully solicitous to conform to the directions of the patent, would naturally have resorted, as Howell did, to this method to secure a vacuum free, so far as might be, from the intrusion of such occluded gases. It is contended, however, that this process of "electric heating on the pumps" in effect produces a carbonization of the filament, that it is now used as a part of the process of carbonization, and that, therefore, because the patent simply directs that the filaments be "properly carbonized," because electrical heating is now used with the understood object of supplementing the work of the carbonizing furnace, because Edison has always thus heated his filaments, and because such additional carbonization is necessary to make a practical lamp under his patent; therefore, he has either purposely suppressed an essential element of his process, or has failed to give the full, clear and exact description of it which the statute calls for. To this proposition we cannot consent. It is immaterial that the philosophy of electric heating on the pumps is better understood to-day than it was in 1879, so long as the requirements of the patent would not be complied with by one skilled in the art, unless he did in fact so heat the filaments. Whether he heated to carbonize or to secure a nearly perfect vacuum, the result would be the same—an operative lamp produced by following the directions of the patent with the ordinary skill of the art, and that is all the patentee was required to show.

Other points interposed by the defendant, based upon legal technicalities, are passed over briefly by the court which finds in them nothing applicable to the cause under consideration. The decision is based squarely on the question of the invention of the first practical incandescent lamp, and as such is a notable victory for Mr. Edison.

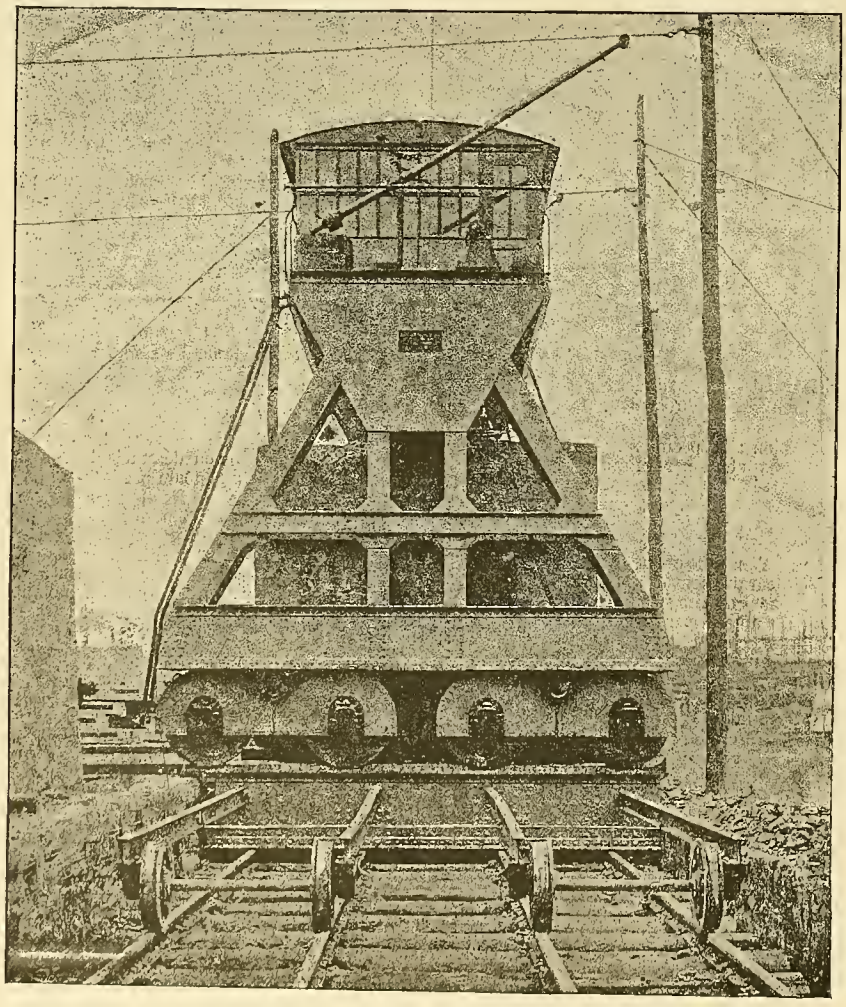

FIG. 2. ELECTRIC CRANES USED IN THE CONSTRUCTION OF A SPANISH BREAKWATER.

The first electric launch has arrived in Spain, and is traveling the waters of the river Sena.

Effect of the Lamp Decision.

It is not anticipated that the decision in the incandescent lamp litigation will have the effect of closing the factories of the other lamp manufacturing companies. The Westinghouse company, for instance, has already placed a new lamp on the market, which, itis claimed, does not infringe the Edison patent. The lamp companies in and about Chicago do not anticipate any trouble. They will undoubtedly continue to manufacture lamps under license if satisfactory arrangements can be made with the General Electric company. Otherwise they will continue the manufacture of lamps until ordered by the court to discontinue. Then it is presumed they, too, will bring out "new" lamps. This at least is the present policy of several companies.

In the East the lamp decision created something of a sensation and it was the only topic of conversation in electrical circles last week. A dispatch dated New York, October 6th, and published in the Boston *Traveller*, created considerable discussion. The paragraph follows

It is announced that the Perkins Lamp company of Manchester, Conn., one of the largest manufacturers of incandescent lamps in competition with the Edison company, has, in view of the recent decision, shut down its works and discharged its employes.

It is hardly necessary to say that this statement is without foundation and that the Perkins company has no intention of leaving the field without a struggle. It is possible, according to a representative of the Perkins company, that an agreement may be made by all the lamp companies not controlled by the General Electric company to close their factories until November 10, 1893, when the Canadian Edison patent expires. This, of course, would only be done on the refusal of the General Electric company to make reasonable terms with the other companies. Inasmuch as the General Electric company's facilities for manufacturing lamps are not sufficient to supply the demand, and as it would undoubtedly discriminate in favor of consumers operating its own apparatus, there would be a general uprising against such a policy. It is not anticipated that the General Electric company will adopt such a course. On the contrary, it will probably be willing to license outside companies, and they will no doubt be willing to pay rather than have any trouble.

The decision had the effect of booming the General Electric company's stock, and the fortunate holders had reason to congratulate themselves on their good fortune.

The electric light companies of Cincinnati employ none but the best legal talent, it seems. The *Times Star* of that city asserts that on September 28th ex-Governor Foraker appeared in the police court to defend John Turner, supervising engineer of the Edison Electric company, who was charged with violating the smoke ordinance Gov. Foraker told how the company had tried to get smok consuming appliances, but that they had not worked well and contracts had been let for new devices. On this statement the case went over to November 15th.

Electric Cranes Used in the Construction of a Spanish Breakwater.

The electric motor plays an important part in the construction of the breakwater at Bilbao, Spain. This protection to the harbor is almost a mile in length and the work when completed will cost about four million dollars.

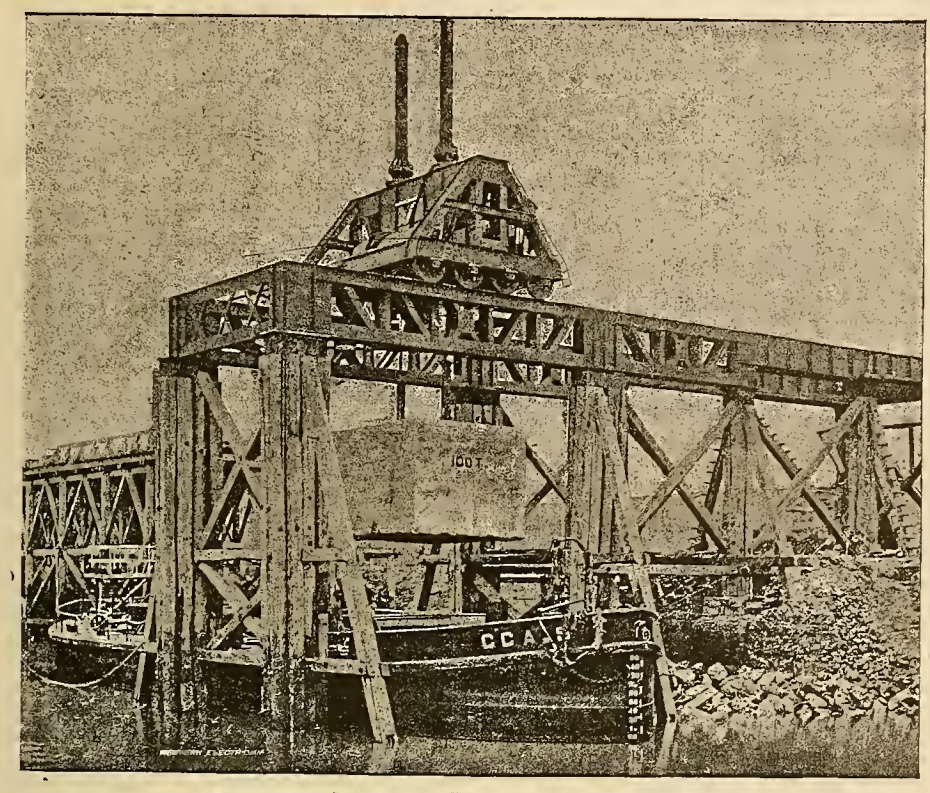

FIG. 3. ELECTRIC CRANES USED IN THE CONSTRUCTION OF A SPANISH BREAKWATER.

The foundation for the breakwater is the rock formation, and the superstructure is built of huge blocks of artificial stone. When the contract was let in 1889 the successful bidders established at the spot a manufactory for making the stone and instituted the preliminary work on the foundation, part of which is fifty feet below the sea level at low tide. The work of laying the stone was begun last year.

The blocks are made in two sizes, the larger moulds containing about 60 cubic yards, and the smaller about 37 cubic yards. The number of the latter used is about double that of the former. A special form of traveling crane is employed for transporting the stone from the platform, where it is made, to the boats from which it is lowered into position. The crane is illustrated in perspective in Figs. 2, 3 and 4 and diagrammatically in Fig. 1. It is built of a stout braced steel framework resting on two four-wheel trucks and carrying on a housed platform at the top, the operating mechanism. It travels on rails 18 feet apart.

The car is operated by an electric motor, taking its current from a trolley wire. As the cuts show, a double trolley system is used, the poles being bamboo. The motor is of the type manufactured by Hillairet & Huguet of Paris, and is of 60 horse power, the armature making 600 revolutions per minute. Its power is employed for two purposes; first, it is applied to the pistons, of the hydraulic machinery by which the blocks are lifted; then, to a shaft which by means of linked chains and sprocket wheels moves the car with its ponderous weight.

The generator, located a short distance away, is of the same make as the motor. It is of 60 horse power and is operated by a compound engine, developing at 300 revolutions 200 amperes at 200 volts.

The blocks are lifted by jointed hooks attached to the pistons of hydraulic lifting devices shown in the diagrammatic cuts. The hooks clutch the block by means of two bands of iron put in position when the stone is in process of manufacture. The band is slightly below the surface, and holes are drilled at the top for attaching the hooks.

After the block is raised from the ground, the crane is set in motion, and run upon a truck or carriage traveling in an opposite direction, as shown in Fig. 2, on two double tracks. The truck is electrically operated, the motor receiving its current from wire strung on the walls of the trench in which the car travels. The block is carried under the trestle shown in Fig. 5, upon which travels a crane similar to the larger machine illustrated in Figs. 2, 3 and 4. It is operated by electricity, and is equipped with hydraulic lifting devices identical to those already referred to. The block is raised, carried out over a flat boat, as shown in Fig. 3, and lowered to the deck where space is available for two blocks. The freight is towed to the point where building is in operation. Here the blocks are handled by a powerful steam crane.

The platform where the stone is made is provided with 517 moulds, 120 of the larger size and 397 of the smaller size. This number of blocks can be transported and laid in favorable weather in about three months. The cuts are reproduced from *Le Genie Civil*.

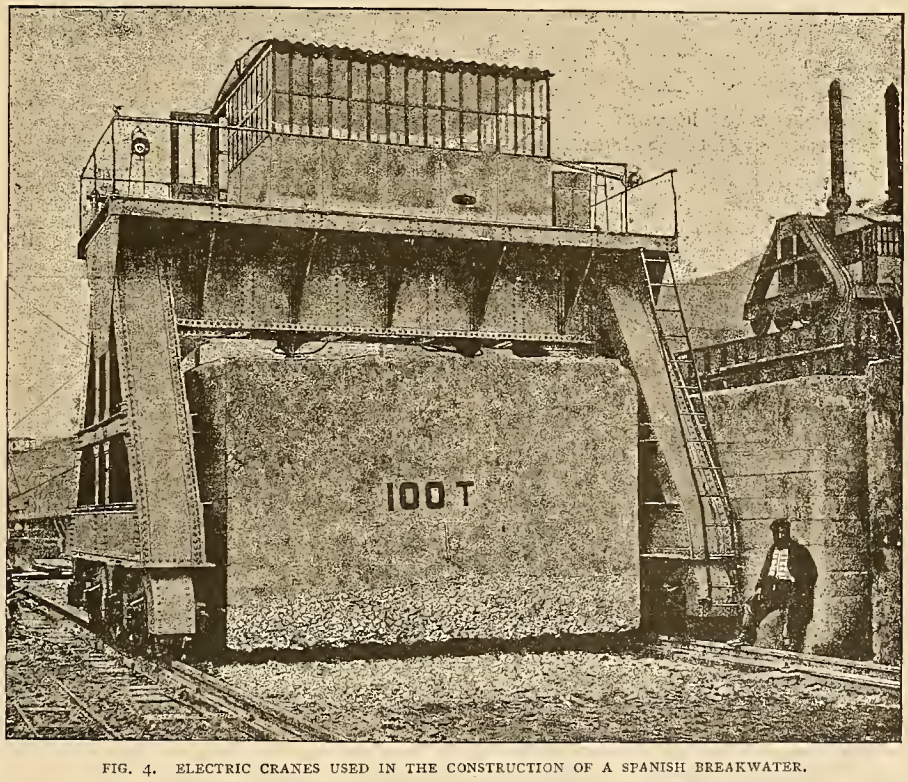

FIG. 4. ELECTRIC CRANES USED IN THE CONSTRUCTION OF A SPANISH BREAKWATER.

One of the heaviest thunderstorms of the season passed over southwestern Pennsylvania on the night of September 25th, doing great damage. Trees and fences were blown down, telegraph, telephone and electric light wires were prostrated, and several houses were struck by lightning. The storm left the Western Union and Postal Telegraph companies badly crippled, while hundreds of telephones were rendered useless. As a result of the prostration of the electric light wires whole districts were in total darkness.

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CORRESPONDENCE relating to electricity, or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

PAGE.

Preparation for Electrically Utilizing the Power of Niagara. Illustrated 193, 194, 195
Edison Lamp Litigation Ended 195, 196
Effect of the Lamp Decision 197
Electric Cranes Used in the Construction of a Spanish Breakwater. Illustrated 197
Editorial 198
Giraud's Thermo-electric Battery. Illustrated 199, 200
Electricity at the World's Fair 200
Litigation Over Storage Battery Patents 200
Steffen's Tachyscope 200, 201
Accident at Sioux Falls 201
California Electrical Society 201
New Electric Gas Burner. Illustrated 201
Volt and Ammeter. Illustrated 201
Packard Motors and Dynamos. Illustrated 201

DEPARTMENTS.

Correspondence 201, 202, 203
New Incorporations 203
Electric Lighting 203
Electric Railways 203
Telegraph 203
Telephone 203
Miscellaneous 203, 204
Trade News 204
Business 204
Electrical Patents 204

MUCH attention has been attracted of late to the project of transmitting by electricity a portion of the tremendous power of Niagara Falls. The project will be realized for comparatively small distances—that is, in the immediate neighborhood of the falls—within eight months, probably, and as far as Buffalo within a year and a half. Prof. George Forbes of London, who has charge of the electrical engineering, talks of the installation of five and ten thousand horse power dynamos for this work, but as no data of these gigantic machines are at hand, comment must be reserved. The whole scheme is one of great interest, and the progress of the work will be intently followed by electricians, both at home and abroad.

ELSEWHERE in this issue is presented a description of a thermo-electric generator that should prove of interest to those experimenting along this line. The apparatus is described in detail, and for this reason the article will undoubtedly be of great value to the experimenter in thermo-electrics. The inventor, Paul Giraud of Chantilly, France, employs in the manufacture of his battery an electrode made of three compositions, according to the size of the apparatus. Each element is made up of two electrodes of composition, and these are arranged around a stove of special design so that the action of the heat may be utilized to the highest degree. Mr. Giraud's apparatus is worthy of a careful study, in that the designer has undoubtedly made considerable research into this undeveloped field. It is to be regretted, though, that no information can be given as to the output of this generator. There is no doubt but that electricity can be produced by heating the juncture of two dissimilar metals, or alloys, and also that a battery of such elements might be made to produce considerable current; but the all-important feature is that the apparatus shall work efficiently. Information of this kind from the designer would be of value.

THE man who is to compile a collection of the funny mistakes made in the newspapers when electrical subjects are under discussion has not yet arisen, although there is an ample field for the exercise of his talents. The *Star* of Pipestone, Minn., has come forward for honorable mention in the list of journals thus distinguished. In a recent issue it published a short but graphic description of a new alternating current dynamo that had been installed in the local electric light station. After stating that the new machine is a "Composit Field Alternater, fitted with new tooth armature, and is one of the best made," the *Star* boldly goes on to assert that "in addition there is a small dynamo called an 'Exciter' of 110 bolt, with 9 empers." "Bolt" and "empers" are very good indeed.

CONVENTIONS of the street railway men are of great importance to electrical engineers and manufacturers of electrical apparatus. That at Cleveland next week will be devoted largely to the consideration of electric railway problems and the men who will present their views on these subjects have the advantage of knowledge that can be gained only by practical experience in the operation and management of important street railway lines. There will be a general display of electric railway apparatus and specialties of all kinds, and visitors will be enabled to see all the standard systems of electric propulsion in actual operation on the Cleveland lines. Many street railway managers who are contemplating the introduction of electrical equipment will have an excellent opportunity to study for themselves the special features of the several systems, and compare their merits.

IT is reported that S. H. Wood, the Minneapolis "inventor" who brought to the attention of the public a marvelous motor which was to accomplish wonderful tasks at merely nominal cost, has actually commenced the erection of a factory at West Minneapolis. It will be remembered that Mr. Wood's announcement was characterized as much by clearness of statement as by modesty of assertion. That is to say, both of these pleasing traits were conspicuously absent from the preposterous prospectus which was noticed in this journal several months ago. One thing was made perfectly clear, however, and that was that Mr. West wanted money from such of the confiding public as he could induce to exchange dollars for experience. From the recent announcement from Minneapolis it appears not unlikely that Mr. Wood's advertisements have been instrumental in attracting persons whose capacities fit them well for this sort of barter.

THE principal electrical display of the dedication ceremonies at the World's Fair grounds will undoubtedly be made on the evening of the 21st instant, after the exercises in the manufactures building. A great Schuckert projector—possibly two—will be mounted on the transportation building, and the light will be thrown on the beautiful light colored buildings of the exposition, on prominent objects down town, out over the lake and up in the sky. The display will probably be visible all over the city, and is sure to excite wonder and admiration, as nothing of the kind has been seen in Chicago on a scale commensurate with that contemplated. A specially wound low tension dynamo will be required, and the current will come from a temporary plant in machinery hall. It is likely that the search light exhibition will remain in the memory of spectators as one of the most impressive features of the dedication.

THE fight for the trolley in New York city has been a good one, but prejudice, it seems, has conquered. Mayor Grant says no, and the aldermen, too, have begun to back water, so to speak, and it now looks as though the battle was over for a time at least. The fight was a good one and was for a cause that the railway companies knew to be just. But the newspapers decided that the city did not want the system, and they proved themselves to be entirely unscrupulous in the methods they employed to excite the people to rebel against it. The fight was against odds, too, for it was not to be presumed that Mayor Grant, after his fierce and determined opposition to all overhead electrical construction, would at this late day submit without a protest to the introduction into the streets of New York of what the people had been taught was the "deadliest" sort of wire. Old fogyism has kept the trolley out of New York proper, but many of the citizens of the metropolis will be surprised as day after day they read in the very papers that condemned it of the success of the system in other territories. The opportunity now is for the storage battery. It is thought, now that the litigation is being brought to a head, that this backward system of electric traction will be brought rapidly to the front. No better place for trial can be had than in New York, and it is hoped that the companies which have this method of traction so much at heart—to say nothing of pocket—will make the most of New York's desire for electric traction without the overhead wire.

IT is a noticeable fact that there have been numerous accidents on electric railways reported in the East, and it is worth while to call attention to another fact, viz., that these casualties have almost invariably been in nowise due to the supposed dangerous characteristics of a 500 volt current. An electrically posted reader's impression after perusing the newspaper accounts of these numerous accidents is that the trouble is with the men who run the cars, and in whose hands they so often become, as the reporters put it, "uncontrollable." Such statements tend to make right-minded men who know how absolutely controllable an electric motor is, highly indignant, to say the least. The fault in the majority of cases lies in the railway's management rather than the machinery. A street railway company equips its cars with a power that responds almost instantly to the touch of a button, and then places in charge a man who, in many cases, does not know enough to experiment in a pit with a shovel and pick, to say nothing of handling a car carrying human beings. Cable railway companies train their gripmen for the most selfish of reasons. They know better than to place in charge of a car a man that through ignorance or carelessness might cut the cable. But the electric railway superintendent has to look out for the safety of no such enormously expensive machinery, and too frequently he yields to the temptation of employing cheap help, and rests content to take the chances of cars becoming "unmanageable," "uncontrollable," etc. The public should bear these facts in mind; a clear understanding of them will enable the patrons to discriminate between faulty machinery and incompetent management.

DURING the last five years the legal controversy over the incandescent lamp patents of Edison and Sawyer and Man has been in active progress. The decision of the United States Circuit Court of Appeals, announced in the last issue of the WESTERN ELECTRICIAN, brings this celebrated litigation to a close, and awards to Mr. Edison the distinction of having given to the world the first practical incandescent lamp for commercial use. An abstract of the opinion fully covering the points in the controversy is presented in this issue. The decree of Judge Wallace, granting an injunction and accounting for damages and profits, from which appeal was taken, is sustained. The principal claim in the Edison patents, as construed by Judge Lacombe, who wrote the opinion, is the combination of carbon filaments "threadlike in size and properly carbonized, used as an illuminant in an incandescent electric lamp with a receiver made entirely of glass, and conductors passing through the glass, and from which the air is exhausted to such an extent that the disintegration of the carbon due to the air washing action of surrounding gases or to any other causes, is so far reduced as to leave the carbon practically stable." According to the decision of the court, "the defendant's lamps are plainly infringements of this claim."

After tracing the development of the incandescent lamp the court reaches the conclusion that "Edison's invention was practically made when he ascertained the heretofore unknown fact that carbon would stand high temperature even when very attenuated, if operated in a high vacuum without the phenomenon of "disintegration."

What the effect of this decision will be on the lamp business of this country is the most important point to the general public. It is not yet announced what the policy of the owners of the Edison patents will be, but it is presumed that a satisfactory arrangement will be made with other lamp makers which will enable all who are willing to pay a license to continue in the business without further litigation.

Personally, Mr. Edison is naturally very much elated over the decision. His claim of having invented the first practical lamp is sustained. It is a notable victory, too, for the Edison interests, and one which, though generally anticipated, is none the less valuable from a commercial view point.

Giraud's Thermo-electric Battery.

Careful study of the accompanying diagrams will give the reader an excellent idea of the details of an apparatus devised by Paul Giraud, of Chantilly, France, for the production of electricity directly from fuel.

Mr. Giraud employs in the manufacture of his thermo-electric battery an electrode made of three compositions as follows:

For elements of small size—antimony, 1,450 parts by weight; zinc, 900 parts; cadmium, 50 parts; pure copper, 80 parts; tin, 40 parts; silicium, 3 parts.

For elements of medium size—antimony, 1,440 parts; zinc, 780 parts; cadmium 60 parts; pure copper, 30 parts; tin, 15 parts; silicium, 2 parts.

For elements of large size—antimony, 1,830 parts; zinc, 960 parts; cadmium, 65 parts; silicium, 2 parts.

Fig. 1 represents a side view and a plan of one element of the battery. Fig. 2 represents a horizontal section of a group of elements connected. Fig. 3 represents a vertical section, in the line *A B* of Fig. 2, of several

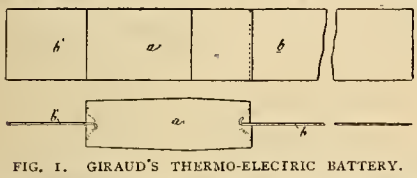


FIG. 1. GIRAUD'S THERMO-ELECTRIC BATTERY.

superposed elements. Fig. 4 is an end view corresponding with Figs. 2 and 3. Fig 5 is a detail view illustrating the connections between the elements. Fig. 6 represents a vertical section of a portable stove, serving for the heating of one of the extremities of the thermo-electric electrodes. Fig. 7 represents a horizontal section on a larger scale than Fig. 6, taken in the line *Y Z* of the latter figure. Fig. 8 represents a vertical section of a modification of the stove shown in Figs. 6 and 7.

Each element, Fig. 1, of the battery is composed of an electrode *a* and an electrode *b b'*, the electrode *a* being a casting of one of the alloys specified above, and the electrode *b b'* consisting of two plates of sheet metal. The elements are formed by placing one end of a plate *b* and one end of a plate *b'*, one in one end and the other in the opposite end of the mold in which the electrode *a* is to be cast and afterward casting the latter electrode in the mold upon the ends of the plates. The electrodes *a* are formed, as above stated, of alloy of zinc, antimony, copper, tin, silicium, and cadmium. Certain of these metals—such as zinc and antimony—have already been used in thermo electric batteries; but Mr. Giraud's experience has led him to employ them in various practical conditions, to the results, first, that they furnish a greater electro-motive force without increasing the internal resistance of the element, and, second, that the primitive crystallization (that resulting immediately from casting) is avoided, as well as the ulterior crystallizations (those produced by the heating of the elements). The solidity and durability of the elements are thus increased. As to copper, it is added, first, to augment the mechanical resistance of the alloy; second, to diminish its internal electric resistance, and, third, to raise the fusion point of the alloy. On the other hand, the tin which enters into the composition of the alloy makes it flow better for casting and renders it more homogeneous and more solid. The silicium increases the resistance to breakage. Finally, the cadmium has for its object to greatly augment the electro-motive force of the elements.

There may be, too, notable differences between the proportions of the different metals. The copper and tin may be omitted in the composition for large elements when the elements by reason of their large size present sufficient guarantee of solidity. The proportions in which the different metals enter into the alloy may vary, in fact, according to the greater or less effect which it is desired to have and the dimensions of the elements. Experiments, Mr. Giraud states, have proved that the composition of the alloy being the same the electro-motive force of an element varies, first, with the three dimensions given to the ele-

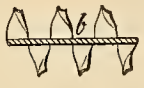


FIG. 5. GIRAUD'S THERMO-ELECTRIC BATTERY.

ment, and second, with the thickness (vertical dimension) of the element, the length and breadth not being changed. Thus, for example, with the same metallic composition the same length and the same breadth an element of two centimeters thickness will have a greater electro-motive force than another of three or five centimeters thickness. The longitudinal electric resistance will also be greater in the former than in the latter.

The changing of the proportions of the alloy has for its end to preserve to the elements, while increasing its thickness, the same electro-motive force, and that without increasing its internal electric resistance. The effect is thus greatly augmented.

Three thicknesses of electrodes *a*, which may be employed with the greatest advantage, are as follows, according to different cases:

Small size, length equals .07 millimeter, breadth equals .02 millimeter, and height equals .02 millimeter; medium size, length equals .07 millimeter, breadth equals .02 millimeter, and height equals .03 millimeter; large size, length equals .10 millimeter, breadth equals .03 millimeter, and height equals .05 millimeter.

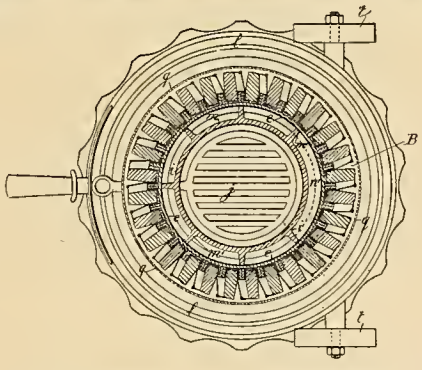


FIG. 7. GIRAUD'S THERMO ELECTRIC BATTERY.

These proportions may evidently vary in a certain degree.

The second electrode *b* or *b'* of each element is constituted of tin-plate or of a plate of pure nickel; but the electrodes may also be made of sheet-iron having its surface coated with irridium, platinum, or nickel, or made of ferro-aluminum. Each of the plates *b b'*, constituting electrodes, is united with the electrode *a* by an autogeneous solder—that is to say, produced by the casting of the alloy forming the latter electrode.

In order to have a perfect union and a large surface of contacts, which, it is evident, is of great importance, the extremity of each plate is first divided by several longitudinal slits. Then the tongues thus formed are turned alternately to the right and left and afterward twisted, as may be clearly seen in Figs. 1, 2, 3 and 5, to anchor the plates into the electrodes *a*. The part of the plate *b* which is next to the inner end of the electrode *a* is folded over against that end, then again folded to be applied against the lateral face of the electrode *a*, a thickness of amianthus or other insulating material being interposed between the last mentioned face and the plate. The plates *b* and *b'* of two adjacent elements are lapped and secured together by a solder which will not melt at the temperature to which it has to be exposed.

This mode of connection permits the easy replacement of one of the elements in case of damage by unsoldering the two joints between that and the adjacent elements in

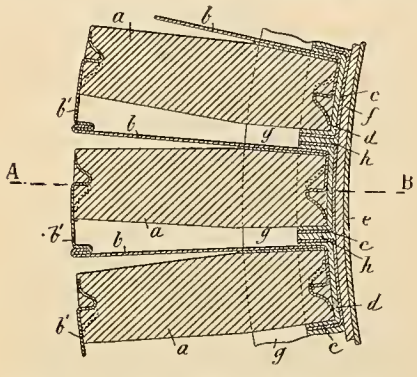


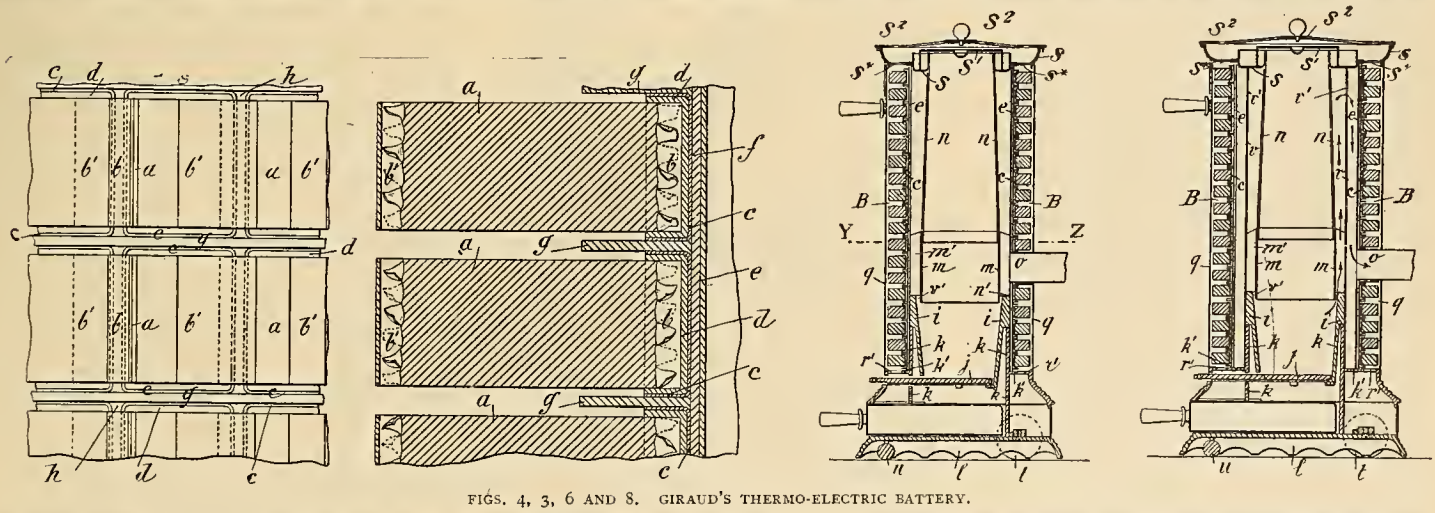
FIG. 2. GIRAUD'S THERMO ELECTRIC BATTERY.

the same row, and replacing the damaged element by a good one and remaking the connections.

The thermo-electric elements of the system above described may apply to all kinds of apparatus emitting heat and capable in consequence of heating one of their extremities, while the other will be maintained cold by any means whatever. They may be arranged around steam boilers, furnaces, etc., in order to utilize the waste heat, and thus to produce electricity without cost while absorbing the heat, which in certain cases is objectionable—for example, on board ships. Or else they may be affixed around a stove in such manner as to constitute an apparatus, serving both for warming the air of an apartment or of any space whatever, and producing electricity for lighting or other purposes.

Figs. 6, 7 and 8 show this application of the elements around a stove. It is here supposed the stove is of a portable kind which may be rolled about from one part of an apartment to another. The employment of the stove in this way as a generator of heat permits the utilization for the heating of the battery of all the heat commonly lost from the stove, whence results a more thorough utilization of the combustible expended, and consequently great economy.

This utilization is more perfect when the stove is so constructed that the outer surface is never above a moderate heat, as it is always desirable that the stove shall be such that the solderings of the elements should not be heated to a sufficient temperature to melt them. In the Giraud system the thermo-electric battery surrounds the stove exteriorly, the solderings, which should be maintained cold, being toward the exterior and being cooled by a current of air, for example, while those solderings which must be heated are toward the interior and exposed to the heating action of the stove. The elements of the battery are not in contact either with the combustible or the gases of combustion, nor even directly with the walls of the heating apparatus, and this, in connection with the special ar-



FIGS. 4, 3, 6 AND 8. GIRAUD'S THERMO-ELECTRIC BATTERY.

rangement of the elements, prevents all deterioration and insures the battery an almost indefinite durability.

The stove represented is composed of two distinct parts —viz, the "stove," properly so called, and a jacket q, which surrounds it, with a space B between them to contain the thermo-electric battery. The whole rests upon a base l, preferably mounted upon wheels u, which permit the apparatus to be moved about.

The stove proper, represented in Figs. 6 and 7' is a conical cast-iron fire-pot, of which the bottom is constituted by the movable grate j, which rests upon a cast-iron cylindrical piece k, carried by the base l; m is a hollow cylinder of cast-iron, situated above the pot and serving with it, to contain the incandescent fuel, and n is a slightly conical fuel reservoir situated above the cylinder m. The cylinder m is of a diameter somewhat smaller than that of the bottom of the fire-pot, so that there is an annular opening v' between them, interrupted only under the mouth o of the smoke pipe, where there is a horizontal flange n', which rests upon the top of the pot. The cylinder m has upon its exterior a series of vertical radial ribs m', the outer edges of which fit to the external cylinder e, which constitutes the exterior wall of the stove proper. This cylinder e and the jacket B both rest on a gallery k', provided on the exterior of the lower cylindrical piece k on the base l. At the top of the cylinder e, reservoir n, and jacket q, which are all carried up to the same height, there is an annular cap plate s, which covers the space between the cylinder e and the reservoir, and that B between the cylinder and the jacket q, and in this cap plate is provided an annular sand-channel for the reception of the edges of the cover s' of the reservoir n, which cover is removable for charging the reservoir with fuel. The cap plate is also provided with a larger removable cover s^2, which also covers the annular space provided between the exterior e of the stove proper and the jacket q to receive the battery. This larger cover is of spider form to permit the escape of air and heat from the annular space.

In this stove the gases of combustion pass from the fuel in the pot i and the lower part of the cylinder m through the opening v' and circulate within the space between the exteriors of the cylinder m and reservoir e and the interior of the cylinder e and pass out by the smoke pipe o to the atmosphere, the circulation, first upward and then downward, being produced by the ribs m' and flange n'.

The gallery k', before mentioned as surrounding the cylindrical piece k and as supporting the cylinder and jacket q, also supports the battery elements. This gallery has in it numerous holes r' for the admission of air to the annular space B between the cylinder and jacket, and the cap plate s has in it numerous small holes for the escape of air from the space. The extremity of each electrode a which is intended to be heated is first plunged into a plaster made of pulverized amianthus and silicate of soda or silicate of potash, preferably silicate of soda, and is then inserted into a little cup c, which may be made by stamping out of sheet metal. This cup serves not only to prevent the metal of the electrode from fusing externally, but also to spread the heat equally around the sides of the end which is to be heated. The plaster of silicate of soda or silicate of potash and amianthus indicated by d in Figs. 2, 3 and 4, contributes to assure the electric insulation at the same time that it produces the adhesion of the electrode to its cup c. The cups c, electrically insulated from the external wall or cylinder e of the stove by a sheet of amianthus paper f, are cemented to the wall or cylinder by means of the plaster of silicate and amianthus. The different horizontal tiers of cups c are insulated one from another by rings or washers of amianthus paper g, Figs. 3, 4 and 5, and between the vertical faces of the cups of the same horizontal tier there are also interposed small pieces of amianthus paper h. Any other insulating material, as for instance mineral wool, may be employed; but the amianthus paper gives very good results.

The external portions of the battery elements are cooled by a current of air, which, entering through openings provided in the base l, passes through the holes r' of the circular gallery k', and through the three spaces left around each element, finally escaping after having been heated, through the holes in the cover s. This circulation of air takes place over all the surfaces of the portions of the elements which require to be cooled, including the vertical exterior face, because there is a certain amount of space left between this space and the jacket q. To favor the cooling, this jacket is blackened inside and outside.

With the construction of the stove represented in Figs. 6 and 7 the gases of combustion pass more or less directly to the chimney. It results therefrom that the higher portions of the battery are less heated than the lower portions and furnish a current less intense than the latter. The utilization of the combustible will then be better and the electric result be augmented if the gases remain a long time within the space between the reservoir n and the cylinder e and are obliged to rise to the upper part of the stove. This effect may be obtained by interposing between the reservoir n and cylinder e an additional cylinder v, serving as a baffle. In this construction, which is represented in Fig. 8 of the drawings, the gases of combustion, arriving at the exterior of the winged cylinder m, rise between the reservoir n and the additional cylinder v, which may be made of cast iron or sheet iron, passing through orifices v' in the upper part of the cylinder, descending through the space between the cylinders v and e, and escaping by the smoke-pipe o after having lost the greater part of their heat. In this example the horizontal flange n' of the winged cylinder m, as shown in Fig. 6, must evidently be suppressed, as the additional cylinder v serves the same purpose and in a much more efficacious manner.

Besides the above mentioned advantages, the additional cylinder v prevents the melting of the elements by any sudden increase of heat which may take place at the level of the hottest portion of the incandescent fuel.

It is obvious that instead of employing in the stove a solid combustible—such as coke or coal, a liquid or gaseous combustible may be employed. The stove represented in the cuts may be heated by gas or other hydrocarbon liquid by simply taking out the grate and introducing in its place suitable combustion apparatus.

Electricity at the World's Fair.

Many manufacturers of electric motors are endeavoring to secure permission from the exposition authorities to allow them to sell motors to exhibitors during the exhibition. The World's Fair people will not consent to this, however, and the motor men must make their contracts with exhibitors outside of the exposition grounds.

The contract between the World's Columbian Exposition company and the Electric Launch & Navigation company has been signed. The stockholders of the latter company are greatly elated over the decision of the United States Court of Appeals sustaining the Brush storage battery patents.

Especially designed incandescent lamps will be used by the Westinghouse company for the World's Fair. Many of them will be keyless, with a switch in the socket so arranged that the light can be turned on or off by a quarter turn of the lamp. There is no brass on the lamp, the butt being of glass.

One of the most attractive features of the horticultural building will be an artificial hill under the great glass dome. This dome is 187 feet high, and even the largest of conservatory palms would look small under it if rising from the floor. The hill will be about seventy feet high, and consist of earth and boulders supported on a strong timber framework, which is now building. It will be laid out with winding walks amid plants and flowers. On the top will be several giant palms, and the whole will have a very fine effect. But the exterior will not be the only feature of the bill, for it will contain a large cave. This cave will be lighted by 800 incandescent lamps, and will be almost as light as day. In here plants will be shown growing by electric light, and it is proposed to make a number of experiments upon the effect of electric illumination on vegetation.

Unless the Chicago council committee on streets and alleys south favorably considers an application of the World's Columbian Exposition for permission to string wires on certain Hyde Park poles, the telegraph service during the dedicatory exercises will be limited. An ordinance was introduced in the council asking permission to string wires on poles of the Hyde Park Electric Supply company. It was referred to the committee on streets and alleys south, and the matter is still unsettled.

Litigation over Storage Battery Patents.

The latest decision in the litigation over storage battery patents was handed down in the United States Circuit Court of Appeals for the Second District of New York, October 4th, in the case of the Electrical Accumulator company against the Brush Electric company. The case was an appeal from the decree of the Circuit Court for the Southern District of New York, enjoining the Accumulator company from infringement of the seventh and fourteenth claims of patent No. 266,090, dated October 17, 1882, and of the first, second, third, sixth, seventh and twelfth claims of patent No. 337,299, dated March 2, 1886, granted to Charles F. Brush for improvements in secondary batteries These cases had been heard by Judge Coxe, who had written three opinions on the points involved. It was on appeal from these decisions that Judge Shipman handed down his opinion, in which he says:

The improvement described in No. 337,299 was confessedly an improvement upon the Plante battery and upon no other. * * * * Brush's secondary battery is Plante's secondary battery improved, and his language is to be read in the light of that fact, and the fact that he was speaking only of a current storing device. It, therefore, serves no useful purpose to show that the Brush patent was anticipated, because some pre-existing scientist had described a battery which corresponds with the general phraseology of the claims, provided their language should be so construed as to include the class of batteries which has been mentioned, a construction which is forbidden by the history of the invention and a disinterested examination of the patent.

Respecting No. 266,090 the decision says: Upon the strength of the clause, "In any manner provided with active coating," which slipped by the scrutiny of the Patent Office it is now insisted that the general language of the various claims covers a plate in a secondary battery provided with an active coating electrically formed or mechanically applied. The literal language of the claims is broad enough for such a construction, but it would be obtained by an undue enlargement of the meaning of an amendment, the effect of which was not appreciated by the examiner. Mr. Brush has obtained all to which he is entitled by construing his patents for improved form of plates in the order and system in which they were originally presented to the Patent Office. What the construction ought to be, had different inventors taken these progressive steps, it is not necessary to inquire, but when one inventor makes a generic invention and also subordinate specific inventions, and presents the whole story in a set of contemporaneous applications, the patentee must not be enabled, by an ingenious use of general terms, to enlarge the boundaries of each invention, to extend into the borders of another, and obtain a series of overlapping patents. This construction is narrower than that permitted by Judge Coxe, who found an infringement by the defendant (Accumulator company) of two claims only. As construed by this court there is no infringement of No. 266,090.

The decree of the Circuit Court will be modified in accordance with the directions herein contained, with the costs of this court to the appellant. In other respects the decree will be affirmed.

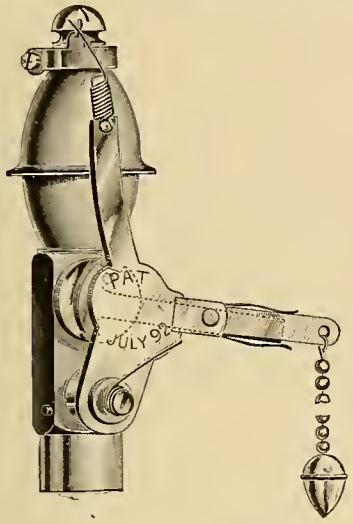
Steffens' Tachyscope.

During the last year the daily papers and technical journals have been telling stories about the efforts of inventors in this country and abroad to produce a machine that would represent photographically, so to speak, figures in motion, such, for instance, as pugilists fighting, soldiers marching, a rider on horseback, etc. It was asserted that a foreigner had built a machine that would produce the effects satisfactorily, and Mr. Edison, it is said, has also announced to his many confiding admirers that if they would wait until the World's Fair opened he would show them what could be done in this line. Mr. Edison promises, it is understood, to throw on a screen a photographic representation of prize fights, with the pugilists striking, parrying, feiting, etc. Few, though, have seen these machines, and it is a question whether any of those referred to operate in a thoroughly satisfactory manner. It seems, however, as though it has remained for a Chicago man to introduce an apparatus of the kind referred to, and one that is very near to perfection. Visitors to Chapin & Gore's restaurant on Monroe street, Chicago, are now having their curiosity aroused by a mysterious-looking cabinet that stands to the left of the cigar counter in the barroom. In general appearance the cabinet reminds one very much of an oak finished wardrobe, except that its front is railed in and about head high on its front there is suspended from a brass rod, bent outward so as to inclose a semicircular space of about the size of a man's head, a short curtain of blue velvet. This curtain covers the only visible opening to the mysterious box, and it is behind this screen, with all external light excluded, that an observer may view through a lens-covered porthole an effect that is simply wonderful.

Dropping a dime in a slot an observer waits but a few moments when with a whirring noise the machinery starts. It is not an easy matter to describe what can be seen by the aid of this remarkable piece of stereoscopic apparatus. A personal inspection is necessary to enable one to appreciate fully the realistic manner in which a horseman is represented riding along a boulevard. Every motion of man and animal may be clearly seen. The movements of the rider's body, hands, arms, legs and feet, the motion of the bridle, every step of the horse, and even the dust stirred up by his hoofs, and what is most astonishing of all, every movement of the muscles in the horse's flank—all this is clearly depicted photographically. In fact the effect should be described as a photographic one in which all live figures are shown as they would appear in real life.

To the electrical man the inside of the cabinet is most interesting. One naturally expects when the door is opened to see much complicated machinery, but on the contrary the arrangement is quite simple. Essentially the apparatus consists of a large wheel, driven by an electric motor, carrying on its outer edge twenty-four photographic

transparencies. These pictures are a series of photographs instantaneously but successively taken so as to show in the proper order every successive movement of the object. It may be explained that the views of the horse and rider already referred to are such as might be obtained by placing twenty-four cameras in a line along a race track and arranging a thread, or an electrical connection, so that the horse as it came directly before each camera would spring the shutter and expose the plate. These twenty-four pictures are attached to the rim of the wheel in such a manner that when the wheel is revolved the pictures pass in rapid succession before the lens-covered porthole through which the observer is gazing. On the rim of the



NEW ELECTRIC GAS BURNER.

wheel, beneath each picture, there is a metal pin. As each picture comes before the lens, the pin at this point on the wheel brushes over a spring clip and breaks the secondary circuit of a large induction coil, producing a vivid spark or flash of electric light. With the wheel revolving rapidly and the flashes being instantaneous and occurring just at the moment when each picture is centered, so to speak, before the observing lens, the result is that the eye sees but one illuminated picture in which the live figures appear in motion.

This "tachyscope," which was developed by M. J. Steffens and E. E. Flora, Chicago, was designed as a coin operated machine. Dropping a coin in the slot has the effect of starting the motor for driving the wheel at full force, and then when the proper speed is attained of automatically reducing the current to suit this speed. Current for the spark coil is obtained from three storage cells.

Accident at Sioux Falls.

By an accident at the station of the Sioux City Electric Light company all the lights in that city were instantly extinguished on the night of September 22d. The *Sioux City Journal* gives this graphic description:

The accident occurred to the center engine. The big drive wheel, 11 feet in diameter and weighing three tons, was running at the rate of 210 revolutions a minute when the belt leading from it to the shaft wheels through which the power is transmitted to the dynamos, came off. The belt gathered about the shafting, and the wheel, relieved of the strain upon it, tore around at an alarming rate. The belt was thrown about with it, and catching in the machinery of the engine, tore the governors off. The engine then went beyond the control of the workmen, and the immense drivewheel tore through the air at such a rate of speed that it fairly churned the air in the room and caused it to send tool boxes, chairs, etc., whirling in every direction. In less time than it takes to tell it the centrifugal force created by the rapid revolution of the wheel was such that there was not sufficient strength in the great steel spokes of the wheel to resist it and hold it together, and it burst with a deafening report. Huge pieces of the wheel flew out on a tangent from the shafting. Four pieces went up through the roof, thirty feet above, tearing great holes in it, and lighted far outside the building. Two pieces weighing upward of 100 pounds each flew off to the north of the shafting. One struck the heavy brick wall about five feet above the floor and tore a hole completely through it. The other struck the wall nearer to its base and where it was stronger, but its force was only sufficient to drive it about half through the wall. The force of the pieces flying off to the south of the wheel was broken by a large fender built around that side of the wheel to protect it. The fender was torn to pieces, though, and one of the pieces struck an iron feed pipe, conveying the steam from the boiler to the engines, which is about a foot in diameter, and protected by a heavy coating of paper. The velocity of the piece was such that it tore a great hole through the pipe. Another piece found its way up among the wires in the roof and tore them apart, so that a short circuit was formed on the dynamos supplying the arc circuits. This sent the shaft wheels in another part of the house off at an alarming rate and another huge belt slipped off. Fortunately this belt was thrown away from the engine in the southwest corner of the room, or it, too, might have been torn to pieces, and great havoc wrought. In the meantime the great belt on the shaft of the center engine was being whizzed through the air at a tremendous rate of speed. Every time is was carried down into and out of the drive wheel pit it struck the heavy floor of the room and dashed the boards nearest it to splinters, which were thrown to all parts of the room. The flooring for a considerable distance from the wheel was torn up by the belting. Andrew Belt, one of the engineers, who was working near by, saw the belting when it came off, and realizing the danger the men working in the building were in, made a race through the shower of splinters being thrown up by the belting, and directly toward the bursting wheel for the cut-off valve and succeeding in reaching it and cutting off the engine's steam supply and escaping injury by a miracle. During all the time he was in the room the steam was escaping from the hole in the feed pipe in clouds.

California Electrical Society.

The California Electrical Society of San Francisco, opened the season on October 3d. George P. Low, electrical inspector of the Pacific Insurance Union, who has lately made an extended tour of investigation throughout the Northwest, made an address on "What the Electrician Finds of Interest in Eastern Oregon and Washington," illustrated by photographic views.

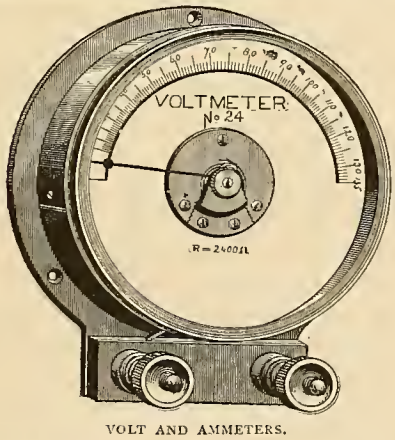
At the next meeting Mr. Low will deliver an address upon a kindred subject entitled: "What the Electrician Finds on the Northern Pacific from Spokane to Portland."

A New Electric Gas Burner.

Illustrated herewith is the Iona safety pendant burner, which possesses several novel features. In this burner there is but one contact made in lighting and extinguishing the gas. This result is accomplished by the wipe spring passing over the electrode on its return from the lighting pull, and on the off pull, by a very ingenious arrangement of the valve cam, the electrode is not touched at all. The on and off pulls are decidedly different, and one can readily tell even in the dark whether the gas valve is open or closed. There is no possible danger of mistake on this point. These burners are made in the best possible manner, the valves being hand ground and always perfectly tight. The movements are simple and positive, and there is no ratchet or complicated springs to get out of order. This burner is being placed on the market by the Redding Electric company, Boston.

Volt and Ammeters.

The Electric Engineering & Supply company of Syracuse, N. Y., is manufacturing and putting upon the market ammeters and voltmeters of the magnetic vane type, the principle being that of magnetic repulsion, which is controlled by a spring of great permanency by means of a large air vane of aluminium. The general type of these



VOLT AND AMMETERS.

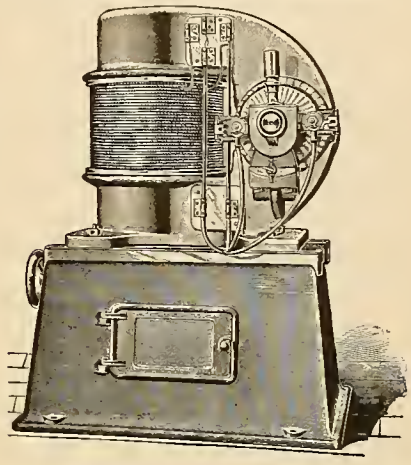
devices is shown in the cut. These instruments are made quite dead-beat, and the pointer in them will come to rest much quicker than in the ordinary instruments of this class. The pointer is furnished with a good sized black dot to render the reading of the instrument possible at quite a distance. High resistance is aimed at in the voltmeters, and low resistance in the ammeters. With a fine finish and an accuracy unexcelled by the commercial instruments, these meters are worthy of a position upon the finest switch boards, as well as being suitable for portable work.

Packard Motors and Dynamos.

In this type of machine, illustrated in the accompanying cut, the field is built up of wrought iron bars held in place and shaped by a coating of soft cast iron. The wrought and cast iron unite and form one solid mass, and there is thus secured a very strong magnetic field by the expenditure of a very small amount of electrical energy. There is but one field coil wound upon a movable spool, and but one joint in the magnetic circuit of the machine. The construction is such that the removal and replacement of the field coil is extremely simple.

The armature is of the drum type, built up of thin disks securely fastened to a shaft made of the best grade of machinery steel of greatest diameter in its central part. The winding is the modification of the Siemens method, and the armature is so proportioned that there is very little idle wire over the ends.

The commutator is constructed of a large number of sec-



PACKARD MOTORS AND DYNAMOS.

tions of pure, hard copper insulated throughout with mica.

The manufacturers claim, as a point in favor of these machines, freedom from sparking at the commutator. The brushes, having been once set at the non-sparking point, require no shifting under extreme changes in load. The magnetism of the field is so powerful relatively to that of the armature, that no distortion of the lines of force is produced, and consequently the line of communication remains unchanged regardless of changes of load.

Self-oiling boxes are used on all the Packard motors and dynamos. All Packard machines, both motors and dynamos, are mounted on a hollow cast iron base fitted with a door and designed to be used as a closet; they are also provided with a belt tightener, and are insulated from the base by hardwood.

These machines are made by the Packard Electric company, Warren, O.

CORRESPONDENCE.

New York Notes.

NEW YORK, October 8.—It now looks as though the trolley would not after all gain an entrance into New York proper for to-day Mayor Grant sent a message to the board of aldermen approving eight of the surface railroad extension franchises recently granted by the board, and asking the aldermen to recall the resolution authorizing the extension of the Crimmins' syndicate's lines on Ninth avenue. It was on this extension that the use of the trolley system was proposed. This action is looked upon by the opponents of the electric system as a practical assurance that the electric system using overhead wires will not be permitted. The mayor has approved the resolutions granting franchises for the extensions and connections asked for, with the exception of that on Ninth avenue. Most of these are so connected with existing lines that the same motive power will necessarily be used that is now used upon them, at least until some change shall be newly authorized for the entire lines. In the case of the Lexington avenue extension, both the consents of property owners and the resolution of the board of aldermen specify the cable as the power to be used. In the case of the Ninth avenue extension the mayor returns the resolution for such modification as shall exclude the use of the trolley. In view of the demonstration of public opposition and the assurance of the company that its purpose was to use the cable on this line, the railroad committee of the board had already decided to recall the resolution for amendment.

The underground workers are also meeting with difficulties which are delaying the preparation of the detailed plans of the Rapid Transit commission. These plans, it will be remembered, were to be ready about this time, but now word comes that a week or two more will be required in which to finish the work. The delay is due almost entirely to engineering difficulties encountered at various

points along the route. The two chief difficulties presented themselves at Houston street and at Canal street. At Houston street the Broadway Cable Road builders have located one of their power houses, and have excavated under Broadway at that point below the surface of the street. This excavation was a serious and, to some extent, unexpected obstacle to an underground rapid transit tunnel, and it was not fully anticipated when the general plans of the rapid transit road were drawn up and published. The excavation is thirty-four feet deep. The rapid transit engineers have been considering two plans for getting around the difficulty. One plan is to go under the excavation; the other plan is to go around it. Both plans have been elaborated in detail and an approximate estimate of their cost has been determined. The engineers are inclined to favor going under the excavation, but the other plan has its advantages, and which one will be finally adopted will depend on the Rapid Transit commission. Proposals to build the contemplated road cannot be advertised for until the detailed working plans are ready for the inspection of would-be bidders for the franchise. It was said that the working plans might possibly be in shape for final adoption by the commissioners at their next meeting. The commission is scheduled to meet Wednesday. Commissioner Steinway, however, is not back from Europe, nor is John M. Bowers, counsel to the commission, and it is not likely that final action will be taken until their return, which will be within a short time. The bill of sale to be inserted in the newspapers in connection with the advertisement for proposals is practically completed.

Mr. Edison is, of course, all smiles over the recent decision in his favor in the lamp suit. He said to a reporter he had always suspected that he was the inventor of the incandescent lamp, but now he was sure of it. It had taken just twelve years to reach a conclusion, but he guessed the matter was settled now for all.

The decision of the Court of Appeals, handed down October 4th, in the appeal from the final decree rendered by the Circuit Court in the case of the Brush-Swan Electric Light company of New England, complainant, against the Brush Electric company, respondent, was a victory for the latter company. The action was based upon the alleged failure of the Brush company to perform a contract. The decision is as follows:

Inasmuch as we are of opinion that the company had not broken its contract, which was not modified, and that it is, therefore, not in a position to ask for a specific performance by the other contracting party, the particular phraseology in which that party placed its final demand for arbitration seems unimportant.

In our view of the testimony, the complainant is asking a court of equity to compel the specific performance of a contract which it has not kept, which it cannot truthfully assert that it will keep, and which it apparently cannot help violating, and desires to compel the defendant to furnish it with merchandise which it cannot pay for, and the ultimate payment for which it cannot attempt to secure.

The decree of the Circuit court is reversed, and the bill is directed to be dismissed with costs in the Circuit Courts and in this court.

The difficulty in New York between the board of underwriters and the Edison Electric Illuminating company over the question of grounding the neutral wire is assuming a serious aspect.

The wish of many merchants to illuminate the outside of their places of business, stores, etc., with electric lights for the Columbus celebration has brought home forcibly the notice of the board of fire underwriters issued six months ago that after October 1st no equipment for electric lighting would be approved by that board where the grounding of the wires was any part of the system. The Edison Illuminating company has disregarded the notice of the underwriters, and refused to change its system. The board of fire underwriters base its determination on the advice of Prof. Henry Morton. The decision of the underwriters, which is in effect the decision of all the insurance companies, prevents any person getting insurance against fire if he has the Edison system in his building, and would vitiate an existing policy if it contains the clause (as all new ones do) requiring the inspection and approval by the board of fire underwriters of all electrical equipments and service used by the insured.

The Edison company looked upon the action of the board as unwarrantable. It is claimed that, should the matter come into the courts, it would rest upon the underwriters to prove that the grounded wire was really a menace.

Assistant Superintendent Harrison of the survey department of the board of underwriters, says: "The company will have to come to our terms. All there is about it is that by the grounding it effects an economy. It can furnish light for less than any other company in the city. But there is an increased risk. We propose to do away with that risk. The insurance companies will uphold us in our action."

The statue goddess, which many people outside of New York have fondly imagined was lighting New York harbor, is at last being properly fitted up. The work of replacing the light on Liberty by one of greater power has been begun by Mayor Heap and a force of electricians. The necessary material has been taken to Liberty Island, together with a large search light and the apparatus for stringing a circle of red lights over the statue's cap. Captain Schley, U. S. N., of the Lighthouse Board, says: "We have begun experiments and will continue them for several days. Everything will be ready for the Columbus celebration The new light will be twice the power of the present one, and a powerful search light will be placed on one of the corners of the fort to illuminate the whole statue. The spikes of the Liberty cap will be gilded and an arc of red lights will be placed just under them."

The American Electro-Therapeutic association opened its second annual meeting Tuesday at the New York Academy of Medicine. About forty members of the association from different parts of the country were in attendance. The meeting was opened with an address of welcome by the president. After this the various standing committees reported and papers were read on subjects connected with the application of electricity in the practice of medicine. At the close of the evening session the members of the association were entertained at the New York Electric club.

W. F. O.

Northwestern Notations.

MINNEAPOLIS, October 8.—The recently reported "combine" of the electrical companies in Minneapolis is not yet officially announced, but there seems to be no doubt that the combination has been effected. The Minneapolis General Electric company is doing business and getting permits for wiring.

The Faribault, Minn., city council has authorized a contract with the Consolidated Gas & Electric company for lighting the city. There will be twenty-five lights, to run all night.

The money has been raised for building an electric street railway at Everett, Wash. and also for electric lighting.

L. Marion, formerly superintendent of the Winona, Minn., street railway system, now has general charge of the new electric light, power, and railway plant at Fond du Lac, Wis. Three miles of track have already been equipped.

At Great Falls, Mont., the electric light company has contracted to furnish the city thirty-five lights at $14 per light.

The electric company at Mankato, Minn, has increased its power, and it is likely that electric cars will be running within a year.

The newly organized Commercial Telegraph & Electric Company in Minneapolis has not yet secured its franchise for putting in conduits.

The Twin City Rapid Transit company has 100 men at work substituting heavy steel rails for the old T rails between the Washington avenue bridge and Oak street, on the interurban line. This will give the line heavy rails from the bridge to Cedar street in St. Paul.

The Cedar Rapids, Ia, Street Railway company is considering the purchase of a snow sweeper.

C. N. Parker has let the contract for the boiler and engines to furnish power for the Brainerd, Minn., car line. Rails and poles for three and a half miles of track have been purchased, and about October 15th work will be begun.

The new electric car line from St. Cloud to Sauk Rapids, Minn., will be ready to run October 15th. There has been delay in getting the cars from St. Louis.

Electric bells are being put into the central high school at Rochester, Minn.

The transfer of the Sauk Centre, Minn., electric light plant from Henry Keller to D. Davidson has been consummated.

Henry C. Payne, president of the Milwaukee electric street railway system, was in Minneapolis the other day and took a tour of the Twin City system in company with Vice-president Goodrich.

There has been some talk in the Minneapolis papers about the need of a central street car shelter, but General Manager Heald says that the scheme is neither practicable nor necessary.

S. H. Wood claims to be going right ahead with his new-fangled motor scheme. He has actually begun work on a factory building at West Minneapolis, which is to be ready for operation March 1st. He has not given his public exhibition yet.

Joseph Willulkern, a former employe, sues the St. Paul Street Railway company for $20,000, on account of injuries received in a collision.

The Northwest General Electric company got the contract for a complete system of arc and incandescent lights for the city of New Richmond, Wis.

The recent pleasant weather has permitted the use of open cars. The closed cars have been painted and otherwise fixed up for cold weather.

The Northwestern Telephone compaay has not yet given up the fight in the Johnson damage case, in which a $3,500 verdict was returned, as the company claimed, through undue influence of jurors.

It is claimed by the Brush Electric Light company that it is being discriminated against in favor of the gas company on the recent city lighting deal in Minneapolis. It is in connection with the change to the all night schedule, and Manager Robertson of the Brush company says that the gas company will gain $50,000 a year by the change.

It is reported, but not formally announced, that the new Cooper-Hampton Electric company will locate its plant in Northwest Minneapolis. The organization has been completed and the following named officers elected: President, John Martin; vice-president, John S. Pillsbury; secretary, Alfred W. Hastings; treasurer, F. M. Walcott; manager, E. D. McMillan; directors, John Martin, J. S. Pillsbury, C. M. Loring, Loren Fletcher, P. B. Winston, S. C. Gale, E. M. Johnson, C. H. Chadbourn, E. D. McMillan, W. K. Morison, C. H. Wood, J. M. Shaw, F. C. Barrows, C. H. Maxcy, J. F. Conklin, C. P. Lovell, William Cooper, A. W. Hastings and F. M. Walcott.

There was a violent electrical storm in St. Paul last Saturday. In the telephone office 200 wires were disabled. Charles Hoppe was struck and killed while driving along the street. Much damage was done by the beating down of the wires. The storm did not strike Minneapolis at all. It visited Stillwater and damaged the dynamos in the street railway power house to the extent of $300.

The St. Paul street railway aldermanic committee and President Lowry have had another long and stormy conference, and it resulted in reaching an agreement which, if indorsed, will settle the Como Park business. Mr. Lowry agrees to have a double track line to Como running by June 1st provided the city will give him a right of way through the park and provide at the lake a pavilion, boats, etc., and maintain attractions. Several large factories have recently been located in the district along this proposed line. If the deal goes through the line will undoubtedly be built to Minneapolis. The daily papers are opposing the deal.

W. E. C.

New England Notes.

BOSTON, Mass., October 8.—The annual report of the Boston fire marshal contains much of interest to electricians. He says: "Electricity has caused its usual percentage of some thing over 2 per cent. of the total number of fires, which, however, shows a larger ratio of loss than those originating from other causes.

"While a considerable majority of the fires during the past five years have owed their origin purely and simply to carelessness, yet 70 per cent. of the entire loss has been classed as accidental. The principal part of this accidental loss is attributed to two causes, electricity and spontaneous combustion, and 70 per cent. of this accidental loss has occurred in wholesale stores and manufactories. Two-thirds of the electric fires have resulted from short circuits, generally caused by imperfect or worn out insulation. During the year several fires have been caused by the burning out of electric car motors, but in no case have the trolley wires been productive of a fire.

"As spontaneous combustion has always existed as a prominent cause of fires the query naturally arises—is the abnormal increase in our fire waste due to the recently introduced agency of electricity? While I must confess myself unable to give any definite or sufficiently reliable answer, the basis for suspicion seems so apparently well-founded that it would seem to be the part of wisdom to adopt every possible method of protection and safeguard for the purpose of lessening the electrical fire hazard. We cannot afford to ostracize this subtle force, which has become one of our most useful servants, and as its use is becoming more and more general every year, our safety from fire must depend upon the exercise of unusual care and insight in installation and maintenance."

It will be noticed that Fire Marshal Whitcomb says distinctly that no fire has been caused by the trolley wire. This statement is of value in view of the threat of the insurance people that they will have to raise their rates if the trolley is introduced in New York. When this system was first put in use in Boston the fire rates were raised, and since that time the insurance companies have made a heap of money, for comparatively no fire losses have been traced to the trolley wire to offset the increased amount of premiums charged.

J. C. E.

St. Louis, Mo.

ST. LOUIS, October 8.—The work of grading the road-bed of the Chicago and St. Louis electric railway at Edinburg, Ill., was begun on the 6th inst. The little town was decorated in holiday attire, the public schools were closed and the local bands were out in full force. A little party of interested capitalists from St. Louis were in attendance at the formal ceremonies. The little daughter of Dr. Wellington Adams turned the first ground with a silver pick. An experienced contractor, with a force of several hundred men, is now at work, and the construction will be pushed right along.

H. H. Humphrey, the electrical engineer, has opened an office in the new *Globe-Democrat* building. In addition to representing the Western Electric company of Chicago, he will do a general business in electrical supplies.

The Southern Railway company, operating an electric railway system on South Sixth street, between St. Louis and Carondelet, has had a number of new motor cars and closed trailers.

William C. Gotshall, late engineer in charge of the building and operation of the electrical railway at Cairo, Ill., has been appointed assistant to William H. Bryan of this city as engineer in charge of the construction of the new 500 horse power steam plant and electric railway, now being installed by the Marshalltown Light, Power & Railway company, Marshalltown, Ia. W. H. B.

PERSONAL.

M. B. Austin, who has severed a six years' connection with the Western Electric company, has allied himself with the Knapp Electrical Works, 54-56 Franklin street, Chicago.

H. S. Rogers, who has for some time been assistant electrician at the factory of the Thomson-Houston company, at Lynn, Mass., has accepted a position with the Eddy Manufacturing company, of Windsor, Conn.

Jay Holmes, of New York, who for the last four years has been in the electrical supply business, has accepted the position of New York representative for the Beacon Vacuum Pump Electrical company, of Boston, with office in the Central building. Mr. Holmes has a large acquaintance among the electrical trade, and is eminently fitted to fill a position of this kind.

On October 1st a complimentary banquet was extended to Albert L. Rohrer, at the Thorndike Hotel, Boston, by sixty gentlemen connected with the Thomson-Houston works at Lynn. Mr. Rohrer was transferred from the Lynn Works to the Schenectady factories some time ago, but still continued his residence in the former city. Now, however, he will remove his family to the Empire State, and reside there permanently.

A. S. Garfield of the mining department of the General Electric company, with an office at Lynn, was recently married to Miss Pauline Hitz of Philadelphia. Mr. Garfield is a son of Secretary E. L. Garfield of the Boston office, and is an intelligent and capable electrician. Last winter he acted as superintendent of the electric drilling plant on a United States government contract at Rock Island, Ill., and it was largely through his energetic efforts that the work there was brought to a successful completion. He has since been developing the work left unfinished by the death of Inventor Charles J. VanDepoele. Mr. Garfield made many western friends at the time of the execution of the Rock Island contract, who will extend hearty congratulations.

NEW INCORPORATIONS.

Citizens' Light & Power company, Rochester N. Y.; capital stock, $150,000; to produce electricity for light, heat and power.

Hearne Electric Light company, Hearne, Tex.; capital stock, $10,000; supplying electric light for streets and houses at Hearne; P. L. Brady, Hearne, Tex.

Citizens' Passenger Railway company, McKeesport, Pa.; capital stock, $30,000; constructing and operating an electric railway in McKeesport, Pa.; W. B. Rodgers, Pittsburg, Pa.

General Incandescent Arc Light company, New York city, N. Y.; capital stock, $250,000; to manufacture, purchase, lease and sell all kinds of electric lamps and other electrical apparatus.

Harvey Electric company, Harvey, Ill.; capital stock, $10,000; to operate, equip and construct street railway, with necessary appurtenances; H. T. & L. Helm, 69 Calumet building, Chicago, Ill.

Hanover & McSherrsytown Street Railway company, Hanover, Pa.; capital stock, $30,000; constructing and operating an electric railway in Hanover, York county, Pa.; G. E. Ehrehart, Hanover, Pa.

Hummelstown Electric Light, Heat & Power company, Hummelstown, Pa.; capital stock, $10,000; supplying light, heat and power to the public at Hummelstown, etc.; F. J. Schaffner, Hummelstown, Pa.

Allen-Hussey company, Chicago, Ill.; capital stock, $10,000; to manufacture electrical apparatus of all kinds, contract, furnish, and put same in buildings; Jones, French & Stone, 720 The Temple, Chicago, Ill.

Reynoldton & Portvue Traction company, Reynoldton, Pa.; capital stock, $18 000; constructing and operating an electric railroad in Reynoldton and Portvue, Allegheny county, Pa.; W. A. Dunshee, McKeesport, Pa.

Ravenswood Electric company, Ravenswood, Ill.; capital stock, $10,000; to furnish electric light and power to residences, shops, stores and buildings in Cook county, Ill.; Walter J. Donovan, 36 LaSalle street, Chicago, Ill.

Pittsburg Land company, Seattle, Wash.; capital stock, $300,000; to buy, sell and improve lands, construct and operate railroads, steamboats, etc., waterworks, mills, gas and electric light works; Eshelman, Llewellyn & Co., Seattle, Wash.

Wichita-Wilder Duplex Electric Burglar Alarm & Messenger company, Denver, Colo; capital stock, $50,000; to sell burglar and fire alarms, messenger service and night watch service under the Wilder Duplex Electric company of New York.

Berkeley Electric Light, Power & Heat company, Berkeley, Cal.; capital stock, $50,000; to establish and operate electric works, generate and deal in electricity, power, gas, light, etc.; Berkeley Electric Light, Power & Heat company, Berkeley, Cal.

ELECTRIC LIGHTING.

A proposition for the introduction of electric light is being discussed by the village council of Reading, Mich.

At a recent town meeting the citizens of Wakefield, Mass., decided not to purchase the local electric and gas plant.

Racine, Wis., people are endeavoring to abolish their present electric light system, and to substitute one controlled by the city.

The Roseburg, Ore., Electric Light company has passed into the hands of a receiver, L. A. Walker, of Portland, now being in charge.

The Chicago City Railway company has installed one Brush arc machine and one 200-light Edison dynamo in its barns at State and Thirty ninth streets.

At Elgin, Ill., the city council has voted to award the extension of the street lighting plant to the Fort Wayne Electric company. The price is $5,578, the company taking the VanDepoele dynamos and lights now in operation.

F. B. Badt, manager of the mining department of the General Electric company, Chicago, closed a contract with the Hamilton Ore company for two 30-arc dynamos and sixty double lamps, together with a steam plant. The plant is for the Biwabik mine, Mesaba range, Minn., and will be installed by the Northwest General Electric company.

An isolated plant of four Edison dynamos—two of 60 kilowatts each and two 15 kilowatt machines—has been installed in the McCormick Harvesting Works, Chicago, by the Chicago Edison company. The factory will be wired for about 3,000 incandescent lamps on the three-wire system. About forty arc lamps will also be installed, the Standard system being used.

The electric light service of Manchester, Mich., is operated by water power, but for some time the light was not satisfactory and recently an inspection was held with a view to locate the trouble. One part after another was examined until finally the water wheel was reached, when it was found to be full of slashed eels, some of which measured four feet and were as large round as a man's arm. They were removed, the water turned on, and now the lamps are burning up to candle power.

A new lighting company has been formed in Rochester, N. Y., to compete with the consolidation of all the old electric and gas companies. The new company will be known as the Citizens' Light & Power company, and it will have a capital stock of $150,000. Among the citizens interested in the scheme are: James W. Gillis, Robert M. Myers, H. Wheeler Davis, Henry D Stone, Isaac Willis, Jonas Jones, P. V. Crittenden, John H. Chase, Ezra M. Higgins, Stephen G. Hollister and Martin W. Cooke.

ELECTRIC RAILWAYS.

Lockport, N. Y., is to have an electric railway.

A fatal accident occurred on the 15th inst. to the fast train from Pontafel to Vienna.

Air brakes have been successfully introduced on the electric street railway lines of Buffalo.

New lines on Pinnacle avenue and Genesee street have been recently laid by the Rochester, N. Y., Railway company.

Shortly before the death of the late Herr Baros, Hungarian minister of commerce, Ganz & Co submitted to him a project for the construction of an electric railway between Budapest and Vienna. The project was, however, returned as being impracticable. Since that time Herr Zipernowsky has been very busy reorganizing the project, and a new plan is shortly to be laid before the present minister of commerce with, it is hoped, more favorable results.

The Cook County, Ill., Board of Public Service committee has concurred in an ordinance giving to the Chicago, Blue Island & Harvey Railroad company the right to construct and maintain an electric or animal power street railway. The ordinance allows the building, maintenance and operation for a period of twenty years of a single or double track street railway on Western avenue, from the south boundary of Blue Island to One Hundred and Forty-seventh street, to the Illinois Central railway, on One Hundred and Forty-fifth street to Leavitt, on One Hundred and Forty-fourth to Leavitt, on Ash to Spaulding avenue, on Spaulding avenue to One Hundred and Forty-seventh street.

Peter A. B. Widener, William L. Elkins, and several Baltimore members of the traction railway syndicate, which operates lines in Philadelphia, Chicago, Baltimore, and other cities, are considering plans for the proposed boulevard and electric railway between Baltimore and Washington. The company has already secured the right of way to Washington. The only difficulty seems to be in settling upon a route out of Baltimore. The present intention is to proceed at once with the surveys and follow the adoption of a satisfactory line by grading and preparing the road. The expense of building both boulevard and electric railroad is so small a sum compared with the value of the investment that there is no doubt of its being pushed with energy.

The Calumet Electric Railway company of Chicago recently endeavored to get Judge Anthony to dissolve the injunction restraining it from crossing the Baltimore & Ohio railroad tracks at Commercial avenue. The attorney for the Calumet relied entirely upon the fact that the city council had granted his client a franchise, and that the route laid out ran across the Baltimore & Ohio tracks at Commercial avenue. No one, he argued, had any right to interfere with the full enjoyment of privileges granted by the city fathers. Attorney Jewett, for the Baltimore & Ohio, told the court that the ordinance provided that the overhead wires should be twenty feet above the surface This would make it extremely dangerous for freight brakemen on high freight cars. The court held his decision in abeyance until the railroad commission could pass on the matter.

TELEGRAPH.

The Postal company has extended its lines to Rockford, Ill., from Holcomb, Ill.

The Western Union company now has over 4,000 stockholders, the largest number ever carried on its books.

The Western Union Telegraph company has brought suit for $5,000 damages against J. DeWitt in the United States Circuit Court at San Francisco. It is charged that De Witt broke the company's wires at Chualar, Monterey county, by driving a threshing machine under them.

The first submarine cable is being laid between France and Algeria. About 15 miles of the cable have been laid from the African coast, and the work is proceeding briskly and satisfactorily.

The English firm of Woodhouse & Rawson has just launched upon the Seine, at Asnieres, an electric boat, L'Eclair. Its first trip was made on August 9th. This boat is 37 feet long, 5 feet 10 inches wide, and has a draught of 16 inches.

The telegraph and express companies are said to be looking forward with great interest to the forthcoming report of the postmaster-general. They fear Mr. Wanamaker may take an aggressive position in favor of postal telegraph and a parcel post. He is known to strongly favor the postal telegraph and to be preparing a recommendation for its use though he doubts the feasibility of the parcel post at this time.

Robert Smith, formerly an operator employed by the Western Union company, was arrested in Cincinnati on October 5th on the charge of wire tapping. His brother John was also arrested. A scheme had been laid to rob two poolrooms. The base of operation was laid in a building on Vine street. In a third story room the instrument was hidden, ready to be used on short notice. The last Louisville race of the date mentioned was the one selected to do the work, but the conspirators learned they were being watched, and the attempt was abandoned.

In the work of receiving and sending messages women do equally as good work as men. They may not be capable of such phenomenal bursts of speed as the male telegraphers, but at the same time extraordinary speed is not so much an element of success or necessity as accuracy and the ability to maintain a fair average rate. They perform really creditable work, and a great point in their favor is their reliability. As yet women have not been successful in the handling of press reports. Day and night the Associated Press and the United Press send many thousands of words to the newspapers in all parts of the country, and the wires are very generally in charge of men. The immense amount of matter to be handled necessitates a very high rate of speed, forty-eight words a minute being maintained for hours at a stretch. A woman's strength is hardly equal to such a task.

TELEPHONE.

It is claimed that Honolulu, Hawaii, has a finer telephone system than any other city in the world.

At the end of 1891 there were 18,191 subscribers to the telephones in France as compared with 11,140 at the end of 1889.

The long-distance telephone line between New York and Chicago has been completed to within fifteen miles of the latter city.

MISCELLANEOUS.

Grand Rapids, Mich., will probably create the office of city electrician.

The directors of the General Electric company have declared a quarterly dividend of 2 per cent., payable November 1st.

At the recent meeting of the Western circuit of wheel-

men at Louisville the track was lighted by electricity, and there was racing in the evening.

An electro magnet at Willett's point, Long Island, is considered the largest and strongest in the world. It is made of two 15-inch Dahlgren guns wound with eight miles of wire.

Sealed proposals will be received at the office of Yost & Packard, architects, Columbus, Ohio, up to noon of October 21st, for furnishing materials and performing labor necessary to erect a partial heating and lighting plant for the Ohio Hospital for epileptics. Plans and specifications can be seen at the office named.

The *Indianapolis Journal* says that one of the great western systems of railroads has placed an order with the electric head-light company, of that city, for twenty-five electric head-lights, and the general manager of the system is negotiating for 150 more, intending to eventually equip all the company's engines with electric head-lights.

Professor Vernon Boys lately lectured in Edinburg, on "Electric Spark Photography." In the course of the lecture Professor Boys explained that by the electric spark articles moving at the rate of 10,000 miles an hour can be photographed, and by the introduction of a revolving mirror a speed of 180,000 miles an hour can be coped with. The mirror makes 1,024 turns every second, worked by electricity, which is equal to about 150 times as fast as a rifle bullet travels. The whole photographic power of the spark is over in a time equal to the ten or eleven millionth part of a second, and it is during that incredibly brief space that the image is made on the sensitive plate.

There is being built across the Colorado river at Austin, the capital of the state of Texas, a massive granite dam, the object of which is to furnish the city with waterworks and electric light and to also furnish manufacturing enterprises with cheap water power. This great structure is being built by the citizens of Austin, who at public election voted to bond the city in the sum of $1,400,000 for this purpose. The dam is 1,200 feet in length, and 60 feet high. It is 16 feet thick at the top, increasing downward and spreading out in a broad toe or apron, making the extreme width at the bottom 50 feet. The structure is being built to allow a depth of sixteen feet of water on its crest.

Within recent years several schemes have been drawn up for the transmission of large quantities of water power to Turin, Italy. Among these there is that of Messrs. Aguidio & Azari, engineers, who have asked for the concession of a large quantity of water power on the Italian side of Mount Cenis. In this scheme it is proposed to generate on the spot and transmit to Turin—a distance of nearly forty miles—for electric lighting and industrial purposes an electric energy of 500 horse power which may be doubled by utilizing the fall of the river Cenischia, which has a minimum of two cubic meters of water per second, falling from a height of over 3,280 feet. The water, which comes from the top of Mount Cenis, now feeds a basin of 60 square kilometers, surrounded by ice. There will be two generating and transmitting stations, each provided with four vertical turbines of 1,000 horse power, each connected to two dynamos of corresponding power. From these stations six large copper wires, supported by special insulated stands, will carry the current to Turin, running parallel with the Susa-Turin railway line, to the electric station in Turin, from where the power is to be distributed. According to the project the estimated cost is put down at $800,000.

TRADE NEWS.

The new work "Trams," by C. B. Fairchild, can be supplied by the Electrician Publishing company. This work has met with a very flattering reception, and should be in the hands of every street railway man.

Manager J. F. McGowan of the Electric Railway Engineering company, 180 Summer street, Boston, Mass., writes that his company has secured a corps of competent engineers and is prepared to do general engineering for the designing and construction of power plants for electric railways, lighting and other stations, also steam plants and water powers.

The Clark Electric company, New York, illuminated its offices with the Clark system of arc lighting during the Columbus parade on Wednesday night. The light could be seen as far down Broadway as Trinity church and Wall street, and the entire length of Dey street. Since Friday of last week the company has displayed one of the finest American flags on Broadway, from the front window of the office. This company has established a very high reputation for its arc lighting system, and it is stated as a fact that its apparatus invariably gives perfect satisfaction to the purchaser. The company is meeting with great success in New York with its handsome arc lamps for incandescent circuits.

BUSINESS.

Those in the market for standard electrical goods and improved electrical specialties should lose no time in writing to the Partrick & Carter company for its new catalogue.

Secretary F. W. Davis of the Perkins Electric Switch Manufacturing company of Hartford, Conn., reports that his company is very busy in filling orders for electrical supplies. The Perkins company has been awarded the contract for furnishing its dovetail ceiling rosette for buildings at the Columbian exhibition at Chicago.

The Whitney Instrument company, Manchester, N. H., has removed its factory to Pennacook, where it now has increased facilities for manufacturing on an extended scale. The call for the Whitney volt and ammeters has increased so rapidly as to necessitate the present enlargement of quarters. The Boston office is now located at 146 Franklin street and is in charge of the company's treasurer, J. F. Preston.

A very complete catalogue, giving a list of every work on electricity published in the English language to date, has been prepared by the Electrician Publishing company, Chicago, and will be furnished on application. This company carries the largest line of books on electricity and kindred subjects of any house in the West. "Houston's Dictionary," "Trams," a new work by C. B. Fairchild, "Dynamo-Electric Machinery," by Thompson, and all other standard works can be furnished promptly. Catalogues sent free on application.

The Electrical Supply company, corner of Randolph street and Michigan avenue, Chicago, reports an unusual demand for the Stanley transformers. The winning features of these converters being their high efficiency and close regulation, customers are learning to appreciate the fact that the regulation of the transformers bears a very intimate relation to the size of the lamp bill. Another specialty of the Electrical Supply company is the Carpenter electric heating apparatus. The company has received many flattering testimonials from electric railways and manufacturers using them.

The Central Electric company, Chicago, is selling large quantities of Acme lead cables, made by the Okonite company. A large stock is always carried. The pin and bracket mill of the Central company is working full force, and turning out thousands of pins and brackets. These goods are made from second growth white oak, sawed with the grain, making them tough and durable. The company will handle the Ionia porcelain rosette. This rosette was illustrated in the WESTERN ELECTRICIAN a short time ago. The cap is removable, and is replaced by a bayonet catch, and does not require a screw-driver.

"Inventive Progress-Benefits of the American Patent System," is the title of a little pamphlet that has just been issued with the compliments of Wm. A. Rosenbaum, electrical expert and patent solicitor, Times building, New York. Mr. Rosenbaum presents a number of interesting portraits of prominent inventors among, which, it may be stated, is that of Elmer S. Smith, inventor of the American engine. Mr. Smith is now but 39 years of age, but the records of the Patent Office show that he has attained some great results in mechanical inventions. But his greatest achievement is the high speed engine.

Among some of the latest specialties in the introduction of which the Electric Appliance company, Chicago, has built up a nice trade is the "C. S." flush face push switch. This device is being largely used for fine residence and office work, and it is frequently mentioned in architects' specifications. The combination branch block, which takes the place of eight ordinary branch blocks, is also in demand. This branch block is made of one piece of porcelain and is provided with a handsome polished hardwood cover. The Ries regulating socket is another specialty which was first handled in Chicago by the Electric Appliance company; the Ries socket has now become a standard stock article with the Appliance compay.

The Detroit City Street Railway company has let the contract for the electrical equipment of the Woodward avenue line to the Detroit Electrical Works, which equipped the Jefferson avenue line. Not the least consideration which entered into the letting of the contract was the satisfactory manner in which the Jefferson avenue line was equipped. The directors of the company can hardly say enough in commendation of the system now operating on Jefferson avenue. They are pleased beyond measure, and say so without reserve. The Detroit Electrical Works are to furnish the poles, wires, motors, and all other adjuncts necessary for the line, and are to do all the work of putting them in place. All the overhead equipment is to be of a heavier type than on Jefferson avenue. Forty horse power motors of the Detroit type will be placed in each of the twenty magnificent cars ordered by the company from the Pullman Car Works. The contract calls for the completion of the road in forty-five days. With the heavy grooved rail and the magnificent rolling stock ordered by the company, the Woodward avenue line promises to be the model electric street railway of the country. The cost of the Woodward avenue equipment will be about $100,000. Another improvement decided upon is a new car barn on Woodward avenue. The present wooden structure will be torn down, and a commodious brick building will be erected in its place to accommodate the cars demanded by the large traffic of Woodward avenue.

ELECTRICAL PATENTS.

Issued Oct. 4, 1892.

483,545. Electric Fan. Elisha B. Cutten, New York, N. Y.

483,556. Adjustable Electric Light Hanger. Herbert L. Holt, Ellsworth, Me.

483,562. Storage Battery. Edward R. Knowles, Brooklyn, N. Y.

483,563. Storage Battery. Edward R. Knowles, Brooklyn, N. Y.

This storage battery consists of a series of trays or boxes having at each end on the bottom a peaked projection, and at each end at the top an angular groove, the trays or boxes being arranged one on top of the other, and the peaked projections on the bottom of the one tray or box fitting into the angular grooves upon the top of the next tray or box.

483,564. Electro Magnetic Mechanism for Operating Printing Presses. Ernst H. Korsmeyer, Kansas City, Mo.

483,582. Motor Mounting for Electrically Driven Fans. Andrew L. Riker, New York, N. Y.

483,625. Electric Burglar Alarm. Homer T. Wilson, Louisville, Ky.

483,646. Process of Making Artificial Mica Sheets for Electrical Insulation. Arthur H. S. Dyer, Schenectady, N. Y.

483,653. Molding Mica Forms for Electrical Insulators. Charles W. Jefferson, Schenectady, N. Y.

483,654. Galvanic Battery. Harry T. Johnson, New York, N. Y.

This galvanic battery has the exciting agent and the depolarizing agent arranged alternately in horizontally disposed strata within the cup shaped positive electrode.

483,689. Trolley Catcher. John J. Hoppes, Springfield, O.

Consists of a trolley arm having an electric contact device supported by a yielding pressure in contact with an overhead conductor, of a spring mechanism on the arm normally under tension, an independent connection from the spring mechanism to a stationary part from which the trolley arm is supported, and means for releasing the spring mechanism to shorten the connection when the contact is moved to an unusual position.

483,692. Electrolytic Diaphragm. Anton J. Lehman, New York, N. Y.

483,700. Armature for Dynamos and Motors. Elihu Thomson, Swampscott, Mass.

The principal claim is:
"The combination, with the annular magnetic core having one or more notches and filling plugs, and having projections on its inner surface, of the separable coils of a size and shape enabling them to be passed through the notch and over the projections, said coils being secured in place between such projections."

483,704. Electric Switch. David H. Armstrong, Long Island City, N. Y.

483,708. Armature for Motors and Generators. Norman C. Bassett, Lynn, Mass.

483,712. Electric Switch. Axel Ekstrem, Lynn, Mass.

483,713. Electric Snap Switch. Axel Ekstrem, Lynn, Mass.

483,718. Telephone Receiver. Ferdinand Gross, Montreal, Canada.

483,725. Hygrometric Valve Controller. Charles W. Rogers, Chicago, Ill.

483,728. Electric Burglar Alarm. Alfred Stromberg, Chicago, Ill.

Claim three follows:
"In an electric burglar alarm circuit the combination, with a flexible surface, of a series of pliable conducting strips, said strips being folded longitudinally and attached by one of the free edges thereof to said flexible surface, and electrical connections between said strips."

483,729. Armature Winding for Dynamo Electric Machines. Ernest P. Warner, Chicago, Ill.

The third claim reads:
"The combination, with the armature core, of coils wound thereon in uniform relation with respect to the different turns, the two halves of each turn upon the face of the armature being removed from diametrical position by the thickness of the wire."

483,732. Commutator for Electric Machines. Norman C. Bassett, Lynn, Mass.

483,739. Door Lock Switch for Electric Lights. Charles Green, Toronto, Canada.

483,745. Electro Therapeutical Instrument. James W. Moliere, San Francisco, Cal.

483,758. Electrical Heater. Arthur E. Appleyard, Boston, Mass.

483,759. Electrical Heater. Arthur E. Appleyard, Boston, Mass.

483,761. Closed Conduit for Electric Railways. William G. Creighton, Norwood Park, Ill.

483,768. Police Telegraph System. Charles A. Rolfe, Chicago, Ill.

The ninth claim reads:
"The combination of the shunt contacts, the rotary cam provided with stops and arranged for separating the shunt contacts for the purpose set forth, and the shunt relay having its armature arranged to engage one of the cam stops when said armature is in its normal position, and to stand in the path of the remaining cam stop, so as to engage the same when said armature is attracted by the relay magnet."

483,771. Insulator. Albert P. Seymour, Syracuse, N. Y.

483,782. Thermo Electric Battery. Paul Giraud, Chantilly, France.

483,806. Insulated Rivet. William S. Hull, Sheffield, Ala.

483,816. Alternating Current Motor. William Stanley, Jr., and John F. Kelly, Pittsfield, Mass.

The invention consists of a combination of an alternating current motor, of a condenser or its described equivalent in a shunt to the motor, and of a capacity or value capable of neutralizing the self-induction of the motor with which it is associated.

483,822. Electric Locomotive. Thomas L. Willson, Brooklyn, N. Y.

483,844. Burglar Alarm Contact. Nevil M. Hopkins, Washington, D. C.

483,856. Electric Railway. William G. Murphy, Jr., Marysville, Cal.

483,862. Electric Switch. Harry T. Paiste, West Chester, Pa.

483,940. Electric Heater. Fred. B. Perkins and Charles S. Jones, Toledo, O.

483,974. Holder for Incandescent Lamps. Edwin P. Allam, Romford.

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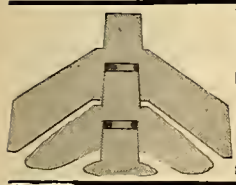

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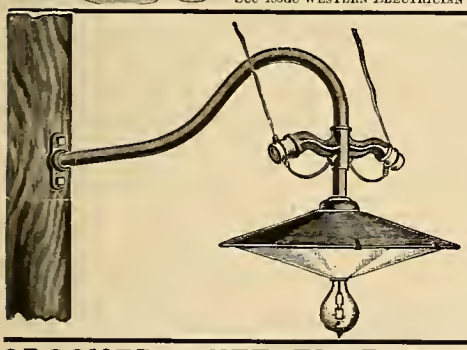

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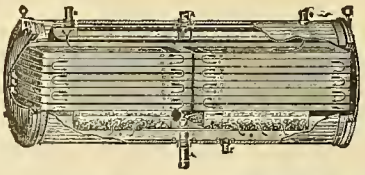

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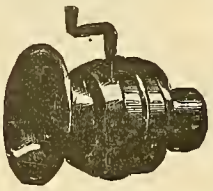

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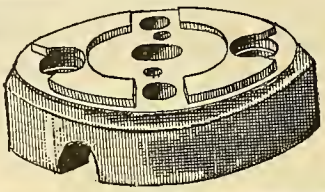

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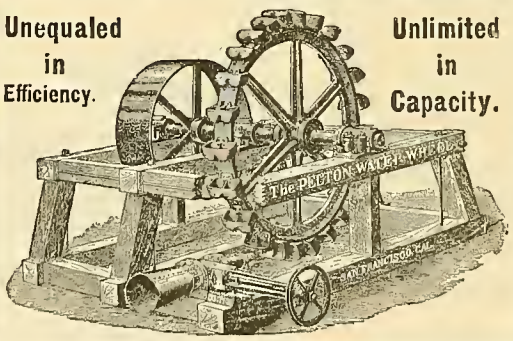

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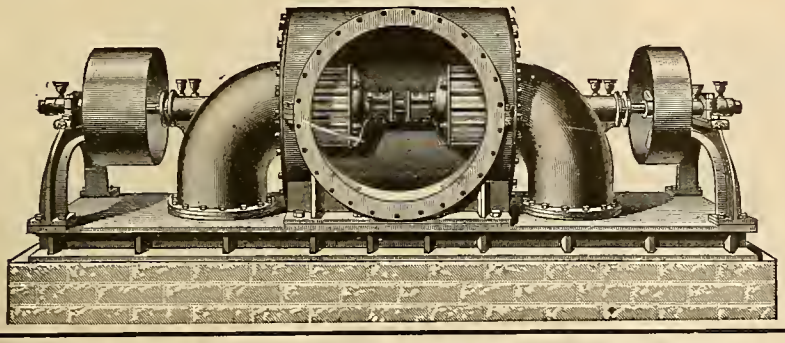

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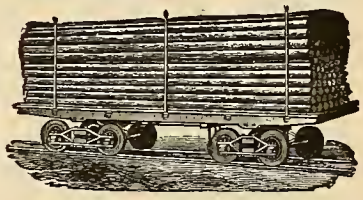

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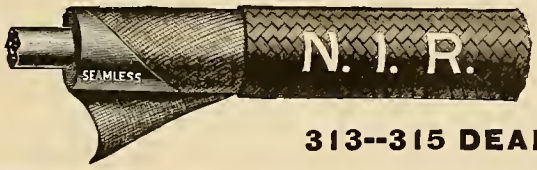

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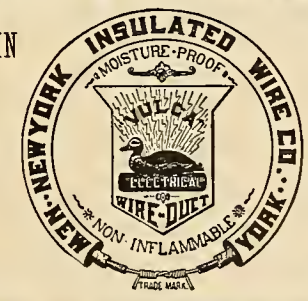

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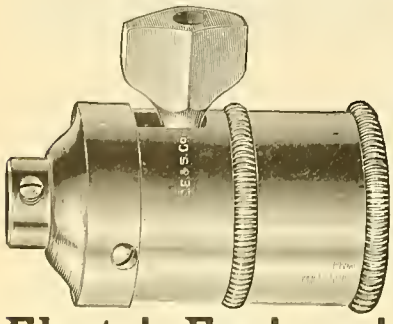

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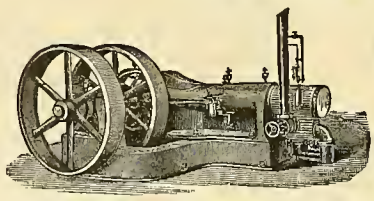

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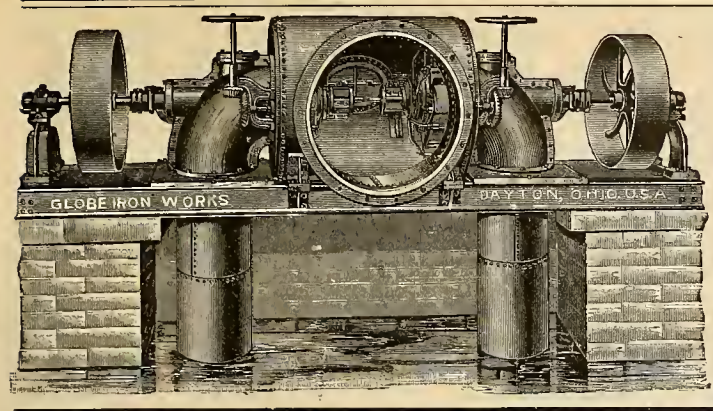

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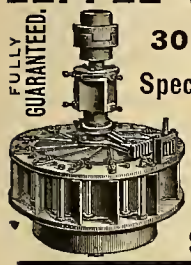

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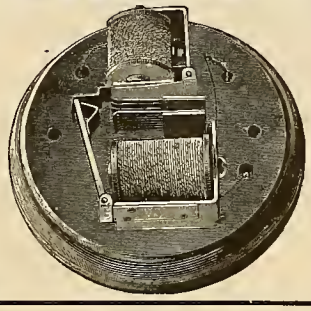

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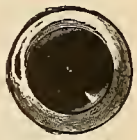

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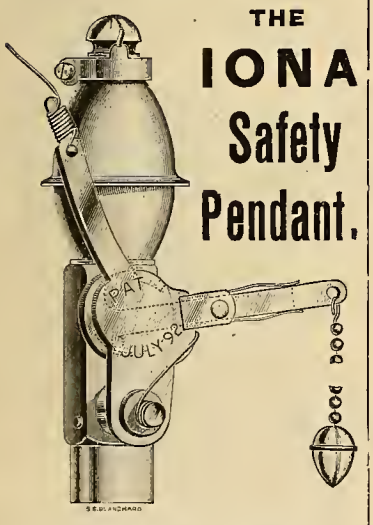

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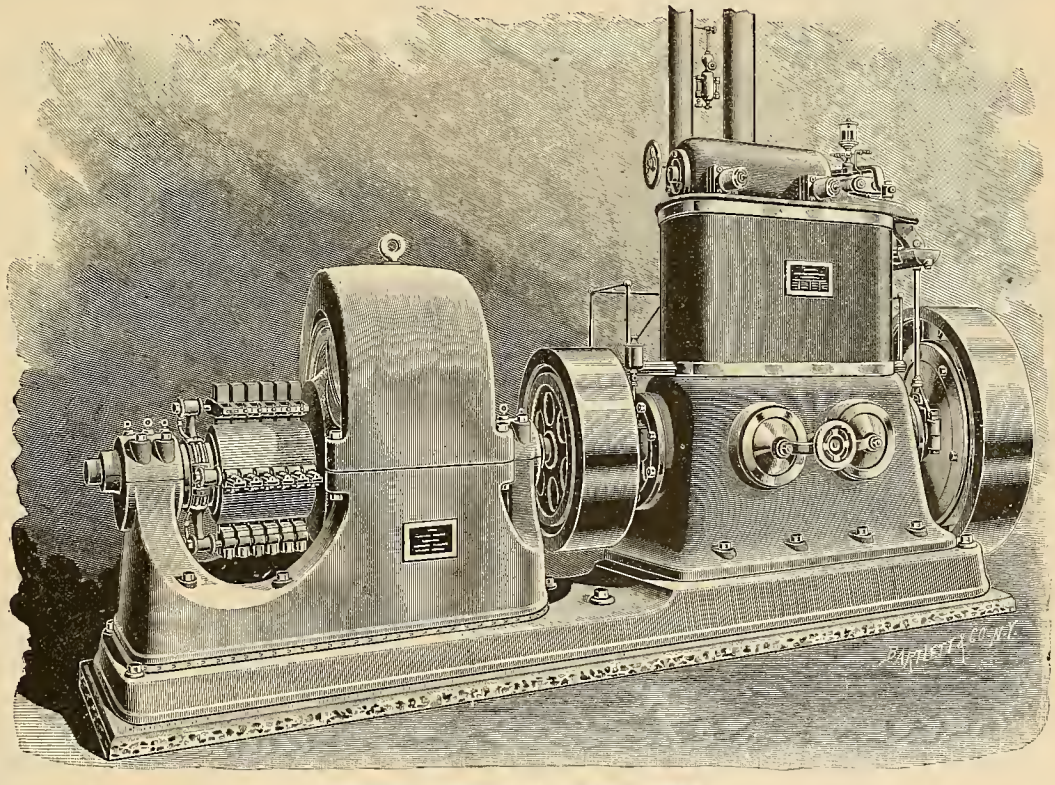

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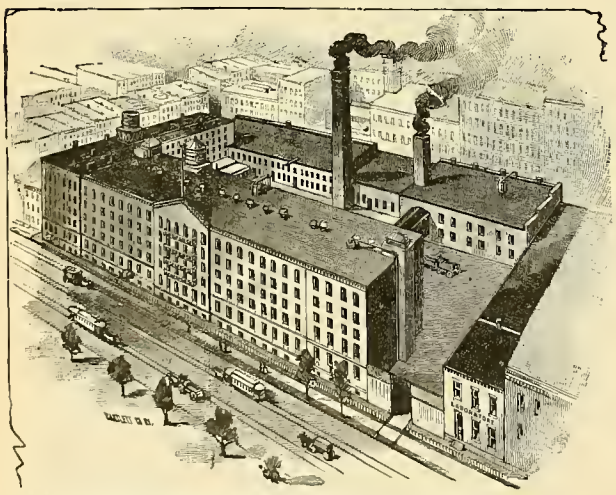

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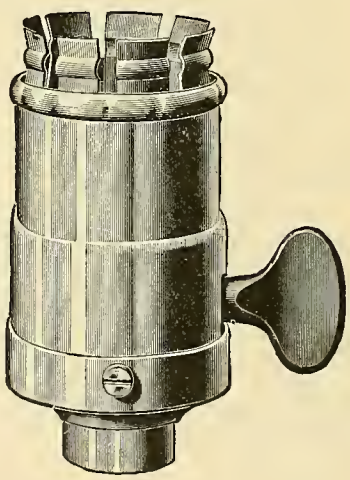

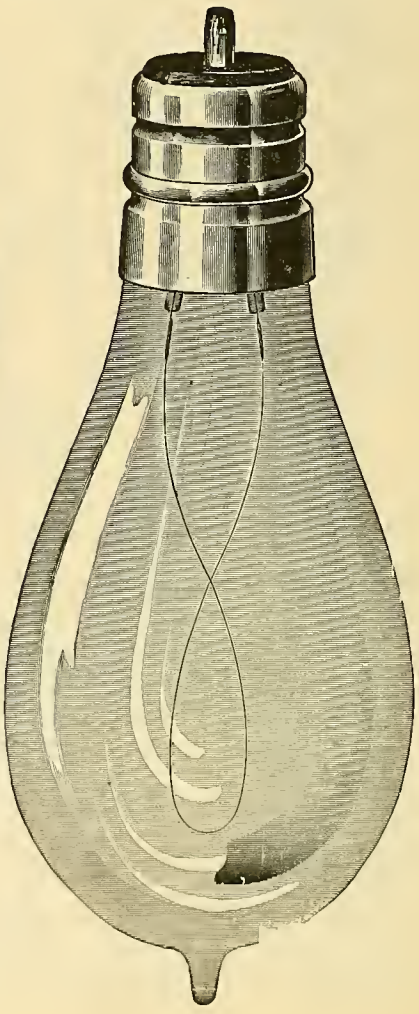

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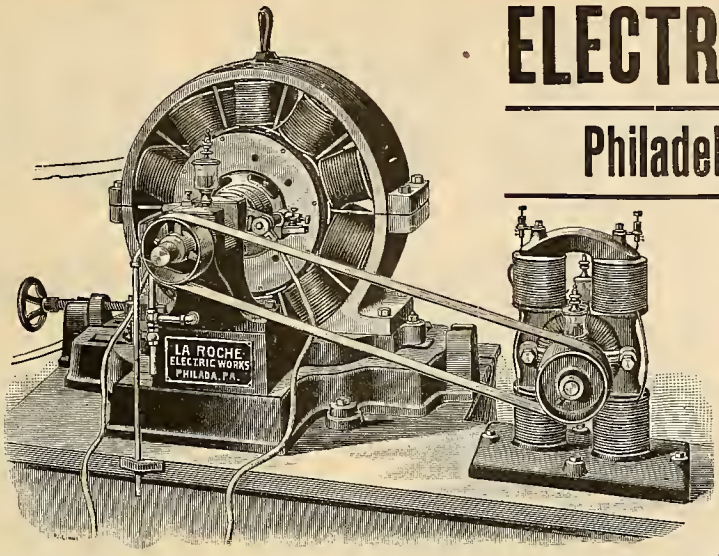

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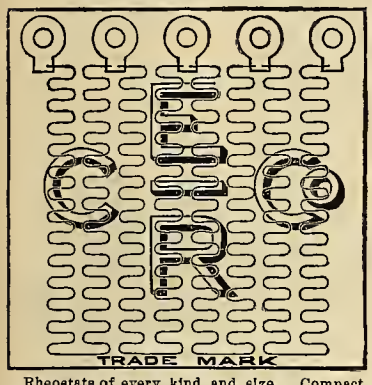

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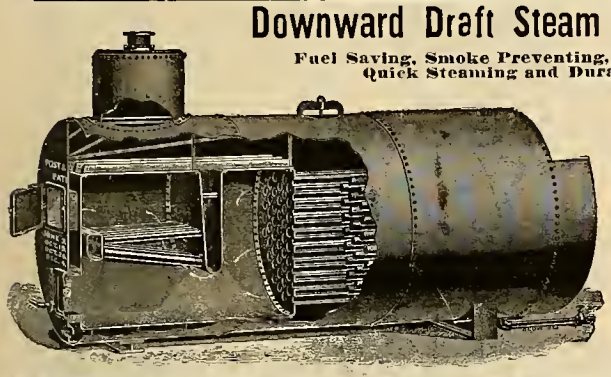

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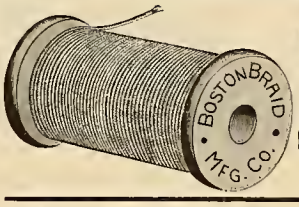

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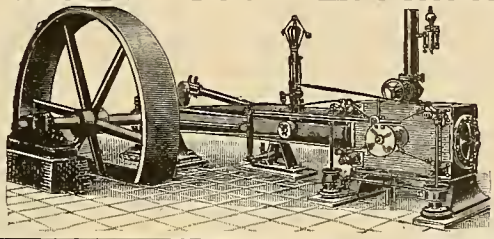

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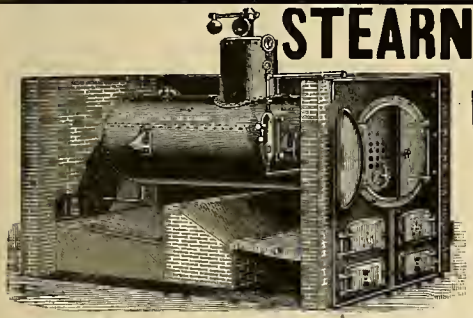

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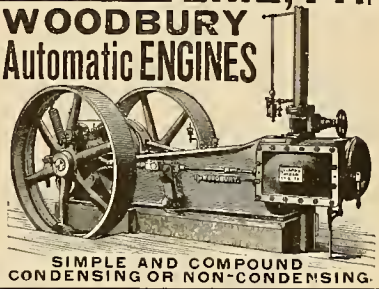

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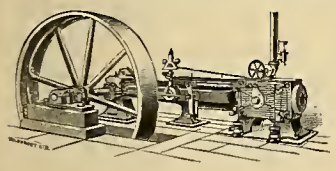

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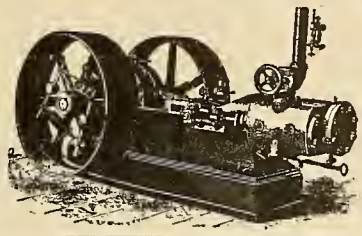

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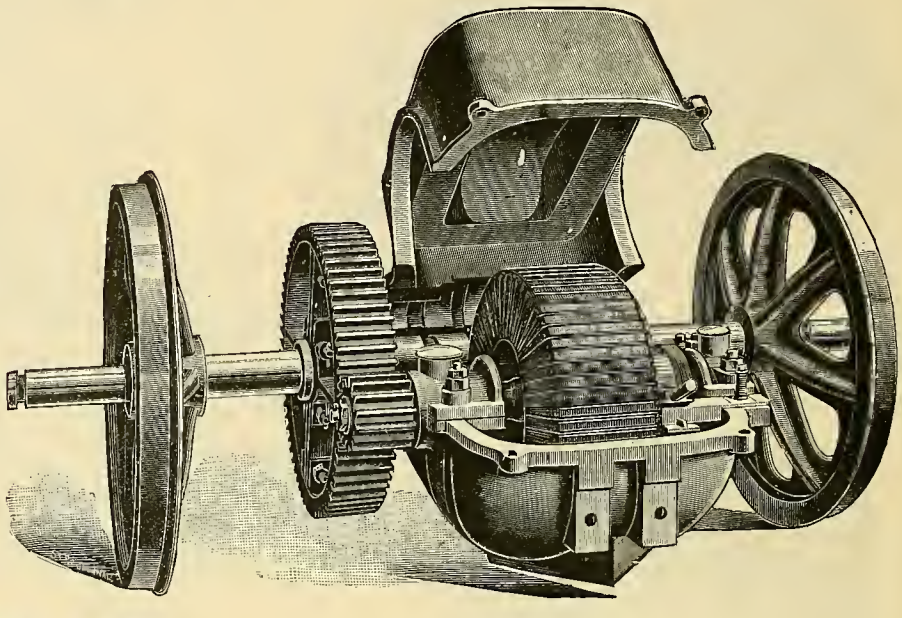

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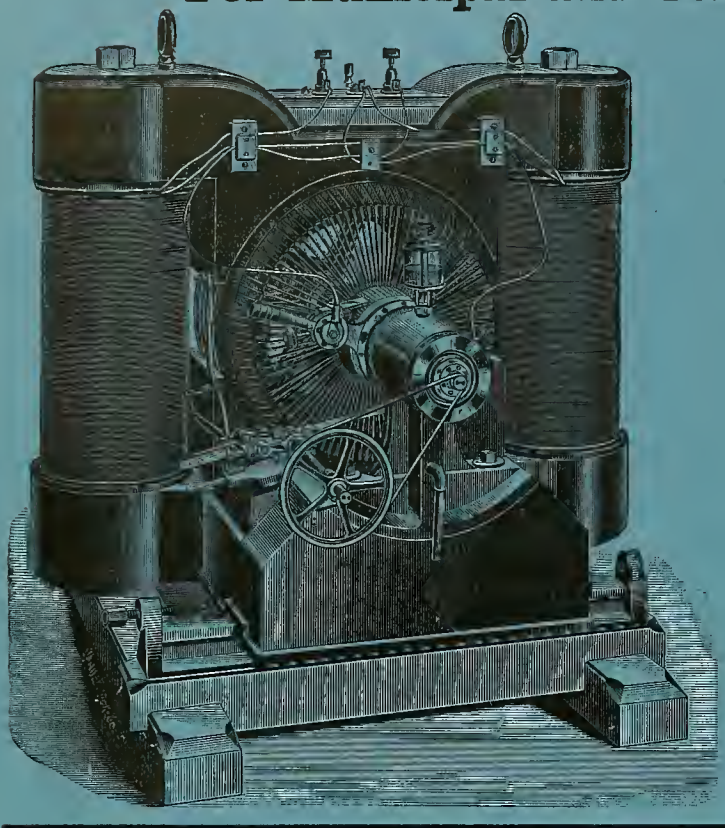

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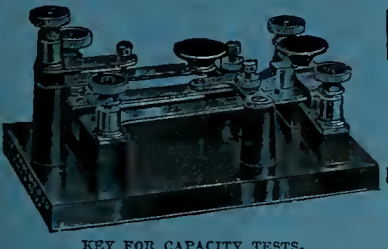

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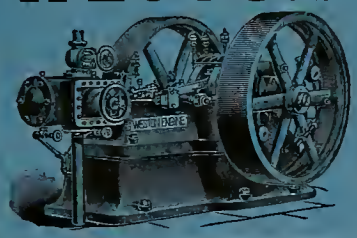

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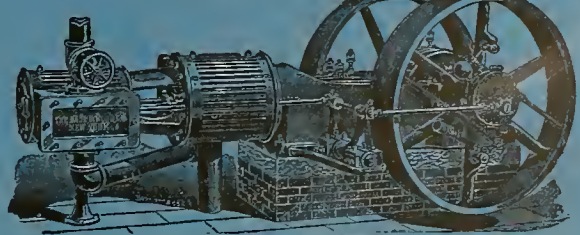

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INDEX AND CLASSIFICATION OF ADVERTISEMENTS.

ALPHABETICAL LIST.

American Battery Co..... xi
American Desk & Seating Co.. xvii
American Electrical Mfg. Co.. xi
American Engine Co..... xiv
Andrews & Co., A. H..... —
Babcock & Wilcox Co., The.... i
Baggot, E..... xvi
Baker & Co..... xiv
Ball Engine Co..... xxiii
Ball & Wood Co., The i
Beacon Vacuum Pump & Elec. Co.i
Becker Mfg. Co., John..... xv
Beggs, J. E., Mch. & Supply Co. xii
Bernstein Electric Co..... xiv
Blanchard, Albert..... —
Boston Braid Mfg. Co..... xvi
Bowers Bros..... xxi
Bradbury-Stone Storage Battery Co..... xvi
Bridgeport Mach. Tool Wks.. —
Brookfield, Wm..... xiv
Brush Electric Co ..... viii, xxi
Bryan, W. H..... xvi
Bryant Electric Co..... xiv
Buckeye Electric Co., The..... xi
Carpenter Enamel Rheostat Co. xxi
Central Electric Co..... v
Chicago Rawhide Mfg. Co..... —
Columbia Inc. Lamp Co..... —
Columbia Mfg. & Supply Co... xv
Crescent Ins. Wire & Cable Co. xv
Crocker-Wheeler Electric Co.. xv
Cushing, F. W..... vii
Cutter, Geo i
Cutter Electrical & Mfg. Co... x
Dayton Globe Iron Works Co.. xix
Densmore Typewriter Co..... xiv
Detroit Electrical Works.... xxviii
Detroit Motor Co..... iv
Diamond Electric Mfg. Co.... xiv
d'Infreville, G..... xii
Dixon Crucible Co., Jos..... xvii
Dudley & Co., W. W..... xxi
Duplex Electric Co., Ltd..... —
Eastern Electric Cable Co..... xv
Eastman Kodak Co..... xvi
Electric Appliance Co..... xiv
Electric Cons. & Supply Co... vi
Electric Engr'g & Supply Co.. x
Electrical Mfg. Co., The..... xvii
Electric Secret Service Co.... xxiii
Electrician Pub. Co x, xviii, xx, xxiii
Electrical Construction Co., The. xv
Electrical Eng. & Supply Co. The.—
Electrical Supply Co., The... xxvi
Elektron Mfg. Co..... x
Empire China Works..... xvi
Enterprise Electric Co..... xvii
Falls Rivet & Machine Co..... xi
Ferracute Machine Co..... xvi
Ford-Washburn Storelectro Co.. xi
For Sale Advertisements. xii, xiv, xv
Fort Wayne Electric Co..... xxviii
General Electric Co.....ii, ix, xxiv
Great Western Elec. Supply Co— —
Greeley & Co., The E. S..... i
Hart & Hegeman Mfg. Co..... xvi
Heisler Electric Co..... ix
Hill Clutch Works..... xxiii
Hine Eliminator Co..... —
Holmes, Booth & Haydens.... xix
Hood & Co., Wm..... xvii
Hughes Bros. Mfg Co..... xv
Ide & Son, A. L..... xv
Illinois Electric Lamp Co..... xii
India Rubber & G. P. Ins. Co. xxvii
Institute of Technology..... xv
Interior Conduit & Insulation Co. xii
International Okonite Co..... i
Jewell Belting Co..... i
Johns Mfg. Co., H. W..... xviii
Kartavert Mfg. Co..... xxi
Klipstein, A..... xv
Knapp Electrical Works..... xxv
Lake, J. H. & D., Co xvi
Lake Erie Engineering Works. xxii
Lane & Bodley Co..... —
La Roche Electric Works..... xxi
Lascll & Co., Edw..... xvii
Leclanche Battery Co., The .. xii
Lefmann, Julius xvii
Leffel, & Co., Jas xix
Link Belt Machinery Co..... xv
Loud, H. M. & Sons Lumber Co. xvi
Mather Electric Co iv
Midland Electrical Wks..... xiv
Moore, Alfred F..... i
Morse & Co., A. M..... xvi
Mosher Electric Co..... —
Munsell & Co., Eugene..... xiv
National Carbon Co..... xvi
National Electric Mfg. Co.... —
National India Rubber Co.... —
New York Insulated Wire Co. xvii
N. Y. Safety Steam Power Co. xii
New York & Ohio Co..... i
Otto Gas Engine Works..... —
Ostrander & Co., W. R..... xxiii
Page Belting Co..... —
Partrick & Carter Co..... x
Pearson & Co., W. B..... xxii
Pelton Water Wheel Co..... xix
Penn. Electric Engineering Co. xii
Perkins Elec. Switch Mfg. Co. xix
Phoenix Glass Co..... xxiii
Porter-Leavitt Elec. Motor Co. xv
Queen & Co..... xv
Racine Hardware Mfg. Co..... —
Railway Equipment Co..... iv, xi
Redding Electric Co..... xix
Ries Electric Specialty Co..... xii
Roehling's Sons Co., J. A .... —
Rose Elec. Light Supply Co... xiv
Samson Cordage Works. xiv
Sawyer-Man Electric Co..... xiii
Schuyler Electric Co..... ix
Sechrist, Albert..... xix
Shawmut Fuse Wire Co..... xii
Shultz Belting Co..... x
Siebert, G..... —
Siemens & Halske Electric Co. vi
Sioux City Elec. Supply Co... —
Sioux City Engine Works.... xxiii
Smith, A. T..... —
Smith, Thos. G. Jr..... —
Somoff, J. L..... —
Sperry Elec. Mining Mach. Co. xxi
Standard Electric Co..... vi
Standard Paint Co xii
Stanley Electric Mfg. Co..... v
Stearns Mfg. Co..... xxiii
Steuben Lamp Works..... xv
Sterling, W. C..... xvii
Stilwell & Bierce Mfg. Co. xvi, xvii
Sunbeam Incand. Lamp Co.. xxvii
Taylor Engine Co..... —
Union Hardware Co..... xiv
Utica Elec. Mfg. & Supply Co. xii
Van Nuis C. S..... i
Vulcanized Fibre Co..... xvii
Waddell-Entz Company..... xiv
Wannopee Pottery Co..... xviii
Washburn & Moen Mfg. Co.. iv
Western Electric Co..... xvi
Westinghouse, Church, Kerr & Co..... xxii
Westinghouse Elec. and Mfg Co..... xiii, xviii
Weston Engine Co..... i
Woodhouse & Rawson, Ltd.... —
Worthington, Henry R..... xiv

CLASSIFIED LIST.

Annunciators.
Central Electric Co.
Detroit Electrical Works.
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Beggs, J. E., Mchy. & Supply Co.
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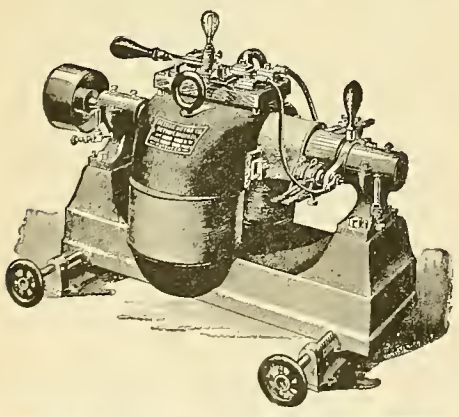

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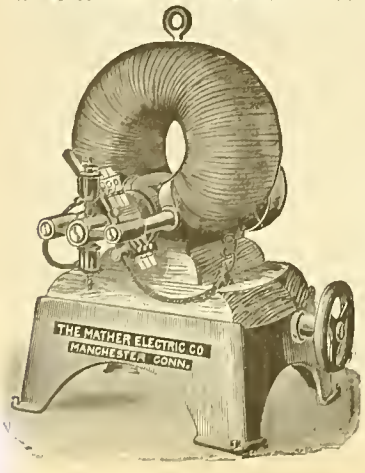

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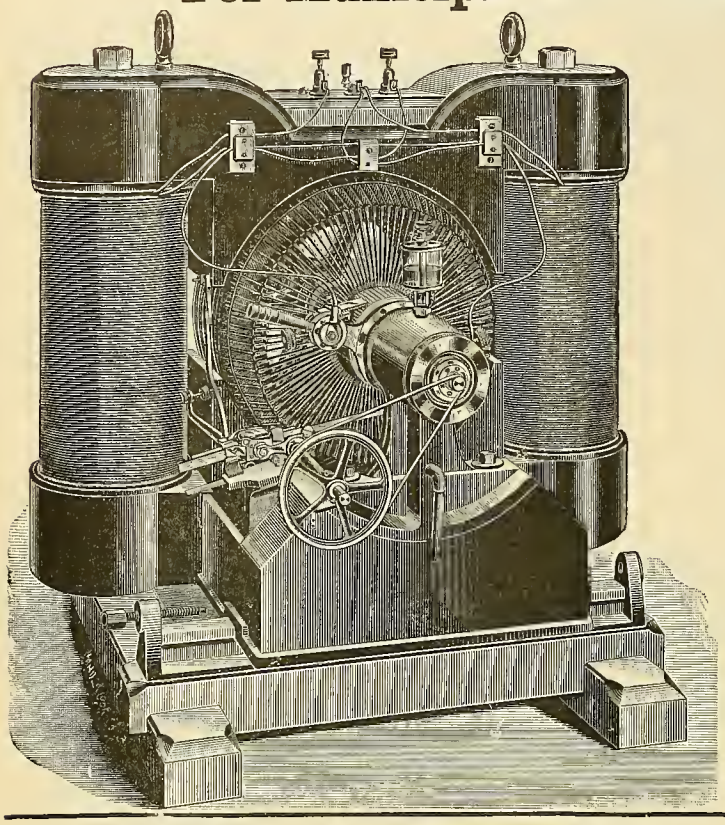

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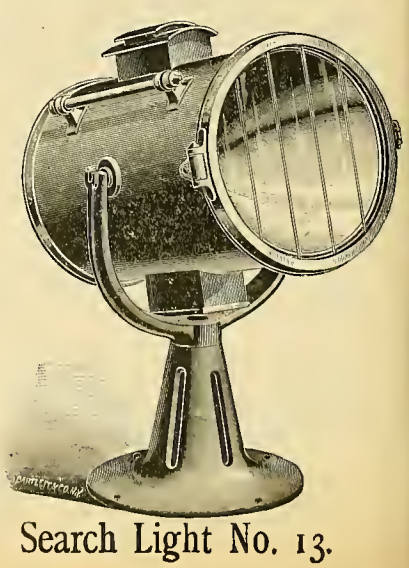

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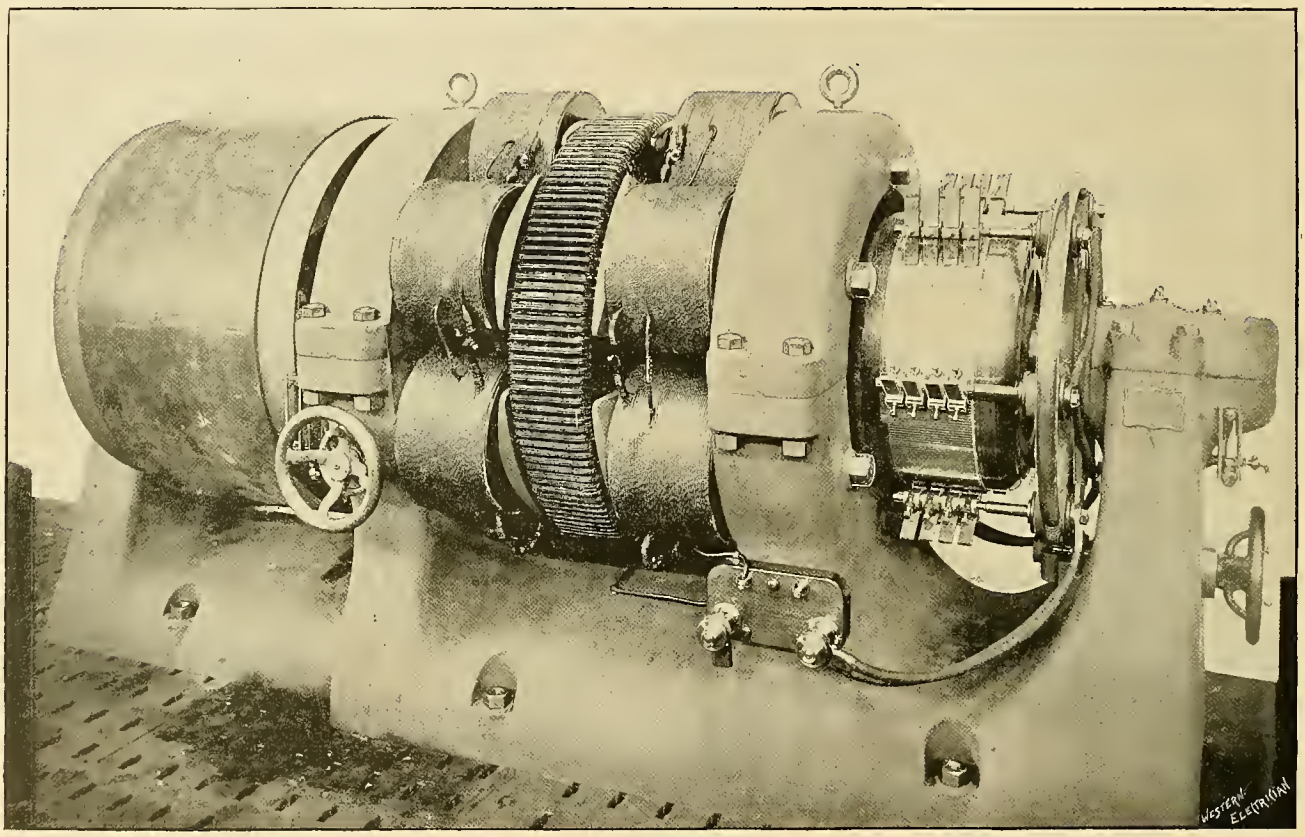

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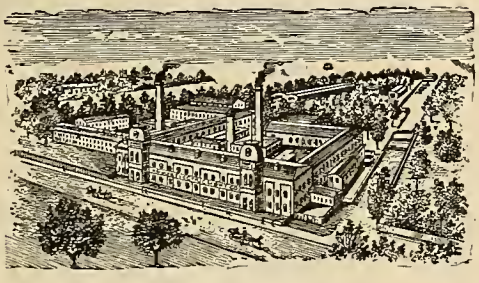

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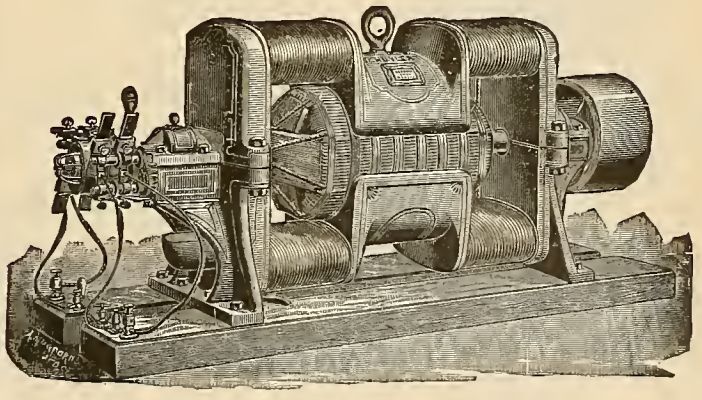

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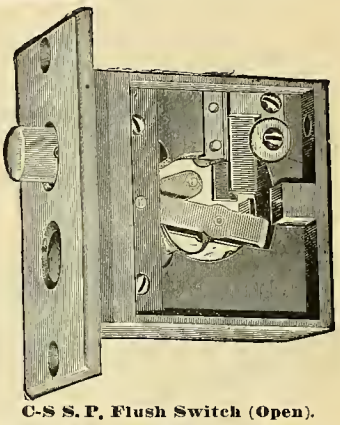

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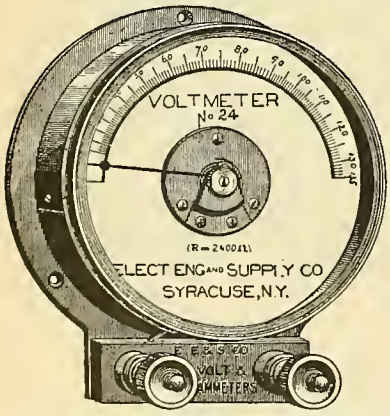

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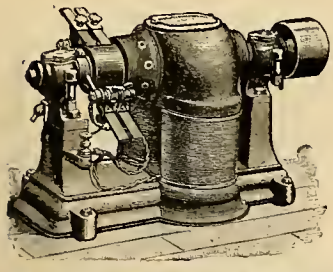

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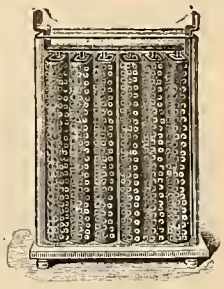

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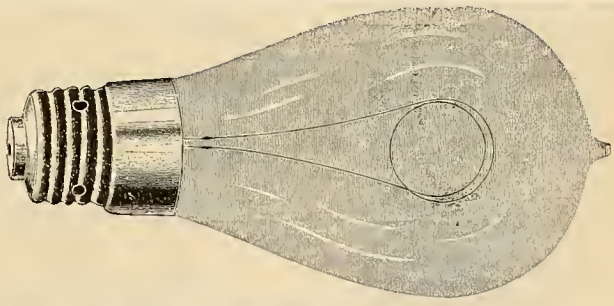

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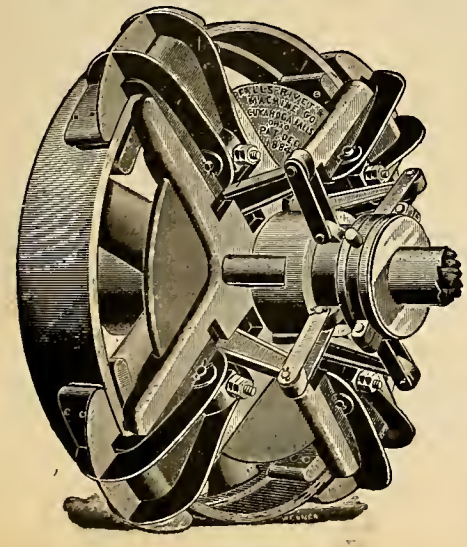

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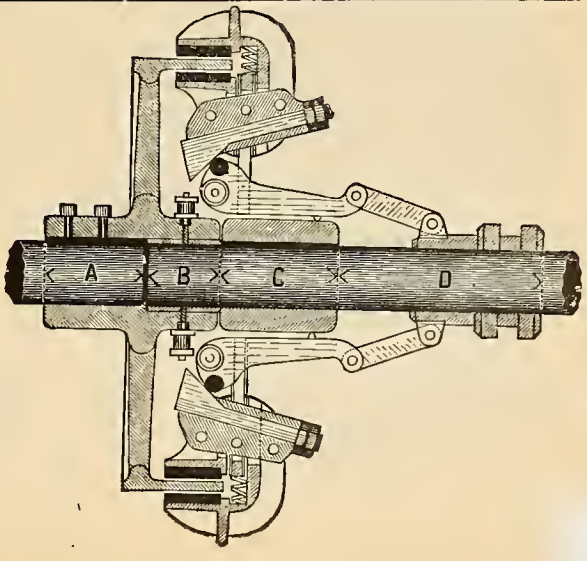

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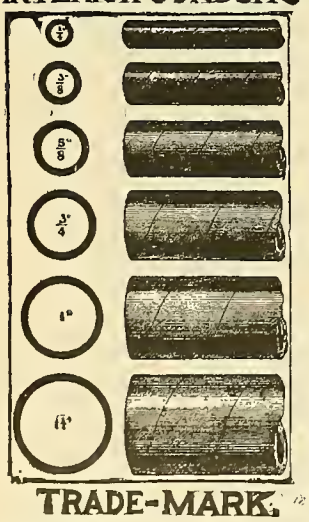

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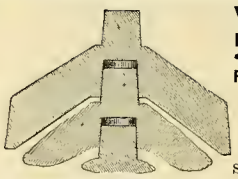

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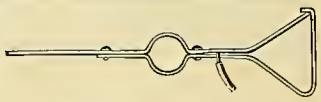

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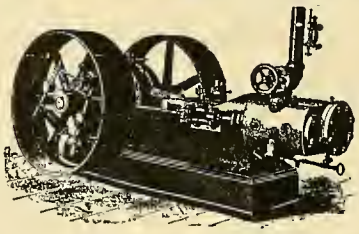

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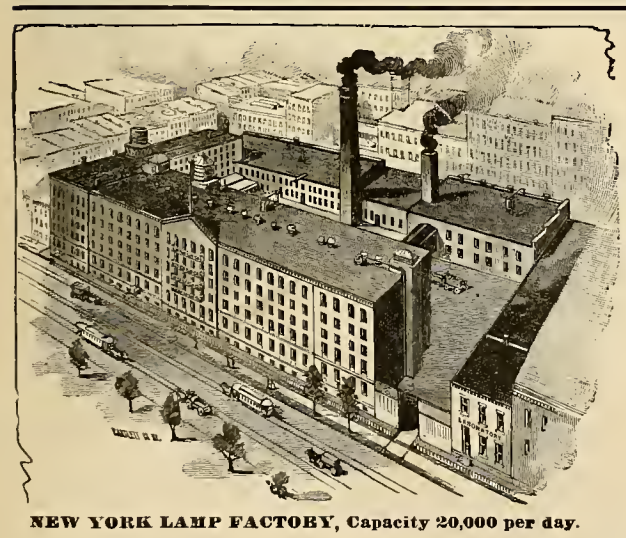

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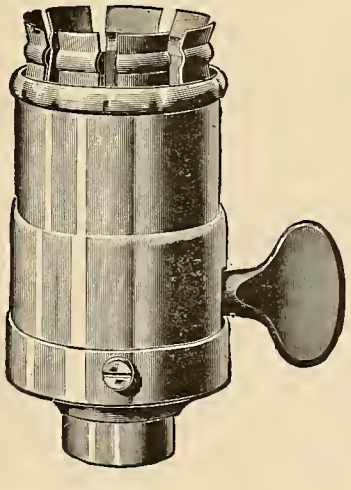

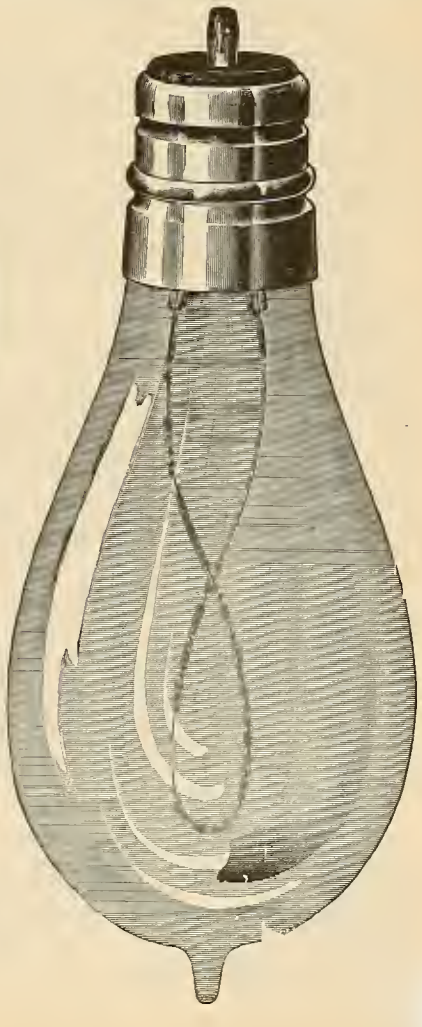

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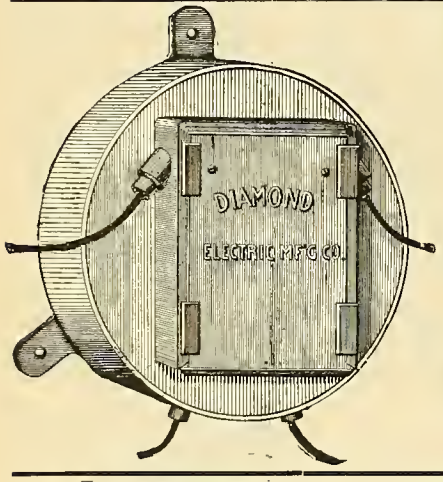

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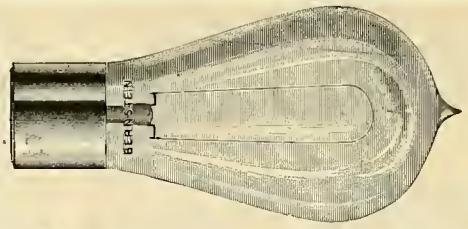

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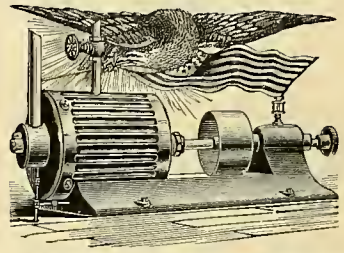

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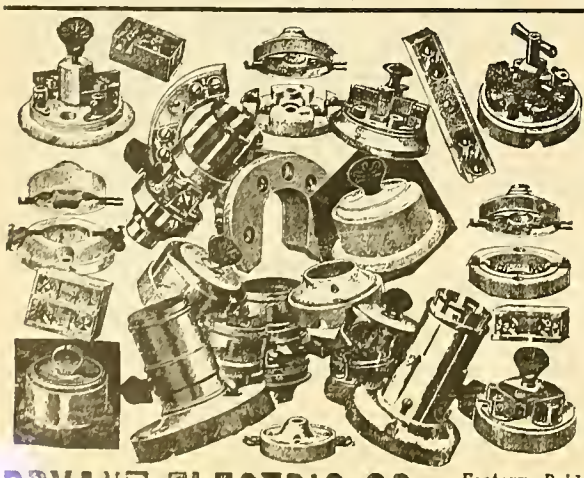

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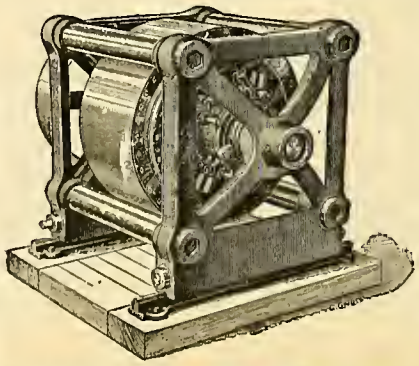

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Vol. XI. CHICAGO, OCTOBER 22, 1892. No. 17

The Ahearn Electric Heater in Ottawa, Canada.

There has been a general awakening this year to a realization of the fact that in the utilization of electricity for heating purposes a field exists which presents astonishing possibilities. Patents innumerable have issued, and the number of electric heaters that have appeared on paper is remarkable. But one hears, too, of a great variety of heating apparatus for which the designers claim a thorough practicability. To those who have not studied the question of the practicability of electric heating from every point of view, these signs of rapid development in what is virtually a new branch of the art may seem somewhat singular. The ordinary observer sees a central station first producing heat at the boilers and after a number of conversions developing the energy which is distributed to consumers under the name of electricity. The fact is readily appreciated that the current thus obtained indirectly from the fuel and applied to the heater can only be produced at a loss even though the current be utilized in the station itself and without transmission to a distance. But when, in addition to the losses due to the various conversions of energy in the station, transmission losses are taken into consideration, it is very easy to see how it will appear to many at first glance as though the introduction of electricity for heating service could only be prosecuted at a disadvantage. Such a view is a very natural one after merely a cursory consideration of the conditions indicated. Nevertheless, even at this early stage, the electric heater is being brought to the front in a manner that leaves no doubt that this apparently uneconomical device, by reason of its extraordinary usefulness under multitudinous conditions where heat directly from fuel is not easily obtainable or perhaps desirable, is proving itself to be of a character that is in reality anything but uneconomical. But by far the most promising field for the introduction of electric heating apparatus, and one that is enlarging itself in a most astonishing manner, lays in districts supplied with electricity from water powers. Where water power is plentiful or fuel is cheap, there the electric heater will be employed to the greatest advantage.

But, some would say, as yet the progress made, although considerable, especially in the line of street car heating, has not been such as to warrant extravagant predictions. A comparatively short time ago it did indeed seem as though the electric heater would have to remain more or less in the background until the much-sought process of efficiently producing current directly from fuel should appear. Recent developments, however, are opening the eyes of many to the immense possibilities in the line of the distribution of electricity for heating purposes from water-driven central stations. In the WESTERN ELECTRICIAN of July 23, 1892, an article entitled "The Electric Heater in Canada" gave an account of some of the work that has been accomplished in the Dominion in this branch by T. Ahearn of Ottawa, Ont. Since the publication of that article arrangements have been consummated between the firm of Ahearn & Soper, which controls the Ahearn apparatus, and General Manager W. R. Mason of the Railway Equipment company, Chicago, for exploiting this heater outside of Canada. Through the courtesy of Mr. Mason a representative of the WESTERN ELECTRICIAN was accorded recently an opportunity to examine the heater in operation in Ottawa and obtain a more comprehensive idea of the extent to which the electrical distribution of heat had been developed on the other side of the line.

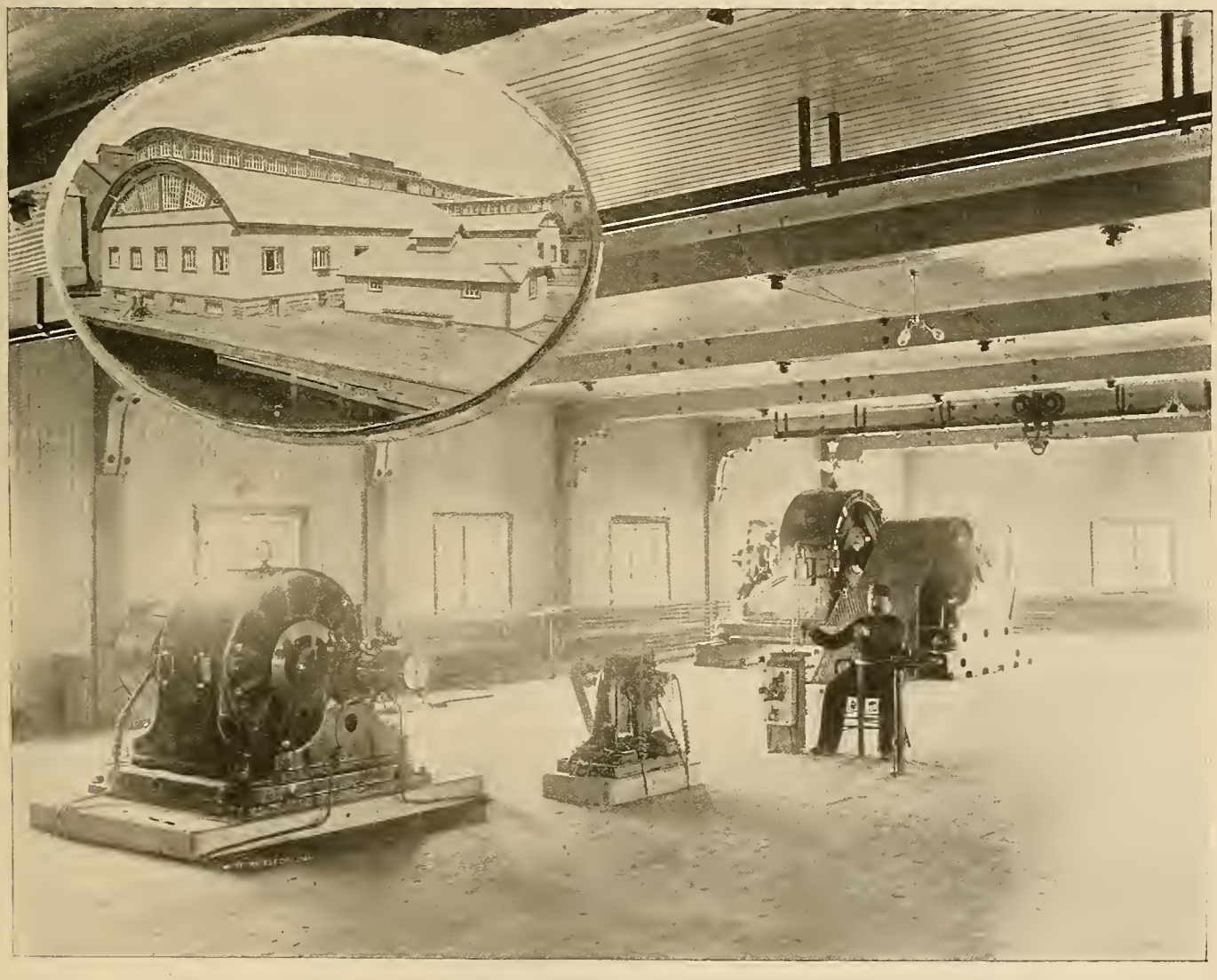

FIG. 1. THE AHEARN ELECTRIC HEATER IN OTTAWA, CANADA.

A visitor from the United States would be surprised many times during a tour of investigation into electrical Ottawa, and his respect for Canadian enterprise would be raised to the highest degree on being brought face to face with a system of electric heating developed to an extent that warrants its projector in seriously considering the problem of electrically heating the Ottawa Telephone company's building. But such is the fact nevertheless.

The firm of Ahearn & Soper, of which T. Ahearn, the designer of the heater, is a member, controls the bulk of the electrical business in Ottawa. Without reference to an extensive electric light and power business, the latter branch including both a system of stationary and railway supply, it may be said that Mr. Ahearn's heating business bids fair soon to rival that of the distribution of stationary power

and light in Ottawa. The Ahearn heaters are in use throughout the city. The device has found its way into barber shops, saloons, apothecary shops, groceries, photographic studios, a livery stable, private residences, etc., until recently it was found necessary to inaugurate a special heating service and purchase a dynamo to supply current solely for heating circuits. Many of the heaters, though, are now connected with the fifty volt secondaries of the

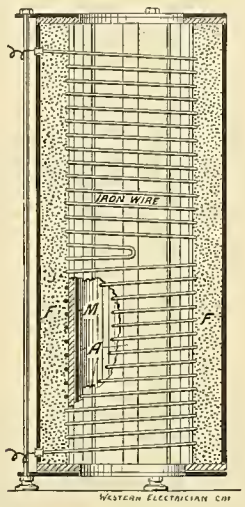

FIG. 3. THE AHEARN ELECTRIC HEATER IN OTTAWA, CANADA.

Westinghouse alternating incandescent lighting system supplying commercial lights.

The accompanying views will enable the readers of the WESTERN ELECTRICIAN to obtain an excellent idea of the general use to which the system has been put. The illustrations are reproductions of photographs of several installations in actual daily service.

In the illustration on the first page, Fig. 1, is presented

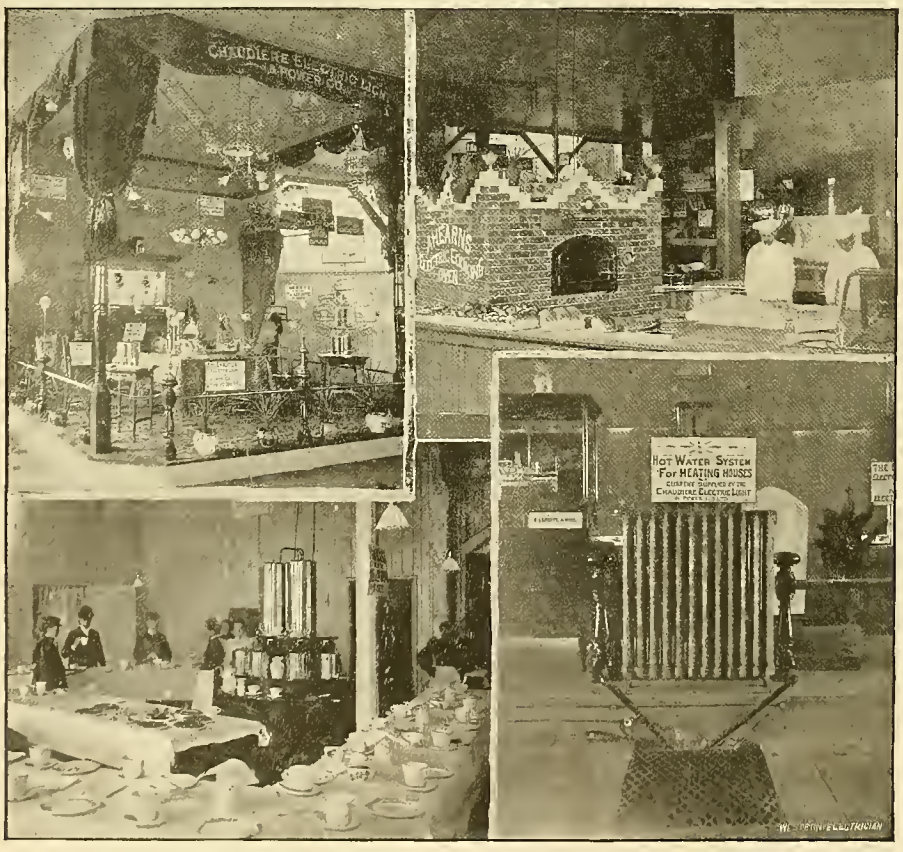

FIG. 5. THE AHEARN ELECTRIC HEATER IN OTTAWA, CANADA.

excellent views of the exterior and exterior of the generating station from which the heating circuits will in the future be supplied. This station is a new one, comparatively speaking, so at present quite a number of the heaters in use in the city are still furnished from converters on lighting circuits from another station. The Westinghouse alternator shown in the foreground in Fig. 1 is the machine specially purchased and installed for the heating circuits. It has a capacity of 150 amperes at 1,100 volts; the secondaries of the converters all supply current at 50 volts. The machine in the background is a railway generator. This station is driven entirely by a water power with a fifteen feet head, from the Chaudiere Falls on the Ottawa river. Its estimated capacity is 5,000 horse power. There are three 600 horse power wheels, two of which drive the

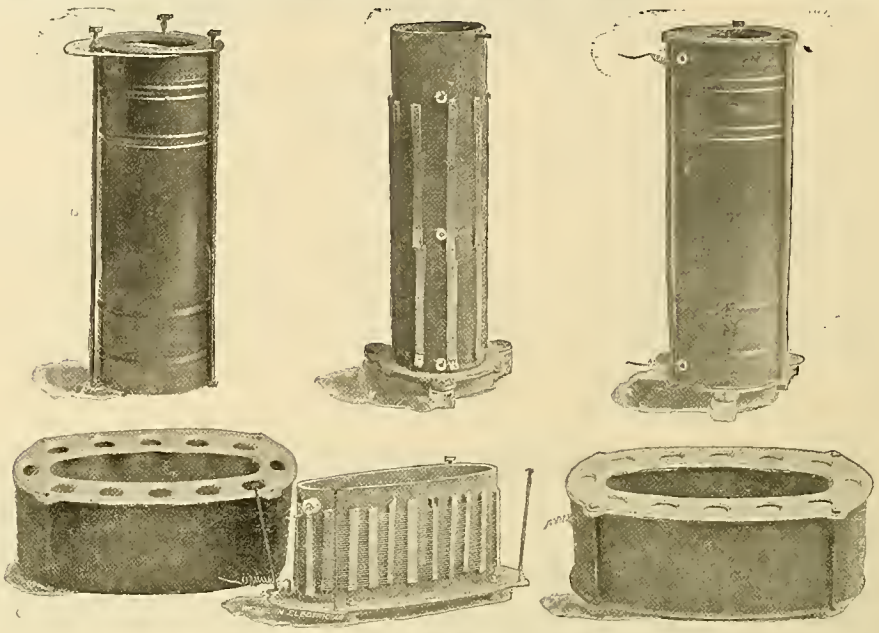

FIG. 4. THE AHEARN ELECTRIC HEATER IN OTTAWA, CANADA.

railway machinery, while the third wheel drives the heating machine. The Minneapolis water wheel governor is used on the turbine connected with the heating dynamo.

While it is not possible to refer to all the places in Ottawa in which electric heaters are used, mention may be made of a number of the more interesting installations.

On the tour of investigation the first visit was to what will doubtless be when finished, the first lumber drying kiln in the world in which electric heat is employed. This kiln was rapidly building at the time of inspection and is now probably ready to receive the heaters, three of which will be installed. The temperature required will have to be not less than 150 degrees Fahrenheit; current for this kiln will be furnished from the station of the Chaudiere Electric Light company near by. This company carries a nightly load of 8,000 Westinghouse lamps. Each of the three heaters in the kiln will take 20 amperes at 50 volts, and for this service a charge of $250 per year will be made, the company basing its price for current on its lamp rates

Before leaving the power plants, which are located not far apart in the lower section of the city, reference should be made to an extensive piece of work now half completed in the station illustrated in Fig. 1. Mr. Ahearn is preparing to heat this dynamo room, which is 80 by 50 by 11 feet, by water heated electrically. The view in Fig. 2, showing a heater in a pit in the corner of the room, and connected with coils of pipe, gives an excellent idea of this installation. To heat the station three heaters like the one shown in this cut in the pit beneath the floor will be

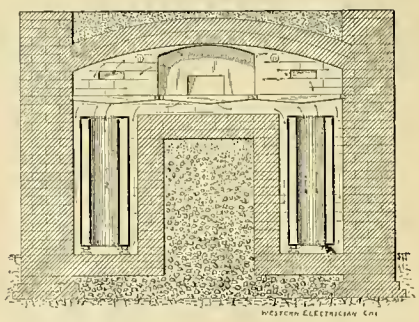

FIG. 6. THE AHEARN ELECTRIC HEATER IN OTTAWA, CANADA.

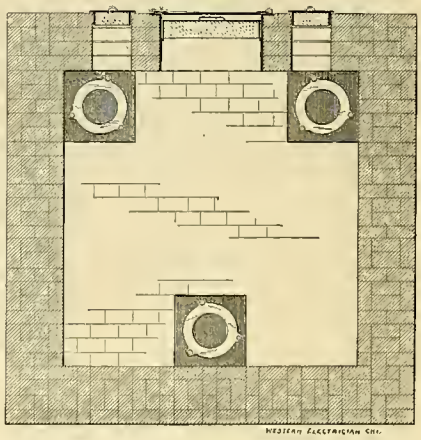

FIG. 7. THE AHEARN ELECTRIC HEATER IN OTTAWA, CANADA.

required, and these, it is calculated, will heat enough water to keep 3,000 feet of pipe at 70 degrees Fahrenheit. The water is supplied automatically to each heater from the little supply tank in the corner. The heaters each occupy a pit space of about 2 by 3 feet, and each one, it is figured, will require about 60 amperes of current at 50 volts. The heater shown in the picture was the first one of so large a size, and had just been built, so it was not possible to give accurately the amount of current it would take when finally connected and its coils adjusted for permanent operation.

On leaving the power house the next visit was to the city water works pump house. The first experimental heater that was built by Mr. Ahearn is now in the foreman's office, Fig. 2, at the water works. It replaces a coal stove, which was used in the fall and spring before the steam furnace was put in operation. The size of the room heated is 10 by 12 by 18 feet. The dimensions of this heater are 5 inches outside diameter by 20 inches high. It takes 4 amperes of current at 110 volts, current being furnished from a United States 60 light dynamo on the premises used for lighting the pump house. The men use this little heater for warming their dinner pails, and in the evenings when the temperature outside is chilly it makes the room comfortable. This heater was constructed in March last and was presented by Mr. Ahearn to the men this summer.

W. A. Jamieson's drug store, Wellington street, was next in order. Mr. Jamieson has a gallon and a half heater wound with German silver wire. He states that after closing his store at ten o'clock at night, when he comes in the morning he finds the water almost hot enough for his purposes. A similar heater is in use in R. A. McCormick's drug store on Sparks street. This heater was put in at the same time, upon the same terms, and is giving great satisfaction. Both these gentlemen say that they are now able to dissolve chemicals without loss of time; they do not have to tell their customers to come again in an hour or so for prescriptions Mr. McCormick has his heater on the counter beside the glass case. These two heaters are made of German silver wire, and the converter capacity has never had to be increased on their account. Each of the druggists' heaters takes a steady current of three amperes at 50 volts, and on account of the German silver winding, no change in current consumed is perceptible after starting. The Jamieson heater is wired from a 40-light converter that supplies several places in the neighborhood with light. For this service he pays $26 per annum, which is $2 in excess of the price which would be derived from the same current if used for lighting purposes. The charge for light is based on what is called the commercial system and is $8 per light per annum; the current for this heater is about equal to that consumed by three lights. On this system the customer is privileged to burn the light all day and all night, paying for his own lamps. The current is on this heater only 4 hours per day.

The barkeeper at the Windsor Hotel in Ottawa is also an advocate of electric heaters. He may be clearly seen in Fig. 2—as may Mr. Jamieson, the druggist—mixing "chemicals" with hot water. The heater at the Windsor replaces a gas stove. It is wound with iron wire instead of German silver and on that account takes a little more current at the start, say 5 to 6 amperes, but at the end of fifteen minutes it drops down to between 2½ and 3 amperes. For this heater $26 per year is charged. The service is from a ten-light converter, which supplies eight lights, all of which are on at night, with the heater on when required.

Insurance men should be interested in the little view of a harness room also embodied in Fig. 2. It shows an Ahearn heater as used in T. W. Chisnall's livery stable on Queen street. The picture is strongly suggestive of lower rates of insurance on stables, due to the introduction of electric heat in place of the hazardous coal or wood burning stove. In this heater bran mashes and other liquid feed for horses is prepared. The hot water is also used for bathing the horses' feet, cleaning harness, etc. This heater has been in operation since May last and replaces a coal stove. It is a question as to whether there should not be a reduction in the insurance rate on this risk on account of the change. The capacity of the heater is six gallons, and it required 6 amperes of current at 50 volts. The charge for current is $52 per annum.

The barber shop was the next in line, and in J. F. St. Louis' "tonsorial emporium" on Elgin street two heaters were found, one of which is the first Ahearn hot water heater. In this a syphon was used through which to draw off water and cool it a trifle before being applied for shaving purposes. This heater is still in service, but the plain style with a faucet, and in which there is no syphon, is preferred. The current for these heaters is supplied from a bank of converters (three 40-lighters); these were on the building before the heaters were installed. Each heater takes 3 amperes at 50 volts.

The Rev. Father Whelan, a prominent clergyman of Ottawa, is also a firm believer in electrically heated water. In his residence there is an eight-gallon heater which warms the water for his bath. It takes 9 amperes at 50 volts. Current is supplied from a 20-light converter that was in use at this gentleman's residence before the heater was put in and no change was made on this account The rate charged is 1 cent per ampere-hour by meter.

In March last Mr. Ahearn had constructed and put in operation in the residence of ex-Alderman Johnstone on Wellington street an electric furnace for domestic

FIG. 2. THE AHEARN ELECTRIC HEATER IN OTTAWA, CANADA.

service. This outfit has been in successful and continuous operation since being installed, and has attracted much attention. The large coal furnace abandoned for the small perpendicular electric furnace suggests immense possibilities for electric heating. The heated water passes upward into a tank in the corner, from which it flows to the two upper stories of Mr. Johnstone's residence. The fact that hot water is being constantly drawn off, and cold water taking its place, is a much more severe test upon the furnace than if the water was being used for house heating purposes only, as in the latter case the same water is being circulated always. Mr. Ahearn has applied the latter principle to hot water apparatus for car heating. Ex-Alderman Johnstone's heater is three feet six inches high by six inches diameter and it is wound for the 500 volt power circuit of the Chaudiere Electric company. It takes 5½ amperes and this amount of current heats a 63 gallon bath tank 18 inches in diameter and 4 feet high, supplying three bathrooms and the kitchen sink. Two of the bathrooms are in the same building and one is sixty feet away in an adjoining building. The water is being

drawn continually, and the users say is is always hot. This was an experimental outfit, no charge being made. The charge, however, would be $200 per annum for this service.

In addition to those already referred to the following named commercial users in Ottawa of the Ahearn electric heating apparatus may be mentioned: M. Lanctot, barber, Sparks street, 3 ampere heater; W. L. Buller, restaurant, 3 ampere heater; Levi Booth, grocer, 3 ampere heater; O. Laurin, barber, Wellington street, 3 ampere heater; G. L Snider, photographer, Bank street, 3 ampere heater; King & Morse, S. Cassidy, W. Codd, saloons, each equipped with a 3 ampere heater.

The need of artificial heat during the summer months for drying out repaired armatures or field coils of electric car motors suggested the construction of a drying kiln for the Ottawa electric railway car barns. This kiln was put in operation several mooths ago, and has proved a great success. To economize space the kiln was put on top of the steam heating furnace which was used during the last winter for heating the premises. Its situation makes it appear somewhat bulky, but it simply consists of the small furnace with pipes running into the kiln four deep, thence back to the furnace. A water tank is placed on top of the kiln to supply the furnace. The hot water circulating through the pipes in the kiln heats the air to 120 degrees, the 500 volt current from the trolley wire being used; 4 amperes do the work.

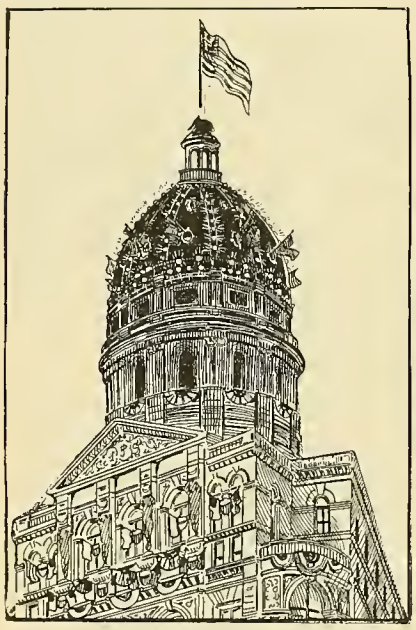

FIG. 1. ELECTRICAL FEATURES OF THE NEW YORK COLUMBUS CELEBRATION.

It may be stated that in connection with the water-driven system of the Ottawa road, the electric heater has proved itself to be a valuable adjunct, serving most profitably to steady the load on the system, and likewise to increase the company's revenue through the sale of the additional current.

It was during the last winter that a series of four 125 volt electric heaters obtained in the United States was first tried in a car of the Ottawa railway. The rigorous Canadian climate, however, proved too severe a test for these heaters. It was due to his appreciation of the fact that a good practical heater would be a most valuable piece of apparatus to operate on this particular system in Ottawa in connection with the power machinery that Mr. Ahearn set to work to develop a thoroughly practical heater. His first production was a 500 volt stove for car service. This stove replaced the coal stove in general use. It is cylindrical in form, Fig. 4, 29 inches high by 11 inches outside diameter by 7 ioches inside, being in fact an iron tube within an iron tube. The inner tube is wound with iron wire, and the space between the inner and outer tubes is filled with whiting, powdered fire clay, or sand. As the stove is placed two inches from the floor, the cold air rushes from the floor upward through the center of the stove, and this movement of the air increases with the temperature, and thus makes a vigorous circulation of hot air. According to Mr. Ahearn, with six amperes of current this stove proved equal in heat-giving power to the ordinary coal stove and in addition possessed all the other well known advantages. This stove was wound to permit of the use of a constant current throughout the day, thereby requiring no attention on the part of the conductor. Three cars have been equipped with this form of stove since February last.

In Fig. 4, in addition to the stove, there is shown a new type of car heater just built by Mr. Ahearn. Four of these oval-shaped heaters will be required for a car, and they will take together the same amount of current that is necessary for the cylindrical stove illustrated in the same cut.

FIG. 4. ELECTRICAL EFEATURES OF THE NEW YORK COLUMBUS CELEBRATION.

These heaters will be placed in the four corners of a car under the seats. Four of these, it is calculated, will furnish heat equal to that of the electric car stove. The winding is of iron wire, done in such a manner, it is claimed, as to

FIG. 5. ELECTRICAL FEATURES OF THE NEW YORK COLUMBUS CELEBRATION.

counteract self induction, and coosequent flashing at the switch; the direction of the winding is reversed at the center of the coil as may be clearly seen in Fig. 3.

There are a number of distinguishing features in the

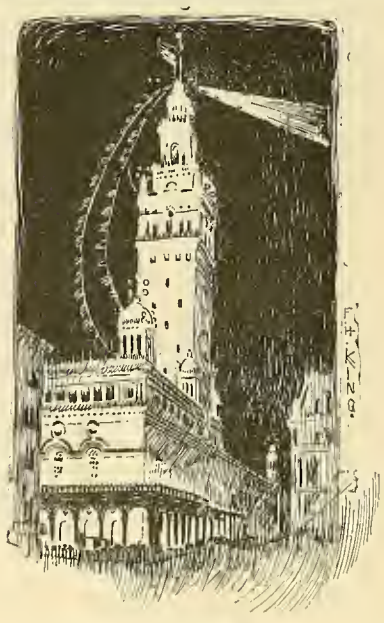

FIG. 3. ELECTRICAL FEATURES OF THE NEW YORK COLUMBUS CELEBRATION.

Ahearn heater. In both the ordinary form of cylindrical air heater, Fig. 4, and the hot water heater, Fig. 2, the construction is such as to make them, it is claimed by the designer, most efficient in their action. In the cylindrical hot air heater the special feature is its hollow form and the winding and insulation of the heating wire around the inner tube so as to concentrate the heat upon the inoer tube and leave the outer casing, practically speaking, cool.

A study of the diagram, Fig. 3, will make clear the manner in which this arrangement has the effect of promoting a constant circulation of air through the heater; the air streams in constantly at the bottom to be heated by the inner tube, and then passes out at the top. It will be noted, too, that the winding of wire does not cover the entire surface of the inner tube, Fig. 4, but is terminated some distance from the top of the tube. The reason given by the designer for this construction is that, as the hottest part of the heater is at its top, there would be at that point, with the winding continued to the top, too great a concentration of heat, which would lead to a rapid deterioration of the wire.

In the construction of the hot water heater the object sought was likewise the insulation of the heat from the exterior of the apparatus, and its concentration upon the interior surface, so as to obtain the greatest heating effect upon the water.

During a recent visit to Ottawa the WESTERN ELECTRICIAN representative was taken out to the grounds of the Central Canada exhibition to see the display that had been made there of electric heating apparatus. A general idea of these remarkable applications of electricity made at a point three miles from the source of energy may be had

FIG. 2. ELECTRICAL FEATURES OF THE NEW YORK COLUMBUS CELEBRATION.

from a close inspection of the four views embodied in Fig. 5. There was an electric bake oven, the size of which can be better appreciated after a comparison with the bakers, who also appears in the picture. Figs. 6 and 7 show the details of this oven and the arrangement of the heaters within it. Fig. 3 is a drawing showing the internal construction of one of the heaters in the oven. With the three heaters a baking temperature of about 400° Fahrenheit is maintained. Only two heaters, however, are necessary under ordinary circumstances; the third was put in this exhibition oven to compensate for the frequent opening and shutting of doors rendered necessary by the large amount of cakes and buns being baked. Without exaggeration it may be said that the Canadians at the exhibition jostled and crowded one another in their attempt to purchase a share of the "electric bread." In fact, this first electric baker realized a small fortune on fresh baked buns "at 15 cents a bag." The size of each of the heaters in the exhibition oven was 29 inches high, 11 inches outside diameter, 7 inches inside diameter. Two of the heaters took twenty amperes, and the third one took nineteen amperes at fifty volts.

In the Women's Christian Temperance Union refreshment room, Fig 5, two 12 gallon hot water reservoirs were in use. These vessels were electrically heated and were connected by a common supply pipe, as shown in the illustration, with five smaller coffee heaters. The larger heaters supplied the smaller ones with hot water, and in the latter both tea and coffee were made. In addition to the heaters just mentioned there were four more in another part of the room, rendered necessary by the incessant demand for hot tea and coffee. This outfit gave an ample supply of hot water in the refreshment rooms. The Chaudiere Electric Light

company's heating exhibit was also a revelation. The most striking feature of this display was the hot water radiator, shown also in Fig. 5, which was heated by water supplied from an electric stove in a pit just in front of it. The pit was covered by a grating level with the floor and was lighted with an incandescent lamp. The radiator, it is figured, was equal to 200 feet of pipe. This heater took twenty amperes at fifty volts.

Across the aisle from the radiator these, too, shown in Fig. 5, were two combination heaters, which contain three compartments for tea, coffee and hot water, each one being provided with a separate faucet like the small heater in use in the restaurant.

Last but by far the most important work that has as yet been contemplated by the Canadian exploiters of the Ahearn heater is that through which the Bell Telephone company's building in Ottawa is to be electrically heated. This building, now nearly completed, is shown prominently in Fig. 2. When finished it will contain 5 000 feet of pipe, the size of the building being 30 by 75 feet, with three stories and a basement. To heat this structure there will be installed in the basement a Gurney furnace and an Ahearn heater. An arrangement of valves will permit either of these heaters being used; the coal furnace is to be employed in the event of anything happening to the electric heater.

Such a task as this, to any one who has not been on the ground, will seem a bold undertaking, but to one who has been in Ottawa and seen what has actually been accomplished, it will not seem a rash prediction to say that the exploiter of the Ahearn heater in this country may, ere long, be justly entitled to point to the first and only electrically heated building in the world.

Electrical Features of the New York Columbus Celebration.

New York has been ablaze with electric lights during the last week, and the many thousand visitors who were attracted to the metropolis by the Columbus celebration were amazed by the display of electric lights. Throughout the celebration electricity played an important part. One of the most striking effects was that of the *World* building, Fig. 1, on the dome of which were arranged 212 incandescent lamps of 32 candle power each. These lamps were arranged in rows of red, white and blue. The wire was encased in a specially made copper covered conduit, manufactured by the Interior Conduit company. Seven days were taken up in the construction of this display, which reflected much credit upon the electrician of the *World*, F. Schede, who planned the illumination.

Among the displays in the business portion of the city that of the New York Life Insurance company, Fig. 2, contained about 1,100 incandescent lamps. The letters and dates 1492 and 1892 were made of gold colored lamps with bands of red, white and blue lamps across the face. A portrait of Columbus, heroic size, was placed over the entrance in a frame of white and gold lamps, the shield being similarly lighted.

The General Electric company made a novel and interesting display. From both sides of its office building on Broad street were hung eight arc lamps, making a frame between which were placed three rows of electric revolving wheels of varied colored lights, located in the embrasures of the windows. Over the principal cornice were the figures 1492 and 1892, in incandescent white lights. From the top of the building was operated a large search light.

The Metropolitan Hotel placed over its entrance a picture of the landing of Columbus in a framework of 16 candle power incandescent lamps.

From the roof of Niblo's Garden was operated a search light of unusual strength and brilliancy. Broadway was made as luminous as day by the brilliant sheen of electric light playing upon this long and crowded thoroughfare.

Madison Square Garden, Fig. 3, was a blaze of light from its search light and numerous arc lamps. A cluster of lamps placed at the extreme top could be seen a great distance.

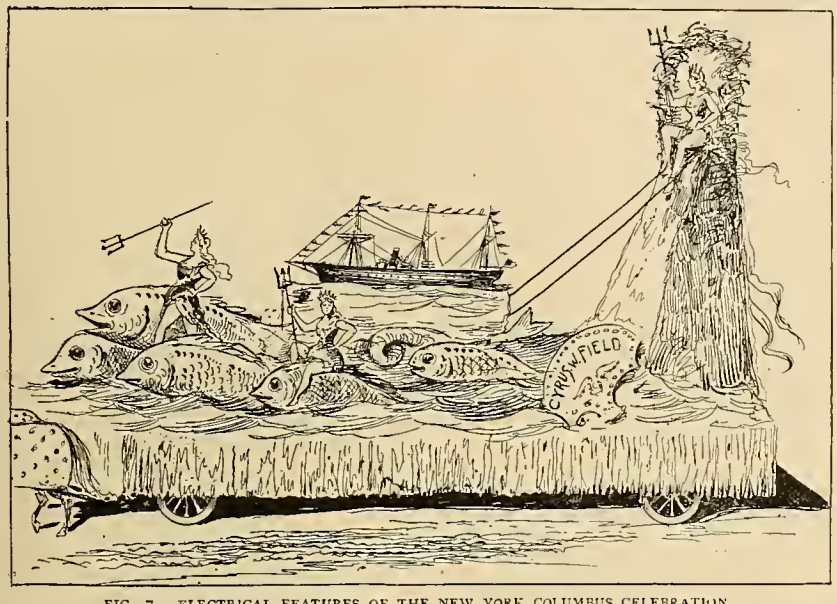

FIG. 7. ELECTRICAL FEATURES OF THE NEW YORK COLUMBUS CELEBRATION.

The electrical displays in the residence portion of New York and Brooklyn were numerous, especially on Fifth avenue, where the designs were worked out in shields, anchors, stars, etc., placed amid beautiful festoons of national colors. Among those noticed was one of Columbus, Fig. 4 standing beside and resting his hand on a globe showing North and South America, the outline of the figure and dis't being of incandescent lights. The Union League Club, located at Fifth avenue and Thirty-ninth street, had a design of red, white and blue lights arranged in perpendicular lines, seven in all, extending the entire height of building, and producing a beautiful effect.

The display of fireworks from the great East River bridge was probably the most extensive ever seen in this country. The set piece, the Falls of Niagara, over 500 feet in length, strung along the outside of the southern roadway, was lit by electricity. During this display numerous search lights, on top of the large office buildings and upon the excursion boats on the East River, were trained upon the bridge and towers, as shown in Fig. 5, producing a weird effect.

Never was there a more expectant throng than that which waited many hours for the appearance of the night pageant and its many electrical effects, especially for the car "Electra," Fig. 6, which was a dazzling exhibit. In the eyes and mouth of the great monster and at all prominent points on the figures on the float were incandescent lamps of various colors. In the chariot, guiding the electric Hydra, was the figure of a woman, and on the sides of the chariot were bronze bas-reliefs of Edison, surrounded by hundreds of electric lamps. At the rear was a large horizontal disk, upon which some twenty girls in metallic costume were standing with lights festooned all about them. Surmounting this larger disk was a smaller disk, on which were the figures of six women bearing aloft a globe, the longitudinal and latitudinal lines of which were shown by incandescent lamps. The current was obtained from accumulators concealed in the car. There were nearly 3,500 lamps used in this exhibit. The Union Storage Battery company furnished the batteries, which had a capacity of over 125 ampere hours, the weight being about 2½ tons.

One other float which attracted much attention was the Ocean and the Cable, Fig. 7. The Great Eastern was seen triumphantly riding the waves, in which flying fish and other creatures of the sea sported, while the Atlantic Cable and Cyrus W. Field's name encircled the globe.

From several conservative estimates, made by well-known gentlemen connected with the electrical business, it is believed at least $250,000 was spent in electrical decorations in New York and Brooklyn for this event.

FIG. 6. ELECTRICAL FEATURES OF THE NEW YORK COLUMBUS CELEBRATION.

Long Distance Telephoning.

The long distance telephone line connecting Chicago and New York is now finished, and will soon be ready for public use. It is operated by the American Telephone & Telegraph company, whose Chicago office is in the Rand-McNally building, on Quincy street. A reception to the representatives of the press was given on Tuesday, and the lines were tested.

Wiremen on a Strike.

The Chicago Edison company is having trouble with its wiremen. The men first demanded an eight-hour day, and when this, with extra pay for overtime and holidays, was conceded, the men demanded the recognition of their union by the signing of a formal agreement. This the company declined to do, and on Thursday of last week 130 men, out of a total force of 160, refused to work until the union's demands were complied with. The officers of the company assert that they will not recede from their position and are filling the places of the strikers as fast as possible. The wiremen of several other companies are also involved.

The Montgomery, Ala., Terminal & Street Railway company will probably equip its line with electric power

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CONTENTS OF THIS NUMBER.

PAGE.

The Ahearn Electric Heater in Ottawa, Canada. Illustrated. 205, 206, 207, 208, 209
Electrical Features of the New York Columbus Celebration. Illustrated 208, 209
Long Distance Telephoning 209
Wiremen on a Strike 209
Editorial 210
New Westinghouse Lamp. Illustrated 211
Electricity at the World's Fair 211
Reproach for Telephone Companies. Illustrated 211
Electric Train Signaling 211
Cleveland Street Railway Men. With Portraits 212
Street Railway Convention in Cleveland 212, 213
Prof. Sidney H. Short. With Portrait 213
Electrical Talk on Wall Street 213, 214
New Wagner Motor. Illustrated 214
An Idaho Electrical Transmission Project 214
Electricity at Niagara 214

DEPARTMENTS.

Correspondence 214, 215
New Incorporations 215
Electric Lighting 215
Electric Railways 215, 216
Telegraph 216
Telephone 216
Electric Mining 216
Miscellaneous 216
Trade News 216
Business 216
Electrical Patents 216

THE convention of the American Street Railway association at Cleveland is one of the most important gatherings of the year from an electrical point of view. It is practically an electrical convention, inasmuch as a majority of the members of the association are interested in electric roads, and all of the papers prepared for the meeting are upon electrical subjects. It is customary to appoint committees each year to prepare reports on special subjects, and these reports form the bases of the discussion at the sessions of the convention. This year it is proposed to give up almost the entire time to the discussion of matters pertaining to the electric railroad. What better evidence of the advancement of the electric railway in America can be asked than this convention of the leading railway companies of the country to discuss the "deadly trolley"?

OPPOSITION to the trolley system on the part of corporations whose interests are opposed to the advancement of the electric motor has been so great that many of the daily papers of the metropolis have permitted not only their advertising and news columns to be used for the publication of false reports and misleading statements, but they have even turned over their editorial columns to those who are opposed to the motor, and day after day they lend their aid and encouragement to those who are fighting the best interests of the city. They have so persistently kept up their senseless chatter about the so-called "deadly trolley" that it is barely possible they have begun to believe these silly and malicious fabrications. Among those who favor fair play, even in New York's municipal affairs, it is agreed that the following paragraph in the *Sun* correctly states the case:

As a matter of truth and soberness the chief objection to the trolley is its unsightliness. The clearer the streets are from house front to house front the better for the beauty of the city and its general convenience.

Yet this concise statement of fact does not fully explain the situation. No one who has ever seen the hideous structure of the "L" road system of which New Yorkers are so proud would pronounce the modern overhead trolley system objectionable on the ground of unsightliness. A city that can turn over its streets to an elevated railroad without violence to the esthetic tastes of its people cannot consistently object to neatly placed overhead trolley wires.

The opponents of the electric system in New York based their objections originally on what they were pleased to term the "deadly" character of the motive power employed. Just at present the opponents of the trolley system seem to enjoy a temporary advantage, but their position is untenable, and their present apparent victory will be turned to inglorious defeat.

READERS of this journal can form an excellent idea of the appearance of the new Westinghouse incandescent lamp by referring to the cuts presented in this issue. This is the lamp for which Mr. Westinghouse makes the claim that it does not infringe on the Edison patents, as upheld by the recent decision of the New York Circuit Court of Appeals; and of course everybody interested in the electric light business wants to see what it looks like. This desire the WESTERN ELECTRICIAN can gratify, but it is not able to do as much in the direction of an exact and detailed description of the construction of the lamp, as this information is withheld by the manufacturers. The leading features are briefly pointed out, however, and no doubt a more ample description will be obtainable in due time.

It is said, and truly enough, that if the claims made for the new lamp, including the low cost of manufacture, are true, its appearance marks a new era in the lamp business. In the absence of precise information as to the construction of the lamp, it is of course impossible to hazard a conjecture as to the probability of an infringement of the Edison patent. The Court of Appeals paraphrased the second claim of that patent as follows:

The combination of carbon, filamentary or thread-like in size and properly carbonized, used as an illuminant in an incandescent electric lamp with a receiver made entirely of glass and conductors passing through the glass, and from which receiver the air has been exhausted to such an extent that disintegration of the carbon, due to the air washing action of surrounding gases or to any other cause, is so far reduced as to leave the carbon practically stable.

This is a broad claim, and it is difficult to see how it is circumvented by the Westinghouse lamp, unless some other material than carbon is used for the burner. Possibly this is the "important discovery" alluded to in Mr. Westinghouse's announcement. It is said that the filament burns in rarefied carbonic acid gas, and not in a vacuum, as in the Edison lamp, but it does not seem likely that this departure will be greatly relied upon, as the language of the claim, as construed by the judges, appears broad enough to cover any process by which the air is exhausted. Speculation of this character, however, although interesting, is of little value. The public will be compelled to content itself with guesses until the exact method of manufacture is known.

IN ENGLAND recently, to judge from the newspapers, quite a stir was created by a display at the Crystal Palace exhibition of electric heating apparatus, and since the demonstration at the Crystal Palace an electrically cooked dinner was given at Oxford on the occasion of the opening of the new electric light station in that town. The people were much interested and of course great things were prophesied for the future. In Switzerland, also, a year or two ago, according to a newspaper paragraph, a hotel keeper used an electrical broiling iron. In the United States, too, more or less progress has been made in the introduction of electric heating apparatus. For instance in Minneapolis electric sad irons have been employed in laundry work; in Chicago and Minneapolis heaters have been used in restaurants for cooking, boiling coffee and tea, baking cakes by electricity, etc. The progress, also, in the employment of the current in the country to heat street cars has been such as to indicate that in this one direction alone the exploiter of a thoroughly practical car heater that combines a sufficient efficiency with durability will find a field of constant growth in which to work.

But the movement forward in the United States or elsewhere in this line, taken all in all, has not amounted to a great deal, comparatively speaking, and it will now have to be conceded that the most decided step in advance in either this country or abroad stands to the credit of a Canadian.

Those who read the WESTERN ELECTRICIAN of July 23, 1892, already have some idea of the remarkable work that has been accomplished in the introduction of electric heat upon a large scale in the city of Ottawa, Ont. But a full understanding of the extent to which the gentleman referred to in the article just mentioned has carried his project to introduce an electric heating system on an extensive scale could only, as it proved, be realized after a personal inspection. A representative of the WESTERN ELECTRICIAN visited Ottawa recently, and a comprehensive description of the electric heating work that has been accomplished and is now under way in that city is presented elsewhere in this issue. To say that surprise awaits the visitor in Ottawa would be putting it mildly. Undoubtedly Ottawa may now come to the front and claim for itself the distinction of being the first city in the world in which there has been established and developed a special electric heating service from a central station. And furthermore it is very likely that the same city will, ere long, point with pride to the first building in the world electrically heated throughout.

A perusal of the present article will undoubtedly open the eyes of many doubters to the astonishing possibilities in store for electric heating. By many the electric heater, as usually employed, consisting essentially, as it does, of a conductor heated by energy obtained from fuel after several conversions, is believed to be an uneconomical device; and so it is when considered in one light. To quote from the description of the Ottawa system:

To those who have not studied the question of the practicability of electric heating from every point of view the signs of rapid development in what is virtually a new branch of the art may seem somewhat singular. The ordinary observer sees a central station first producing heat at the boilers and, after a number of conversions, developing the energy which is distributed to consumers under the name of electricity. The fact is readily appreciated that the current thus obtained indirectly from the fuel and applied to the heater can only be produced at a loss even though the current be utilized in the station itself and without transmission to a distance. But, when, in addition to the losses due to the various conversions of energy in the station, transmission losses are taken into consideration, it is very easy to see how it will appear to many at first glance as though the introduction of electricity for heating service could only be prosecuted at a disadvantage. Such a view is a very natural one after merely a cursory consideration of conditions indicated.

But those who have undertaken the work of introducing the seemingly uneconomical apparatus are in a position to see that the electric heater, by reason of its peculiar advantages over the ordinary fuel stove under many conditions, will slowly but surely demonstrate itself to be in reality of anything but an uneconomical character. Even at this early stage its field of usefulness is rapidly widening. As was the case with the incandescent light the electric heater at the start will come in competition with gas; and, undoubtedly, where the device is used upon the majority of electric systems supplied from steam-driven stations, the cry as to a heating service being expensive will have to be met by a demonstration of an electric heater's extraordinary usefulness and advantages under multitudinous conditions where heat directly from fuel is not easily obtainable or perhaps desirable. And just here it is very much to the point to raise the question as to what will be the electric heater's influence upon the Boards of Fire Underwriters? Surely, for instance, the introduction of an electric heater into a stable or barn in place of an ordinary fuel stove should lead to lower insurance rates. This is but one, too, of many other situations that might be mentioned, as peculiarly advantageous to the introduction of electric heat.

But, on the other hand, the most promising field by far for the introduction of electric heating apparatus, and one where the best work will be done, lays in districts supplied with electricity from water powers—like that of Ottawa. Where water power is plentiful or fuel is cheap; there the electric heater will be employed to the greatest advantage. So with a knowledge of the rapid manner in which American water powers are being utilized through the aid of electricity, it is most reasonable to presume that the electric heater will before long find a place in line with its relatives, the electric light and the motor.

New Westinghouse Lamp.

The accompanying cuts show the new Westinghouse incandescent lamp, of which so much has been said since the decision of the United States Circuit Court of Appeals in New York, upholding the validity of the claim of the Edison General Electric company as the possessor of the first patent on a practical incandescent lamp. Mr. Westinghouse has met this decision by asserting that he has a new lamp "which not only does not infringe the Edison patent nor any of the patents of other companies, but is fully covered by patents of our own."

A keyless lamp of this new type is shown in the illustrations. Fig. 1 represents the lamp itself. There is no brass at the base of the lamp, the butt being of glass. No platinum is used for the leading-in wires, its place being taken, it is said, by an alloy which is claimed to be a satisfactory substitute, and to have a proper coefficient of expansion. The nature of this wire composition is, of course, kept secret. The lamp is a separable one—that is, the filament can be removed and the bulb used over again. This is accomplished by attaching the burner to a ground

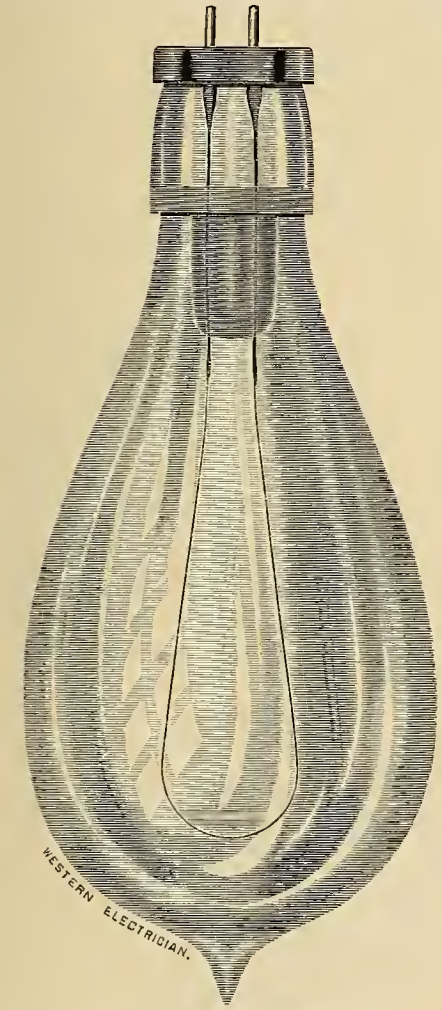


FIG. 1. NEW WESTINGHOUSE LAMP.

glass stopper, which is tightly inserted in the bulb. Then, after the air is exhausted, the lamp is sealed by a peculiar brownish paste. To remove the filament the lamp is soaked in hot water, which softens the sealing compound and allows the removal of the stopper, which, when refitted with a new burner, can be replaced in the manner described, it being necessary, of course, to again have recourse to the pumping process.

The connection with the socket is made directly through the leading-in wires, the projecting ends of which are shown in Fig. 1. The parts of the socket are shown in Fig. 2. The base is of porcelain, and is of extremely simple construction. The binding posts are connected to two spring clips, as shown in the cut, which are arranged to receive, in the middle portion, the two wires leading from the lamp. Contact is made by turning the lamp so that the wires are at right angles with the spring clips, which are thus forced farther apart, one wire pressing against each strip. A quarter turn of the lamp places the wires parallel and between the strips, which spring back to their normal position, shown in Fig. 2, and the light is thus extinguished. The shell of the socket, which is nickel-plated, is also shown in Fig. 2. The lamp is not screwed into it, but simply pushed in, being retained by the springs shown on the sides. It is asserted that these lamps can be sold at wholesale for 30 cents each.

Electricity at the World's Fair.

The wiring for the temporary arc lighting for the dedication ceremonies was completed last week. There are 250 lamps installed in the manufactures building, the scene of the dedication proper, 50 in the agricultural building, 30 in the transportation building, 25 in the electricity building, 25 in the mines building and 150 on the grounds—about 530 in all. Current will be supplied from the present station, south of the transportation building, and from a temporary plant in machinery hall, consisting of three Ball & Wood engines and eight Standard arc machines, steam being supplied from Babcock & Wilcox boilers. In the big manufactures building there will be twelve clusters of five lights each above the speakers' stand and the reserved seats section, and there will also be four clusters over the orchestra and chorus stand. Above the gallery will be seventy-two lights, one in the center of each arch between the roof trusses. Under the gallery will be ninety lamps, and one at each end of the four entrances to the building. There are also sixteen lights in the nave, where luncheon will be served.

The Electric Launch & Navigation company of New York, to which the concession for running electric launches in the lagoons of the World's Columbian Exposition has been awarded, announces that it is the exclusive licensee of the Consolidated Electric Storage company, the owner of the Brush patents. The recent decision in New York will, the New York company asserts, prohibit any other company from running electric launches on the fair grounds.

R. E. Richardson, who was chief inspector of the electrical department of the bureau of construction at the World's Fair, has resigned to accept a position with the Electrical Supply company, Chicago. Mr. Richardson had charge of the arc lighting, and his plans received general commendation. He will be succeeded by Prof. Dodge, late of the United States Navy, in the inspection department, while G. B. Foster will have charge of the arc lighting.

To accommodate the representatives of the press at the dedication, space in the manufactures building was assigned as follows: Western Union Telegraph company, 20x40 feet; Postal Telegraph company, 20x30; reporters' room, 20x75; typewriters, 20x40; telephone and district messenger service, 20x40.

One of the big Schuckert projectors was tested on the top of the transportation building on Wednesday evening of last week. The special dynamo needed for the purpose was not at hand, but an Edison 500 volt generator was utilized by changing the field connections, reducing the potential to about 70 volts. The monster lamp threw a great flood of light over the grounds and buildings, but owing to the foggy nature of the atmosphere the result down-town was not as successful as had been hoped for, although the light at the Auditorium, seven miles away, was very powerful. There was one amusing incident, which was thus described in Thursday's *Tribune:*

Six innocent reporters with no evil intentions touched off a pan of red fire on top of the Auditorium tower last night and almost caused a panic in the audience listening to John Philip Sousa's band below. Some bright young man on the street saw the light, turned in a fire alarm by telephone, and a fire engine, hook and ladder truck, hose cart, chemical engine, a police ambulance and a score of firemen were hurried to the scene. The reporters were working in the cause of science. In the tower of the transportation building of the World's Fair grounds, seven miles away, a massive search light was being tested. It was shooting its rays around over Illinois, Indiana and Lake Michigan, prying into other people's business, and it had been arranged beforehand that at a certain hour it should be thrown on the Auditorium tower, where an ash pan of red fire would burn. The men at the World's Fair grounds found the red lights, and so did the Fire Department. Among the numerous names that will go down to posterity with the Auditorium tower is that of Eva Cartan of Toronto, Can., which is chiseled in the stone on the east side of the tower and 270 feet from terra firma. The letters are two inches high, and the name could be read when the light's rays struck the tower.

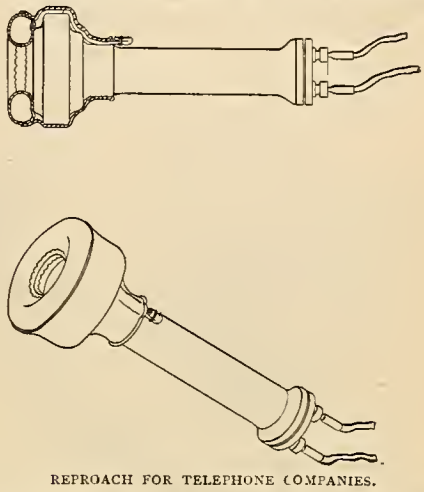
It is said that over 500 men are employed in electrical wiring at the World's Fair.

Twenty telephones were installed at the World's Fair grounds by the Chicago Telephone company for use at the time of the dedication. These were in addition to those already in place.

The City Street Car company of Staunton, Va., which has a franchise to operate its road by electricity, has awarded the contract for the equipment of its road. Work is to begin by November 1st, and be completed by January 1st, 1893.

Reproach for Telephone Companies.

To hold a telephone to the ear for ten long minutes awaiting the usual response "They're busy; shall I call you?" is not calculated to soothe one's temper. Neither is "holding the line" for what seems to be an interminable time a pleasant occupation. Telephone receivers, too, as they are now made are of a shape and are built of a material that causes a long-waiting user to feel his suffering auricle and wonder if its original shape is still preserved. Telephone companies, then, it must be agreed, do not concern themselves much about the comfort of sub-



REPROACH FOR TELEPHONE COMPANIES.

scribers, and for this reason the accompanying cut constitutes a reproach that should not pass unheeded.

The designer of the device says that it is intended to be "attached to the ends of telephone receivers to exclude external sounds without discomfort to the user from a firm pressure of the instrument against the head," also that the device can be applied to the receiver without detriment to it and it will effectually exclude external sounds by allowing a greater pressure against the ear without any discomfort and secure a perfect accommodation of its surface to the ear.

In brief the device is simply an air cushion constructed of a hollow soft rubber ring having an elastic hood or sleeve for securing it in place upon the end of the telephone receiver. A close inspection of the cut will show the arrangement of a small tube by which the ear cushion may be inflated. Ferdinand Gross of Montreal, Canada, is the designer.

Electric Train Signaling.

From Wells street depot, Chicago, to West Fortieth street on the Galena division and to Clybourn Junction on the other two divisions of the Chicago & Northwestern railroad the Westinghouse electric system is to be put into use in the course of the next sixty days. Under it trains will be no longer started by conductors. Five minutes before the time of their departure they will be inspected by the train inspector to see that connections are properly made, air brakes and bell cords in working order and everything in perfect condition. As soon as he has satisfied himself in this respect he will touch an electric button in the depot, which will communicate to the tower man at the bridge that the train will be ready to leave the depot in five minutes. Immediately on receipt of the signal the tower man will flash the intelligence all along the line from the bridge to Clybourn Junction or West Fortieth street as the case may be, and the tracks will be cleared and every switch properly set, and as soon as everything is in order

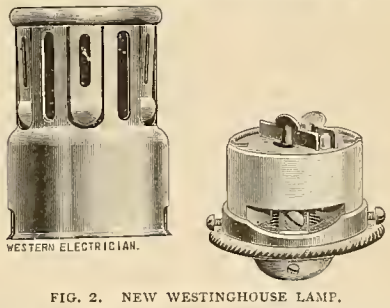


FIG. 2. NEW WESTINGHOUSE LAMP.

throughout the section the tower man at the bridge will be notified and be prepared to signal to start at the appointed moment. One minute before the time of the departure of the train the tower man will again be signaled that the train will be ready to leave in a minute, and he will again repeat the signal to the end of the section. Having received in reply another signal that the tracks are clear, he will display a given signal from the tower house, which, on being seen by the engineer, he will start up his train and proceed without further hindrance at as high a rate of speed as the city ordinances will allow to the end of the section.

Cleveland Street Railway Men.

Cleveland has many men whose work in developing street railway lines in the Forest City has secured for them considerable distinction. Those whose portraits are herewith presented are known by reputation to street railway men throughout the country.

There are few street railway men, for instance, who are better known than J. B. Hanna, secretary of the Woodland Avenue & West Side Street Railroad company. He was born at New Lisbon, O., in 1854, and removed to Cleveland in 1862. He received his education in the public schools of that city and began business with the firm of Rhodes & Co., the largest coal and iron ore dealers in Ohio. From this concern he went to the West Side Street Railroad company as secretary and purchasing agent, and when this road was consolidated with the Woodland Avenue Railway company, he was made secretary of the consolidated company. Mr. Hanna has been engaged in the street railway business for ten years, in which time he has gained a practical knowledge of the business that ranks him among the leading railway men in the country. He has been secretary and treasurer of the Ohio State Tramway association for six years, and has taken an active part in the work of this organization.

J. B. Hanna. Tom L. Johnson. H. J. Davies.
CLEVELAND STREET RAILWAY MEN.

Tom L. Johnson, who is interested in the Brooklyn and South Side railway companies, has of late figured more prominently in politics than in street railway work, although his street railway interests were never larger than they are to-day. But as a member of congress and a democratic leader in Cleveland he has attained more than a purely local or business reputation. Tom Johnson comes from an old southern family which occupied a prominent position before the war, but which, like many others, was overcome by reverses during the late unpleasantness. Unlike his father and grandfather, the subject of this sketch was obliged to begin life for himself at a tender age. He secured a position in the Central Passenger office at Louisville. At the age of sixteen he was made secretary of the road and placed in charge of the offices of the company. He continued to advance and became complete master of the business. He invested largely in other railways and soon became a power in street railway circles.

Beside his interests in the Brooklyn and South Side Street Railroad companies of Cleveland, Mr. Johnson is a large stockholder in the Southern Railway company of St. Louis and the Johnstown Passenger Railway company of Johnstown, Pa., of both of which companies he is the president. Under his direct supervision and management both were changed from horse roads to electric roads. Under his direction, also, the Tuscarawas Electric company built an electric line connecting New Philadelphia and Canal Dover, O. While connected with the Louisville company, Mr. Johnson invented and patented a fare-box, which was adopted and used by the Central Passenger and many other companies. Later, and before the introduction of electricity into street railway work, he designed a cable system and built a short experimental road in Cleveland and a longer road in Brooklyn, N. Y., which was successfully operated, but was abandoned as soon as electricity, in his opinion, was shown to be a more desirable motive power. He also invented and patented an automatic lever brake, which is now in use on almost every cable road in the United States. Among his other inventions are a tower-wagon used for stringing overhead wires, and the Johnson lifeguard, which is used on all the roads in which he is interested, and which has lately been adopted by the West End Railway company of Boston.

He is a director and a large stockholder in the Johnson company of Johnstown, Pa., which is engaged in the manufacture of all kinds of rails for street railroad use. He is the inventor of the Johnson girder rail, which is largely used on electric roads in the United States.

Another officer of the Brooklyn and South Side companies who has contributed largely to the needs of the road is H. J. Davies. Mr. Davies was born in Canada in July, 1859, and went to Cleveland in April, 1863. He attended public schools in Cleveland. In 1875 he studied short-hand and became a successful stenographic reporter. In October, 1889, he became private secretary to Hon. Tom L. Johnson, and in January, 1890, secretary and treasurer of the Brooklyn and South Side Railroad companies.

Dr. A. Everett has been interested in street railway affairs since 1860, when he purchased a controlling interest in the East Cleveland road. At that time, however, the system comprised only two miles of track on unimproved streets and four horse cars of the style known as "bob-tails." There are now, however, 40 miles of electric road and 90 motor cars equipped with the Edison system. Dr. Everett is over 70 years of age, but he is still the controlling power in the corporation. He is a firm believer in the electric motor and was one of its earliest advocates in the state.

H. A. Everett. Dr. A. Everett. J. J. Stanley
CLEVELAND STREET RAILWAY MEN.

Associated with Dr. Everett is H. A. Everett, secretary and treasurer of the company. His business training has been almost entirely in this line of work and his experience has proven valuable to the company. It was largely through his negotiations that the Montreal and Toronto lines were secured by the Cleveland capitalists who now control them. He has given considerable attention to these lines, although he continues to personally direct the East Cleveland company.

John J. Stanley, general manager of the Broadway and Newburg railway, has taken an active part in arranging for the present convention, and the excellent preparation for the entertainment of visitors speaks well for his executive ability. Mr. Stanley is practically the executive head of the Broadway road and is one of the most enterprising street railway men in the Forest City.

Street Railway Convention at Cleveland.

When the American Street Railway association voted to hold its 1892 convention in Cleveland it reached a wise decision, for that city presents many attractions for the street railway man. Not the least important consideration was the fact that the local members were anxious that the association should meet in the city, and that they were ready to devote to the preparatory work sufficient time, attention and money to make the meeting successful from every point of view. As soon as the decision to meet in the Forest City was reached, these gentlemen at once began their preliminary work, and unless all signs fail they have been remarkably successful. They pinned the hotel-keepers down to a contract binding them to refrain from the overcharging to which they seem to be addicted at convention times; arranged an excellent exhibition of street railway apparatus, and prepared an unusually interesting programme for the entertainment of visitors.

The headquarters of the association were located at the Hollenden; the Army and Navy Hall on Superior street, almost directly opposite, was rented for exhibits, and the hall of the Young Men's Christian Association, a short distance away, was secured as a place for holding the business meetings.

The committee met with the most cordial co-operation from local manufacturers, and especially from the Short Electric Railway company, which proposed to entertain the visitors on a most lavish scale at its works. The local street railway companies, too, agreed to afford the committee all possible assistance in providing for the entertainment of the attendants at the meeting.

A large share of the work fell upon the shoulders of H. J. Davies of the Brooklyn Street Railroad company, who took charge of the correspondence. The other members of the local committee are: Dr. A. Everett, president of the East Cleveland Railroad company; Horace Andrews, president of the Broadway & Newburgh Street Railroad company; J. B. Hanna, secretary of the Woodland Avenue & West Side Street Railroad company; A. L. Johnson, vice-president of the Brooklyn Street Railroad company, and F. De H. Robison, president of the Cleveland City Cable company. Owing to the absence in Europe of Horace Andrews of the Broadway & Newburgh Street Railroad company, most of the work assigned to him was performed by John J. Stanley, vice-president and superintendent of that company.

CLEVELAND STREET RAILWAYS.

A person who wishes to study the operation of electric railways can find in no city in the country better opportunities than in Cleveland. Whenever an electric railway installation is proposed in any city a trip to Cleveland is always the proper thing. A New York paper, in its ravings on the trolley system, amused the Cleveland railway men recently by saying that "in no city in the country has the electric devil-fish got its tentacles so firmly fixed." They are afraid of no such expressions in the Forest City. The motor car has contributed in such a marked degree to the prosperity of the city, it has afforded such splendid rapid transit, and has proved so far from dangerous that little objection is found to the system. Although the best cable road in the country is in operation

in Cleveland, it suffers badly in comparison with the electric lines in the estimation of the residents. No one who makes even a superficial investigation can fail to be struck by the fact.

There are five street railway systems in the city, under the control of the same number of companies, although nominally the number of the latter is greater. Three of the five systems are electrically operated, with an aggregate length of 116 miles of single track; one will be electrically equipped within a few weeks, thereby adding 32 miles to this number, and the fifth, as already stated, is a cable line. That the tendency is toward electrical operation is set forth plainly in that statement, but it may be added that the company operating the only cable line in the city shares in this tendency. It controls the St. Clair street line, which is operated by horses. A petition is now before the city council to substitute electricity for animal power on this road. The company has stated that the installation would be a temporary one to afford rapid transit to the patrons until certain improvements are completed in the street. It may be added, however, that no one expects when electric motors are once in operation that St. Clair street will ever be cabled. The electric lines are liberally patronized, and they make such rapid speed and are so generously laid out that citizens are continually increasing the profitable short haul traffic.

What makes Cleveland a city of particular interest to those who study electric railways is the diversity of the equipment. If one is anxious to see in operation any particular kind of apparatus, or to note the advantages attending any special arrangement of power station, it is safe to assume that examples will be found in the city. There are to be seen the oldest forms of double reduction motors and the latest type of gearless, mounted on trucks of a dozen different makes, all kinds of car bodies and every arrangement of power station. Should you wish to see a station in which generators are belted directly to high speed engines, three illustrations may be found at as many points on the line of the Brooklyn company; if you desire to see a station with Corliss engine and countershaft, the East Cleveland company has a plant worth studying; if you are interested in direct belt connection between slow speed engine and generator visit the station of the Broadway & Newburgh company; and in the new station of the Woodland Avenue & West Side company you may examine in embryo form a plant in which generators are to be attached to the shafts of triple expansion marine engines.

It is not proposed here to give detailed descriptions of the several systems, but to note briefly the electrical apparatus that is in use.

EAST CLEVELAND RAILROAD COMPANY.

The East Cleveland Railroad company is the pioneer electric railway company. It introduced electric motor cars in December, 1888. At present it controls fifty miles of track, all of which is traversed by electric motors of the following types: Eighty Edison double reduction, ten Edison single reduction, one Thomson-Houston single reduction. The power station is located at the Cleveland & Pittsburgh track, near Cedar avenue. Current is generated by sixteen Edison machines, varying in capacity from 40 to 150 kilowatts each. They are driven by three Armington & Sims engines of 250 horse power each, three engines of the same make of 125 horse power each; and two C. & G. Cooper & Co.'s slow speed engines of 500 horse power each. The Armington & Sims engines are belted directly to the generators, and the slow speed engines are connected to a countershaft. There are 14 boilers of a capacity of 130 horse power each; half the number are of the Cooper make, and the remainder was made by the Variety Engine Works company of Cleveland. A special feature of the East Cleveland company's system is the car shops located at the terminus of its main lines. Their equipment is complete in every respect, and they have been arranged in such a manner that the work of inspecting and repairing motors is greatly facilitated. The officers of the company are: President, A. Everett; vice-president, C. W. Wason; secretary and treasurer, H. A. Everett; assistant secretary and treasurer, L. E. Beilstein; superintendent, E. Duty.

BROOKLYN STREET RAILROAD COMPANY.

The Brooklyn Street Railroad company and the South Side Street Railroad company are to all intents and purposes a single company. All the good or bad that they both may do is ascribed to the former corporation, and it alone is known to residents of Cleveland, few of whom ever hear of the latter company. On the books the two corporations are separate, and they have different officers, but they are the same men in different capacities. The two roads may here therefore be considered as a single system, officered by President Tom L. Johnson, Vice-president A. L. Johnson, Secretary and Treasurer H. J. Davies and Superintendent Samuel Harris. The roads have been operated by electricity since the fall of 1889, and at the present time 70 motor cars and 92 trailers carry passengers over the lines. The cars are all operated by Thomson-Houston double reduction motors with the exception of six, five of which are operated by Wightman motors and the sixth by a Short gearless. Located at three different points on the system are power stations, each arranged in practically the same way. In the Scoville street station are installed five Thomson-Houston generators, each of 62,500 watts capacity. They are belted directly to five Straight Line engines. The boiler room contains three boilers of 150 horse power, made by the Variety Engine Works company of Cleveland, and equipped with the Roney mechanical stoker. In the Pearl street station the generators are ten in number, of the same capacity, and belted to Ball high speed engines. The boilers are of the same make as in the Scoville street plant and are 150 horse power each. The third station, on Canal street, is equipped with seven Thomson-Houston generators of the same capacity, belted to engines of the same make. The boilers are of the same make and capacity as those in the Pearl street station.

PROF. SIDNEY H. SHORT.

BROADWAY & NEWBURGH STREET RAILROAD COMPANY.

The Broadway & Newburgh Street Railroad company operates on its two lines thirty motor cars. Of this number 25 are Edison double reduction; 12 Short, 11 double and one single reduction; and one Westinghouse single reduction. The power station, which is located on Broadway, corner of Ætna street, is of special interest, as the generators are belted directly to Corliss engines, and it is claimed by this arrangement most economical results have been obtained. The four engines are Reynolds-Corliss, made by E. P. Allis & Co. of Milwaukee. The largest of the four, which is of 600 horse power, drives two 150 kilowatt Edison machines. The other three engines are each of 250 horse power and each drives two 80 kilowatt Edison generators. The boilers are five in number, each of 200 horse power, and were made by the Variety Engine Works company of Cleveland. The officers of the company are: President, Horace E. Andrews; vice-president and superintendent, John J. Stanley; secretary and treasurer, Dr. Edwin Fowler.

WOODLAND AVENUE & WEST SIDE STREET RAILROAD COMPANY.

Within a few months at the furthest the 32 miles of track comprising the system controlled by the Woodland Avenue & West Side Street Railroad company will be electrically operated. Had it not been for a succession of unforeseen delays the lines would have been by this time traversed by electric motor cars. At the present time work is in progress on all parts of the system. The Westinghouse Electric & Manufacturing company secured the contract for the motors, which are to be of the single reduction type. Forty new motor cars will form the new equipment, and the present cars will be used as trailers. The overhead equipment was furnished by the Railway Equipment company, of Chicago. The power station is to be equipped on lines that are novel in this country, at least. The engines will be three in number, all triple expansion and of the marine type, with a capacity of 500 horse power each. They were constructed by the Globe Iron Works company of Cleveland. The generators, which will be installed by the Westinghouse company, are of 250 horse power each. Each engine shaft will be coupled to two generators, one at each end. It is expected that this mode of connection will produce marked economy in operation, and every electric railway manager will be interested in the results. The boilers, which were built by the Globe Iron Works company, are also of the marine type, and each is of 500 horse power.

Prof. Sidney H. Short.

Prominent among the men who have contributed to the advancement in the application of the electric motor to the street railway and have done valuable work in bringing the system to its present state of development is the subject of this sketch, Prof. Sidney H. Short of Cleveland, O. Although Prof. Short's work has been of the most advanced kind, and has already earned for him enduring fame, he has by no means ceased to take an active part in street railway work, and seems confident of further and greater achievements. He is still comparatively a young man. Born at Columbus, October 8, 1858, he received a thorough education and was graduated by the German University of that city. When the Ohio State University was opened he accepted the direction of the department of physics. Later he accepted a similar position at Denver University, which he occupied until 1886, when he withdrew from educational work and engaged in commercial pursuits. He had for several years given the subject of power transmission and application of electricity special study, and had devised considerable apparatus which he placed in the market at this time. He had formed a company to be known as S. H. Short & Co. at Columbus, but this was soon organized under the name of the Short Electric Railway company.

To Prof. Short, more than any other American electrical engineer, is due the development of the gearless motor. When the single reduction motor was presented it was considered great advancement, and when it was afterward announced that a practical gearless motor had been devised by an American, universal interest was attracted. Prof. Short has contributed several papers on this subject, giving the result of experiments and researches conducted by him. He is enthusiastic, but he is also practical, and his inventions have always been marked by a completeness of mechanical detail, which, it is to be regretted, is not always found in electrical machinery. Prof. Short continues to be the guiding spirit in the corporation bearing his name, and he personally superintends the mechanical and electrical departments.

Electrical Talk on Wall Street.

Of course the incandescent lamp decision and Mr. Westinghouse's recent move in bringing out the new style lamp have occupied the attention of the electrical fraternity in a manner to make the electrical decorations of the Columbus celebrations of secondary importance. Dealers in electrical stocks can speculate now in more ways than one, for the market is, to say the least, far from being steady. Wall street isn't quite certain, and all sorts of rumors are, of course, going the rounds. The announcement that George Westinghouse had a new incandescent lamp through which his company proposes not only to get around the patent claims lately upheld for Edison by the United States court, but which, it is intimated, is destined to bring down the price of such lamps 50 per cent. or so, has attracted much attention in financial circles. It has helped the price of Westinghouse stock, perhaps. It looks now as if one of the biggest fights is ahead in the electrical business that the industrial world has known in years. Wall street continues, too, to gossip about the plans of Mr. Edison himself. According to the current tales, he is not only at outs with his old colleagues, but is hard at work in developing plans which, if carried out, will result in some odd situations. This rumor, though, is given only for what it is worth. It is intimated

that Mr. Edison has patented a new lamp quite outside of anything covered by his old patents, and that he intends to go into the manufacturing business on a tremendous scale. If he does intend to go into a new electric manufacturing scheme, some people say that his purpose is to locate in Chicago. It is claimed that he has lately been making a close canvass of certain matters which would, under such circumstances, have to be considered. One of his business associates, it is rumored, has been in Chicago industriously at work on the quiet for the last fortnight or more, while Mr Edison's private office has suddenly become decorated with Chicago maps.

All the above is the street talk, and it has been denied at the Edison company's New York office that Mr. Edison was preparing, with Henry Villard and other financiers, to organize another company with $12,000,000 capital to fight the Edison company. The general sentiment in the street, too, seemed to discredit the rumor, although the grounds for Mr. Edison's alleged action were that his interests were not wisely guarded, and he was consequently thrust aside in the consolidation of the Edison and Thomson-Houston companies.

Said a man who is conversant with Wall street matters:

"I don't think there is anything in the rumored deal for several reasons.

"Moneyed men are not going to throw away money in fighting such a well-backed concern as the Edison company with its many millionaire directors.

"So far as the Edison company is concerned they might not worry over Mr. Edison's withdrawal, for he has sold them his inventions."

John H. Herrick, third vice-president of the Edison company, said to a reporter:

"I don't believe a word of the rumor. Mr. Edison is still with the company, and so far as I know has no intention of withdrawing from it."

"Would the company be indifferent to Mr. Edison's withdrawal?" asked the reporter.

"No, I will not say that. It is true that the company owns Mr. Edison's present inventions, but we cannot foresee what may happen in the future."

Word comes, too, from Charles A. Pillsbury, whose name has been mentioned in connection with the rumored new Edison company. In an interview recently at Minneapolis he denied that he had been consulted regarding such a move.

"I am not looking for new business chances," he is quoted as saying, "and am neither directly nor indirectly connected with this. I am at a loss to understand how I have been mixed up with Mr. Edison's affairs."

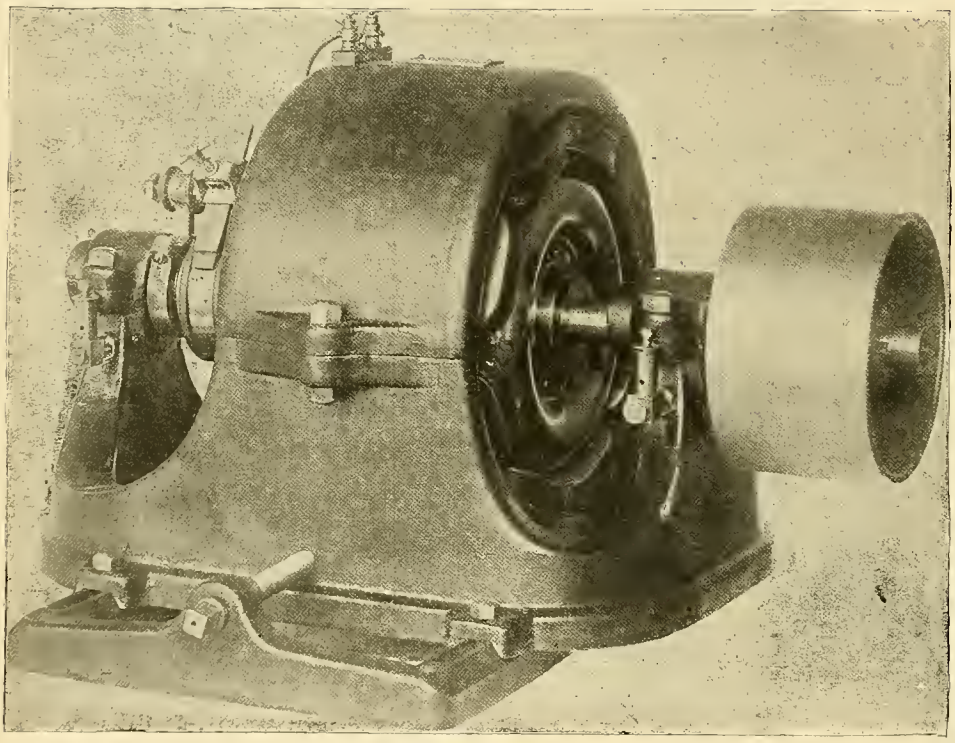
In connection with the rumor in question Wall street was also discussing a rumor involving the Westinghouse company.

Mr. Westinghouse held a conference with Mr. Villard on Tuesday of last week, which led to a supposition that Mr. Westinghouse and the Edison people were coming together. After the conference, however, Mr. Westinghouse said:

"The Edison people are trying to give the impression that we must consolidate with them to keep afloat. They would probably like to have it so. The fact is, we are going to stand alone as an independent company. We will keep right on with our business. Full explanation of the bearing of the recent decision has been made public, and further than that there is no need of any statement now."

New Wagner Motor.

Illustrated herewith is a new motor that has just been turned out of the factory of the Wagner Electric Manufacturing company of St. Louis. Herbert A. Wagner is the inventor. As will be seen by the illustration, the motor is compact, with heavy iron base and occupies only a small floor space. The claims made for the Wagner motors are that they embody all the most recent improvements in electrical and mechanical designs, and meet in every particular all the requirements suggested by the most advanced modern practice. They are, it is claimed, constructed with a perfect mechanical and electrical balance, with very broad base and low center of gravity. The number of parts is small; the armature and field coils can easily be removed without disturbing the pillow blocks. The field coils are wound on spools, which may be easily removed should occasion require. One of the principal features of this motor is its very low speed. All of the armature wire is completely embedded in the iron core, but good ventilation is secured. All of the bearings are self oiling by means of a loose ring, which takes up the oil in the boxes and feeds it on the bearings as required. By this means the motor requires oiling about once a month while in constant service. Each of the bearings is provided with a sight-feed, so that the amount of oil in the boxes may be readily seen. All of the bearings are mounted on ball sockets, so that the friction is reduced to a minimum. The brushes, which are self-feeding, may be changed while the motor is running, and there is, it is claimed, no sparking under any change of load. The Wagner motors are reversible without changing or removing the brush holders. The regulation is good; the motors maintain a constant speed under all variations of load. They readily start under a full load and attain the normal speed very rapidly. There is no external magnetism, and the small air gaps in the magnetic circuit have effected great saving in the field current. These motors are perfectly adapted for 110 and 220 volt currents, and they are wound as well for 500 volt circuits. The ends of the armatures are protected by a neat bronze cap and the appearance of the entire motor is one of handsome mechanical design. The manufacturers of the Wagner machines have arranged with Taylor, Goodhue & Ames, Chicago, for the exclusive agency for six states.



NEW WAGNER MOTOR.

An Idaho Electrical Transmission Project.

A company has been formed under the laws of the state of Illinois to utilize by electricity the power of the Shoshone Falls in the Snake River, Idaho. It is stated that the amount of available water power at these cataracts is second only to that of Niagara, and that it is constant all the year round. The principal fall is 950 feet wide and 210 feet high, although a second fall increases the total head to 290 feet. The newly incorporated Shoshone Falls Electric Power & Irrigation company, which is capitalized at $25,000,000, has secured control of both sides of the river at the falls, and proposes to erect a great plant for the generation of electric power. The conformation of the banks of the river lends itself very readily to the scheme, and no tunneling will be necessary. Large power units will be employed, but the details of the plant are still to be worked out. The Snake River flows through a canyon of considerable height, and this fact has heretofore prevented the use of the water for irrigating the surrounding valley, the soil of which is extremely fertile. It is now proposed to carry the current along the river from the generating stations at the falls to points where the canyon walls are lowest. Here, by pumping 40 feet, the water can be raised to the land above, where it is needed. Electric pumping stations will be installed at these points, and the water will be raised into irrigating canals and sold to farmers. The rates now prevailing for irrigation are from $15 to $40 for bringing the water on the land, and then an annual rental of $2 or $3 per acre. It is estimated that, under the conditions existing, the expenditure of 5,500 horse power will irrigate 120,000 acres of land. It is the intention to ultimately transmit power and light to the Wood River mining country also. The incorporators of the company are Nelson W. Perry, H. C. Baker and John B. Schmalz. Mr. Perry, who will have entire charge of the designing and construction of the plant, is peculiarly fitted for the work, as, in addition to a complete equipment as a mining engineer, he has a thorough knowledge of the applications of electricity. He was formerly editor of *Electricity*, New York, and is well known to the electrical fraternity of Chicago, Cincinnati and New York. Ground will be broken for the works at the falls within thirty days.

Clear, Concise Statement in Demand.

A professor informs us, says the *Baptist and Herald*, of Dallas, Texas, that science has now immediately before her three great problems to tackle. The first is to produce electricity directly from coal; the second is to produce for illuminating purposes the "beautiful soft beaming light of the firefly and the glowworm," which illuminates without heat; the third task is air navigation. With these undertakings inventors must wrestle victoriously before there is any remarkably improvement in mechanical science. This is all well. But there is one problem as mighty as any, which he does not mention. That makes four for the coming man of science to solve. The fourth problem is to find a way to make professors of science and philosophy write plain, short, decent sentences, such as people can understand. The tremendous waste of gray matter, brain cells and "potential energy" involved in the attempt to make head and tail of scientific and philosophical writing as far exceeds the waste of fuel in producing steam as 10 exceeds 1. Take a sentence in this very magazine article. The reader begins it. He gets muddled and glances back to the beginning. It is so far off that he has a curinsity to count the words in it. There are 185; nearly half a page, and it wasn't a very good day for sentences either.

CORRESPONDENCE.

New York Notes.

NEW YORK, October 15.—The electrical side of Wall street has had plenty to think about during the last week, and even those whose mental exertions were the hardest will have to confess that they are now no wiser than before. Of course Dame Rumor has been gossiping at a great rate about the Edison and Westinghouse interests, and it is patent to everyone that the future may have surprises in store. Mr. Westinghouse's latest move—placing on the market the new lamp—is taken as an indication that he does not consider himself badly beaten, to say the least. As a matter of course the new lamp is the subject of much speculation. A number of descriptions of it have appeared, but it wouldn't be an easy matter to find a New Yorker who knows what the lamp looks like, to say nothing of possessing information as to its construction and manufacture.

Another rumor of an electrical character that permeates the air of the historic street in which so many fortunes have been made and lost, is that negotiations have about been completed for the transfer of the control of the Postal Telegraph company to the Western Union. This report persists in remaining in circulation in Wall street in

spite of the disclaimers of Jay Gould and persoos connected with the Postal Telegraph. The current belief that there is something in this report is due no doubt to the peculiar wording of President Green's official statement submitted at the annual meeting of the Western Union stockholders last Wednesday. In speaking of the proposed increase of the capital stock of the Western Union company from $86,200,000 to $100,000,000, Dr. Green said:

The charter stipulates that the lines shall be extended from the sale of capital stock, and not otherwise. No definite disposition of the proposed increase of stock has been determined upon. If the stockholders (at the special meeting called for October 25th) give the necessary authority the board of directors will determine such disposition of new stock as shall be for the best interests of the company.

Quite naturally Wall street men regard Dr. Green's language as indicating that the Western Union people propose to pay for the Postal Telegraph property with new Western Union stock. George J. Gould said that he knew of no negotiations looking to the acquisition of the Postal Telegraph company by the Western Union.

W. F. O.

Northwestern Notations.

MINNEAPOLIS, Oct. 15.—The Selby avenue hill in St. Paul has always been a source of worry to the street railway management. The grade is terribly steep. Several lives were lost there by a car breaking loose and cavorting down hill. Engineer McCook thinks he has a scheme that will make such accidents impossible. The device consists of an endless chain or belt passing over carriers down and on its return passing over a sprocket wheel mounted on a shaft or friction break. A hook hangs from the car and if the car slips the hook would at once catch and bring the car to a standstill. The endless chain is intended only for the track on the right side. On the other side will be an iron ladder with apertures at short intervals. When the car goes up the hook drags over the apertures, but if it should begin to slip back it would catch and hold the car. It will cost $17,000 to put it in. The aldermen are favorably disposed.

Notice has been served upon the St. Paul authorities to the effect that the use of the Gamewell fire alarm system is an infringement of a patent. Minneapolis has received similar notice. In both cities the system has been in successful operation for years. The St. Paul council has contracted with E. B. Birge for his appliances for opening the doors of fire stations when the alarm comes in. The drop box, over which there has been a patent war, will be thrown out entirely.

The much-talked of combination of the Brush and Edison electric companies in Minneapolis has been duly consummated. At a meeting at the office of the Brush company a few days ago officers were elected as follows: President, E. S. Corser; vice-president, H. M. Byllesby; secretary, A. M. Robertson; treasurer, A. B. Barton. Most of the officers were officers in the Brush company. Mr. Byllesby is a St. Paul man and president of the Northwest General Electric company. For the present, at least, both power stations will be maintained. The general offices of the Edison company in the Lumber Exchange have been abandoned and all business will be handled at the old Brush office on Washington avenue. The changes in personnel have not been announced. The capital of the new company will probably be $1,250,000. The Brush company had $750,000 capital and the Edison $500,000.

The compromise agreed upon by President Lowry and a joint committee in St. Paul about the proposed Como line has been repudiated by a special council committee and the matter is practically no nearer a settlement than before.

The Phœnix Electric company has filed amended articles of incorporation at Duluth.

The Rocky Mountain Bell Telephone company proposes to run a wire from Missoula to Deer Lodge, Mont., thus giving direct communication between Missoula, Butte, Helena and Anaconda.

The contract has been let for the new electric power house at Ashland, Wis.

St. Louis, Mo.

ST. LOUIS, Oct. 15.—The council committee on railroads held an important meeting on the 13th inst. The Delmar avenue and Clayton railway, and the Manchester Road railway bills were taken up for consideration. A number of prominent citizens urged the passage of the bills. No final action, however, was taken.

The attorney of the City Central railway announced the readiness of the projectors of that enterprise to deposit $50,000 in the city treasury as a forfeit, if that company failed to build the railway, provided a franchise was granted.

The Chicago & St. Louis Electric Railway company, which has just begun actual construction at Edinburg, Ill., announces that it will place on the market 50,000 shares of stock at $4 per share, the par value being $10. This company recently sold 100,000 shares at $3, and the next sale will be made at $5. This present sale will open on October 1st and close October 7th at the company's office at St. Louis.

Telegraphic advices just received indicate that Atchison, Kan., is to have electric cars. A company known as the Atchison Electric Motor & Street Railway company has been organized with a capital stock of $500,000. It is reported that thirty miles of track will be built.

At the meeting of the city council held on the 11th inst., an ordinance was introduced granting a forty-five year franchise to the Connecting Electric Railway company. The route of the proposed line begins at the intersection of the New and Old Manchester roads, along New Manchester road to King's Highway, then on Berthold avenue to Clayton road, and then on either Childes or Louisville avenue, across Dale avenue into either Plateau, Mitchell or Glades, whichever may appear most desirable; thence to McCausland avenue and Manchester road to the terminus at the city limits. This company agrees to deliver its passengers down town, from any point of its line for five cents, the transfers to be good on all connecting lines.

Work is progressing rapidly on the new power plant of the Marshalltown Light, Power & Railway company, Marshalltown, Iowa, plans for which were prepared by William H. Bryan of St. Louis. There are to be five 120 horse power steam boilers, two 150 horse power Corliss engines and two 100 horse power high speed engines, together with necessary shafting, clutches and pulleys. The boilers are to be made by the Lennox Machine Works at Marshalltown. The first Corliss is now being completed by the St. Louis Iron and Machine Works. The two high speed engines are of the Ideal type. The contract for shafting, clutches and pulleys went to the Falls Rivet & Machine company. A 600 horse power brick stack is nearly completed. Thomson-Houston electrical apparatus will be used throughout, the total capacity being 2,650 incandescents, 100 arcs and a 125 horse power railway generator. Five cars are to be operated on three miles of track. It is expected that the new plant will be ready for service about the middle of November.

The Thomson-Houston Electric company and the Pueblo City Railway company have filed a petition in the United States Circuit Court here against the Union Trust company of this city, asking for an injunction to prevent the Trust company from selling certain bonds. The Thomson-Houston company claims that the Pueblo company owes it $116,000. The Thomson-Houston company also claims to own 2 510 shares of the capital stock of the Pueblo company, whose property is bonded for $500,000 on a first mortgage. These bonds were given the Trust company as security for a loan of $250,000, due September 1, 1891. This note was afterward surrendered for a new one for $279,336, bearing ten per cent. interest. The Thomson-Houston company claims that the Trust company is now preparing to dispose of the bonds, and that it has no right to do so. An order was granted requiring the defendants to show cause why a preliminary injunction should not be granted.

B.

NEW INCORPORATIONS.

Amityville Electric Light company, Amityville, N. Y.; capital stock, $20,000; to produce electricity for light, heat and power.

Panora Electric Light company, Panora, Iowa; capital stock, $6,000; to maintain and operate an electric light and power plant; G. M. Reynolds, Panora, Iowa.

Electric Power company of Wilmington, Chicago, Ill.; capital stock, $1,000,000; general electric light, heat and power business; G. W. Kretzinger, Monon block, Chicago, Ill.

Selma Photo Electric Manufacturing company, Kittery, Me.; capital stock, $10,000; to manufacture and deal in electric and photographic goods; Frank E. Rowell, Kittery, Me.

Redlands Electric Light & Power company, Redlands, Cal.; capital stock, $200,000; to generate electricity by water or steam for lighting, heating, manufacturing and other purposes.

Twenty-third Avenue Electric Railway company, Oakland, Cal.; capital stock, $300,000; to construct and operate a street railroad in Oakland, a distance of two miles; George W. Reed, Oakland, Cal.

Grand Forks Electric Street Railway company, St. Paul, Minn.; capital stock, $100,000; to manufacture, generate, sell, and furnish electricity, gas and steam, for light, power and heat; construct, own and operate street railways, water powers; F. C. Stevens, Pioneer Press building, St. Paul, Minn.

Columbia Manufacturing company, Seattle, Wash.; capital stock, $10,000; to deal in mechanical and electrical machinery and appliances, patents and patent rights; Geo. H. King, Seattle, Wash., Box 996.

Helios Electric company, Philadelphia, Pa.; capital stock, $100,000; manufacturing, contracting, furnishing all articles, apparatus, machinery, equipment, etc., for the use and application of electricity; Frank S. Marr, 1310 Filbert street, Philadelphia, Pa.

Pacific Grove Electric Light & Power company, Pacific Grove, Cal.; capital stock, $60,000; to generate and deal in electricity for light, heat and power, operate telephone and electric lines, and do other kindred business; Carnall & Hopkins Co., San Francisco, Cal.

Butte General Electric company, St. Paul, Minn., and Butte, Mont.; capital stock, $600,000; to manufacture, generate, sell, furnish and supply electricity, gas and steam for light, heat and power, telegraph and telephone purposes; Jesse R. Wharton, agent, Butte, Mont.

ELECTRIC LIGHTING.

An electric light plant is to be equipped at Hearne Tex.

Metropolis, Ill., has just completed a system of electric lights.

The Mutual Light & Power company will erect a $150,000 electric plant at Mobile, Ala.

Leamington, Mich., has voted $5,500 toward the purchase of an electric lighting plant.

The citizens of Pecatonica, Ill., are contemplating the purchase of the local electric light plant.

The trustees of Shelbyville, Ky., have appointed a committee to consider the practicability of erecting an electric light plant.

The Brush Electric company has offered to buy the city plant of Moline, Ill., for $16,000, if it be given a contract for five years.

The electors of the village of Linwood, O., will vote next month on the question of issuing bonds for an electric light station.

It is said that the placing of powerful arc lights in front of the penitentiary at Columbus, O., deters convicts from attempting to escape.

The left bank of the Seine at Paris is about to be lighted electrically. A company has just been formed with a capital of $1,500,000, and an office has been opened at the Boulevard St. Germain.

The supply of natural gas used for fuel at the Thomson-Houson electric lighting station at Buffalo was suddenly cut off one night last week, and for a time a portion of the city was in darkness.

At Richmond, Va., the aldermanic committee on light has adopted a resolution to appropriate $125,000 for the erection of an electric light plant, and submitted it to the city council, which referred it to the finance committee.

The new Citizens' Light & Power company of Rochester, N. Y., has purchased property for a station on Brown's Race, Genesee river, with several water rights. A steam plant is also to be added to supply power when the water of the river fails during the summer months. The work of construction will commence at once. The officers of the new corporation are: Robert M. Myers, president; H. W. Davis, vice president; Ezra M. Higgins, secretary; P. V. Crittenden, treasurer.

The cases of the Brush Electric light company against the Jones Bros. Electric Light company and the Queen City Electric Light company were argued in the Supreme Court of Ohio recently. These are Cincinnati cases. The Brush company secured perpetual injunctions restraining the defendant companies from stringing wires on its poles but the Circuit Court held that the council had no right to grant the Brush company permission to erect its poles and that the poles were therefore the property of the city.

Recently the old electric light company of Mobile, Ala., sued out an injunction in the Chancery Court of Mobile against the new electric company restraining the latter company from stringing its wires along Royal street in proximity to the wires of the former company. It is alleged in the bill of complaint that the new company in stringing its wires is endangering the wires of the former company. It is alleged that they are so close that by the swaying of the wires from storm or accident great damage may be done the former.

ELECTRIC RAILWAYS.

The village authorities of Lowell, Mich., have granted to McDannell & Church a franchise for the construction of an electric railway in that place. Both passengers and freight will be handled.

The matter of consolidating the Negaunee & Ishpeming Street Railway company and the Ishpeming Gas & Electric Light company has been broached to the officers and stockholders of both companies, many of whom are interested in the two concerns.

The Denver, Lakewood & Golden Railway company has decided to erect an electric power house at Lakewood, Colo. Temporary arrangements have been made with the Golden Electric Light company for power for the cars. When

the resorts are opened next season an independent power house will be constructed at Golden.

The new electric line on Bainbridge and Catherine streets, Philadelphia, is nearly completed. All the poles are in place, the hangers are up, the power house is nearly under roof, a portion of the rails are down, feed wires have been laid between Thirteenth and Fifteenth streets on Bainbridge, and the men at work are doing their utmost to complete the work at an early date.

The power house of the electric railway at South Chicago is rapidly nearing completion. This road is to run from the gates of the Columbian Exposition to One Hundred and Sixth street. It has been mainly built by a bond issue, but the stockholders have now ratified the proposition to increase the capital from $100,000 to $1,000,000. The date set for the opening is the holiday season.

A concession for an extensive system of underground electric railways in Madrid, Spain, has been given to an architect of Barcelona. It comprises several lines, which will connect all the important parts of the capital, particularly the railway stations and public walks. It is not known so far whether the necessary capital will be forthcoming, but it is generally considered that the project has little chance of being carried out.

The plans for the traction syndicate's boulevard and electric road between Baltimore and Washington have been completed. The electric road will be constructed with a double track, and will be stone ballasted, the same as for steam railroads. Its construction will admit of the running of cars or trains at the rate of sixty miles an hour, which it is thought will furnish the rapid transit service so necessary between the two cities and the intervening towns. The boulevard is to be patterned after the one in use between St. Paul and Minneapolis.

TELEPHONE.

The Ishpeming, Mich., Telephone company is extending its lines to the Winthrop, Saginaw and Fitch mines.

The long-distance telephone between Trieste and Vienna has been connected to Prague, a total of 728 miles. From end to end the sounds are perfectly clear, and conversation is carried on with ease.

Considerable comment has been caused by the order of the Chicago Telephone company that henceforth all the young lady operators must dress in black while on duty. The change was brought about, it is said, at the instance of the chief operators, who objected to the practice of some of the girls in wearing out all sorts of odds and ends of old finery and party dresses in the exchange. It is also claimed that the girls do better work when neatly and tastefully dressed. There was some objection to the order, but no formal complaints were made.

By burying its wires in the business district the telephone company of Cincinnati will replace 1,500 poles by 48. This district embraces the territory from Third street to the canal, and from Central avenue to Broadway. The poles to be removed are all those on the streets included within the boundaries mentioned, and this means that not a single telephone wire will cross streets, but all will radiate from 48 center poles (there are 48 squares in the district), each in the alley of its respective square, and in such a location as will injure or bother no one.

TELEGRAPH.

The Pecos Valley Telegraph company will build a line from Roswell to Eddy, Colo. A telephone line will also be strung on the same poles.

Several changes have lately been made in the rules governing the business of the Western Union Telegraph company. One of the changes will save considerable money for the people engaged in commercial pursuits. Formerly every character not a part of a word was counted as a word, hence "100,000" expressed in figures was counted as six words. The new rule permits figures to be grouped in threes, which would allow 100,000 to be sent by telegraph as two words. The rule applies to all characters except initial letters, which will still be sent as though each constituted a word.

ELECTRIC MINING.

The company operating No. 7 Mine at Green River, Wyoming, has installed a sixty horse power electric motor, which will be used to haul pit cars to the surface. The motor has a traction capacity of thirty loaded cars.

Additional interest in the great Atlantic and Pacific tunnel in Colorado will be excited in consequence of a large electric plant operated in connection with this project. By this system the same wires furnish power to the air compressors and a fifteen horse power locomotive as well as lighting and ventilating the tunnel. The plant is operated by water power, and electrical energy transmitted to each end of the tunnel where work is progressing. At each heading air compressors are placed, each capable of driving two 3½-inch drills. These compressors are kept close up to the headings, so there will be little loss in the transmission of power.

MISCELLANEOUS.

It is said that no less than 30 new houses are being erected in West Lynn by men who work in the Thomson-Houston factories.

The Franklin Institute committee on science and the arts has recommended Lieut. Bradley A. Fiske's electric range finder for the Elliott Cresson gold medal.

The city of Denison, Tex., was visited on October 14th by a severe electrical storm. The Missouri, Kansas and Texas ice house was badly wrecked by lightning.

On September 17th a curious electrical phenomenon was witnessed at Oberhausen, in Germany. Under a bright sun and clear sky several flashes of lightning were suddenly seen, accompanied by clashes of thunder of great violence. A flash of lightning struck a telegraph pole and rendered the wire useless for some time. In the village of Osterfeld the lightning struck a house and paralyzed a woman.

The Hull House, 335 S. Halsted st., Chicago, is making its announcements for the college work for the coming terms. The course in physics will be conducted by Thomas G. Grier, M. E., University of Pennsylvania, and will consist of talks and discussions on the laws of motion, the forces of nature, energy, heat, sound, description of the metric system, and the determination of units used in practical work. Lectures on the fundamental principles of the science of electricity will be given by L. K. Comstock, Ph. B., University of Michigan. Experimental investigations in applied electricity will be conducted by Edward Shaw, E. E., Boston Institute of Technology.

TRADE NEWS.

Those wanting to purchase second-hand machine tools should send to Manager E. D. Goodwin for the list of stock now carried by his house, the Lodge & Davis Machine Tool company, 68-70 South Canal street, Chicago.

The Ries Electric Specialty company, Baltimore, Md., has received a letter from Morris W. Mead, superintendent of the bureau of electricity of the Pittsburg department of public safety, in regard to the Ries socket. Superintendent Mead states that he has examined the socket, and finds in it all that the company has claimed for it as a convenient and good regulator of electric incandescent lighting. The device is positive in its action, saving in its results, and at the same time it is simplicity itself.

The Electric Appliance company, Chicago, reports great activity in all lines of its business. It is working overtime with a largely increased force, and is only enabled to keep up with its orders with great difficulty. The Elkhart transformer factory is working day and night. The Packard Lamp company is crowded to its utmost capacity. The Paranite people are doubling their force, and other factories furnishing specialties to this company are obliged to increase their working forces.

The Rice Machinery company is now permanently located in new quarters, 166 174 South Clinton street, Chicago, having removed from its old quarters, 63 and 65 South Canal street, October 1st. This concern is now making a specialty of complete shafting equipments for electrical generating plants, and with the increased facilities and heavy machine tools recently added, is in position to handle contracts of any size. The Rice company is general agent for the Dodge Manufacturing company of Mishawaka, Ind., and is pushing the sale of the Dodge patent split disk friction clutch pulleys and cut-off couplings, also the Dodge special dynamo pulleys.

BUSINESS.

One of the most handsome and unique souvenir folders that have been distributed to the electrical trade this season is the illustrated "History of Illumination from Prehistoric Times to the Beacon Incandescent Lamp."

The Carpenter Enamel Rheostat company of Bridgeport, Conn., has recently finished doubling its furnace capacity. The works are running night and day with this enlarged capacity. These enamel rheostats seem to meet with universal approval from the electrical manufacturers and engineers. The theater and street car rheostats seem to be especially appreciated.

The Brush Electric company of Cleveland, O., through its agents, S. W. Trawick of Atlanta, Ga., and A. D Dorman of New York, has just closed a contract with the Mutual Light & Power company of Montgomery, Ala., for a complete central station plant, the consideration being considerably in excess of $100,000. The station will have a capacity of 300 arc lights and 2,500 16 candle power incandescent lights. The contract for the complete steam power plant was awarded to the Heine Safety Boiler company of St. Louis, represented by C. S. Munoz. The Heine company has sub-let the engine portion of the contract to the Hamilton Corliss Engine company, represented by J. A. Vail of St. Louis. The complete plant must be installed and in operation by January 1, 1893. Mr. Dorman has also just closed a contract with T. S. McLachlin of Whitehall, N. Y., for a 90 arc light plant of the Brush system.

ELECTRICAL PATENTS.

Issued October 11, 1892

484,045. Electric Cable Splice. Frederic A. C. Perrine, Trenton, N. J.

Each spliced conductor is surrounded by a sleeve of non-absorbent paper or similar non-absorbent material, and a casing is provided outside the group of spliced conductors.

484,068. Railroad Signal. Eugene Urbain, Brooklyn, N. Y.

484,077. Rosette. Charles Wirt, Chicago, Ill.

484,096. Galvanic Battery. John W. Hoffman, Chicago, Ill.

The battery comprises a zinc cup or cell provided with a plastic lining of starch and an excitant which is filled with a moistened mixture of crushed coke or carbon, and a depolarizing agent; a carbon stick or plate is embedded in the filling.

484,110. Apparatus for Regulating the Intensity of Incandescent Lights. James F. McElroy, Albany, N. Y.

A hinged piece of iron is adapted to be inserted into the interior of a coil of wire included in the lamp circuit thus increasing the self-induction of an alternating current traversing the coil and causing a decreased current to traverse the lamp.

484,120. Secondary Battery. William L. Silvey, Lima O.

The invention embodies a process of preparing secondary battery plates which consists in mixing a suitable metallic oxide with a liquid, placing the resulting paste on a suitable support, subjecting the oxide to the action of heat and pressure, and then pickling the whole in an acid solution.

484,123 Electrically Operated Railway Switch. Charles A. Stone, Newton, and Edwin S. Webster, Boston, Mass.

484,140. Electric Fire Alarm. Harvey Cortland, Toronto, Can

484,150. Magnetic Telephone. Charles S. Forbes, London, England

Compound ringing magnets having soft iron pole pieces carried by one end are combined with a tympan box and tympan, and adjustable polar extensions, each carrying an inducing bobbin filled with a conducting wire connecting line and earth

484,182. Method of Electrical Refrigeration. Mark W. Dewey, Syracuse, N. Y.

The invention embodies a method of electrical refrigeration in which a portion of a suitable electrical conductor is subjected to a cooling atmosphere and an electric current is sent through the conductor to increase the conduction of heat from the warmer portion of the conductor to the cooled portion.

484 183. Electrical Depositing Meter. Thomas A. Edison, Llewellyn Park, N. J.

484,184. Manufacture of Carbon Filaments. Thomas A. Edison, Llewellyn Park, N. J.

The filaments are placed in a chamber with a quantity of lead or other fusible metal above and around them, which, when the chamber is placed in a carbonizing furnace, will melt, and the filaments will then be subjected to the pressure of a liquid column formed by the melted metal while exposed to the carbonizing heat.

484,185. Manufacture of Carbon Filaments. Thomas A Edison, Llewellyn Park, N. J.

A number of the filaments of carbonizable material are placed in a tube and packed with powdered carbon or other material of good heat conductivity which will not fuse under the heat necessary for carbonization; a number of these tubes are then suspended in a carbonizing chamber out of contact with the walls of the chamber.

484,199. Electric Arc Lamp. Joel A. Hayes, Carson City, Nev.

The upper and lower carbons are continuously fed toward one another so that the arc may remain fixed in position.

484,205. Apparatus for Indicating the Positions of Railway Cars. Joseph H. Hunter, Pittsburg, and John S. Lucock, Allegheny, Pa.

An inclined plane is provided with gates at certain points, which are actuated by electro magnets adapted to be thrown into operation by the cars passing certain points of the line; balls moving upon the inclined plane as the gates are opened indicate the passage of the cars through certain sections.

484 206. Device for Preventing Accidental Closing of Electric Circuits in Signal Boxes. William H. James, Boston, Mass.

484,207. Incandescent Electric Lamp Socket. Charles J. Klein, New York, N. Y.

A packing in the form of an elastic rubber ring is placed so as to surround the neck of the lamp and be in contact therewith, and with the adjacent portion of the socket.

484,208. System of Electrical Distribution. Harry W. Leonard, New York, N. Y.

Main lamps are placed in multiple arc with the main generator, a low voltage storage battery is in series with the main lamps, and in multiple arc with a series of low voltage lamps, whereby the low voltage lamps may be burned when the main generator is thrown out of circuit.

484,209. Insulator. Fred. M. Locke, Victor, N. Y.

An insulator pin has one end pointed and threaded, and the other end solid and channeled longitudinally.

484,232. Portable Burglar Alarm. David D. Nolley, Wilson, N. C.

484,233. Combined Electric Burglar and Fire Alarm David D. Nolley, Wilson, N. C.

484,280. Trolley Wire Insulator. Albert Anderson, Boston, Mass.

The invention embodies an arch shaped frame adapted to be secured to the span wire without cutting the same, provided with an enlarged portion to form a socket or insulator receptacle.

484 344. Trolley Wire Cleaner. Ernest B. Smith, South Amherst, Mass.

A wheel provided with radial cleaning arms is normally held out of contact with the trolley wire by a detent, and is adapted to be pressed against the trolley wire by a spring when the detent is released.

484,375. Railway Train Telegraph. Matthew S. Reiley, Washington, D. C.

484,380. Electric Switch. Milton R. Utley, Minneapolis, Minn.

280,385. Battery Compound. William Wright, New York, N. Y.

The invention embodies a process of making a dry chemical sand or granular composition which consists in subjecting sulphuric acid containing a metallic oxide and a chromium compound to a temperature of 275 degrees for fifteen minutes, and then spreading the same upon a plate cooled to 60 degrees to become dry and granular.

484,385. Battery Compound. William Wright, New York, N. Y.

ELECTRICAL ENGINEERING

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One 220 Volt, 200 Ampere Generator,

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Insulation Guaranteed wherever used, Aerial, Underground or Submarine.

In a letter from the Inspector of the Boston Fire Underwriters' Union, under date of March 29, 1886, he says: "A thoroughly reliable and desirable Wire in every respect."

The rubber used in insulating our wires and cables is especially chemically prepared, and is guaranteed to be waterproof, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather and is not affected by heat. The insulation is protected from mechanical injury by one or more braids, and the whole slicked with Clark's Patent Compound, and special extra finish, which we have now adopted for all our solid wires as an extra weatherproof protection, and also preventing chafing and abrasion, which is water, acid, and to a very great extent fireproof. Our insulation will prove durable when all others fail. We are prepared to furnish Single Wires of all gauges and diameter of insulation for Telegraph and Electric Lights from stock. Cables made to order. We are now prepared to furnish our Clark Wire with a white outside finish for ceiling cleat work as well as our standard color.

Clark Joint Gum should be used for making waterproof joints. This is put up in half-pound boxes, in strips about one foot long and five-eighths inch wide, and when wrapped about a joint and pressed firmly it makes a solid mass. **FOR RAILWAY** and **MOTOR** use, we make all sizes of stranded and flexible with Clark insulation.

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Second-Hand Dynamos

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We have a number of Dynamos and Motors nearly new, which we will sell at a low price, among the number being **two 650-light, 1,000 volt Alternators.**

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Second-hand machine, from 50 to 200 lights, 110 volt.

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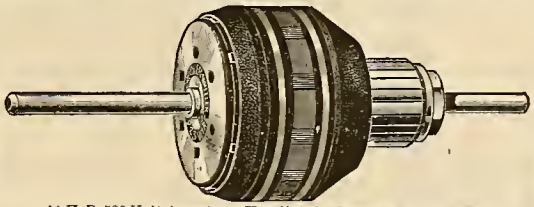

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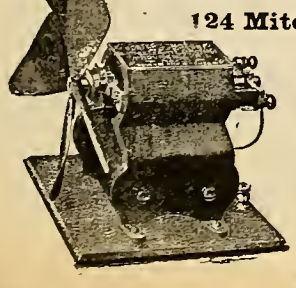

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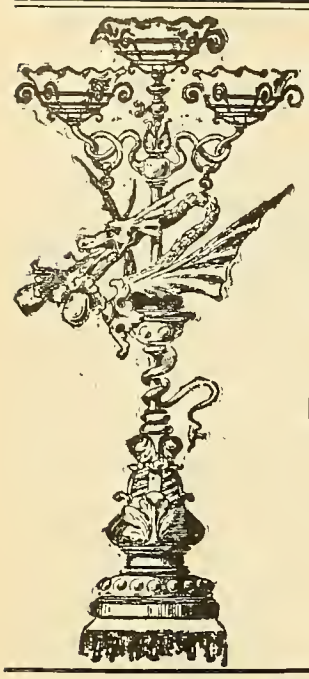

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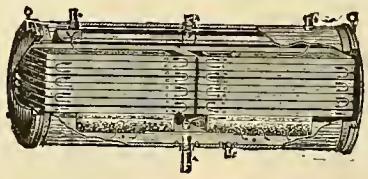

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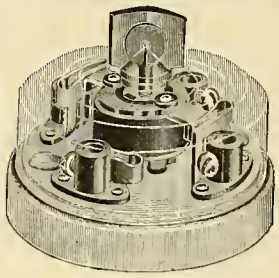

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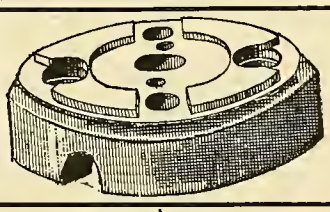

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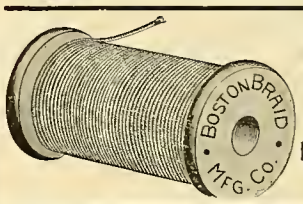

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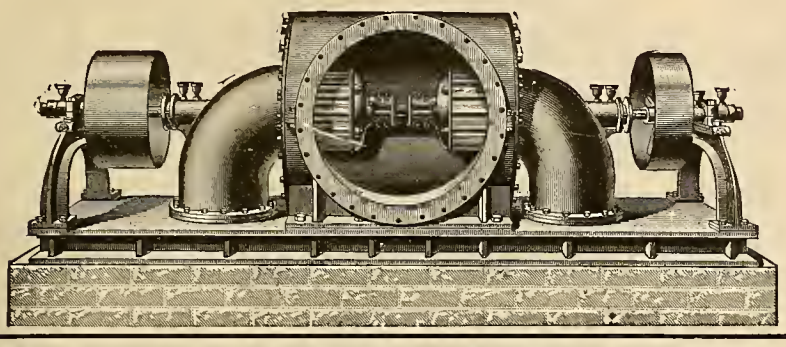

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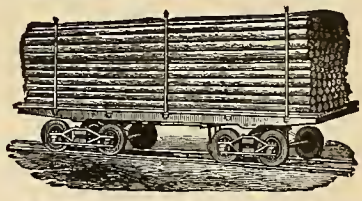

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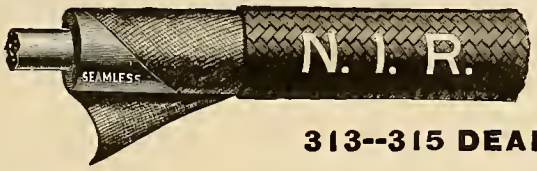

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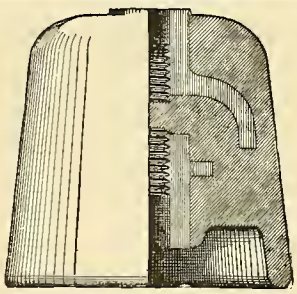

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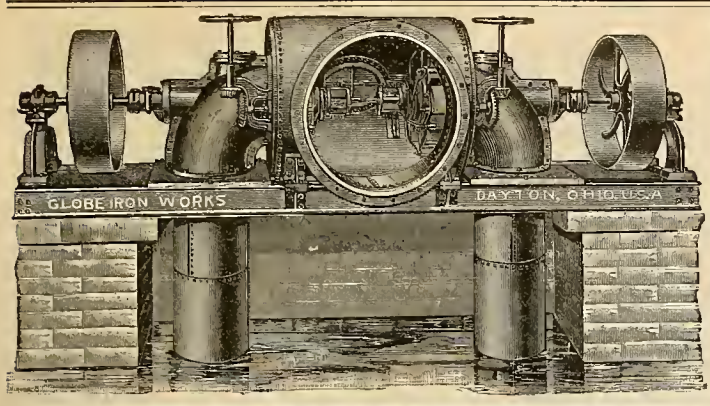

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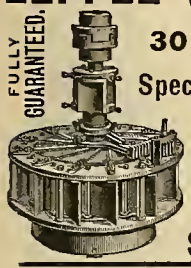

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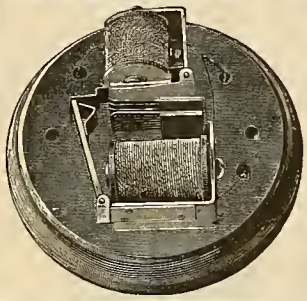

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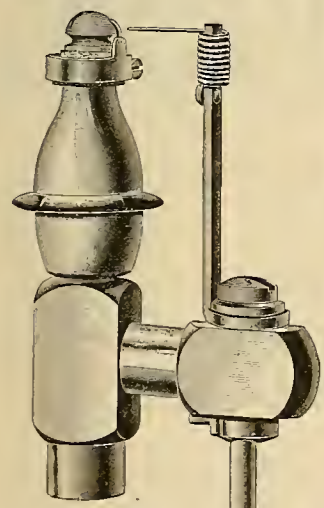

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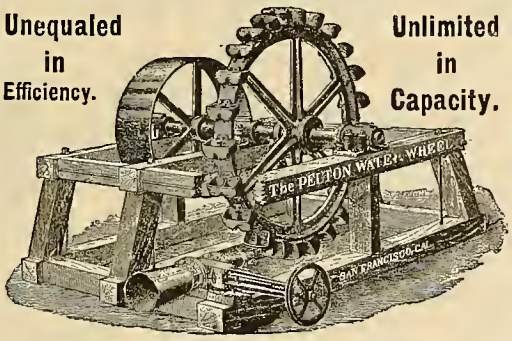

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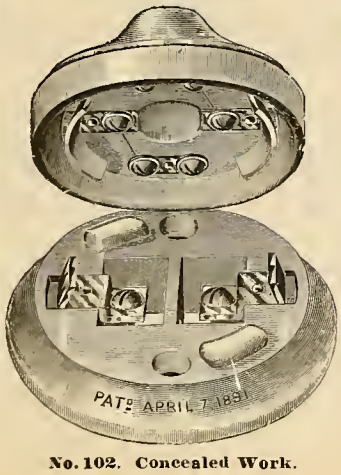

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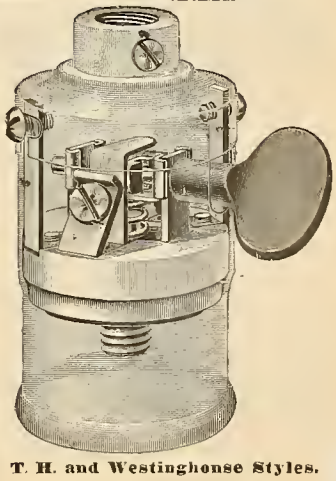

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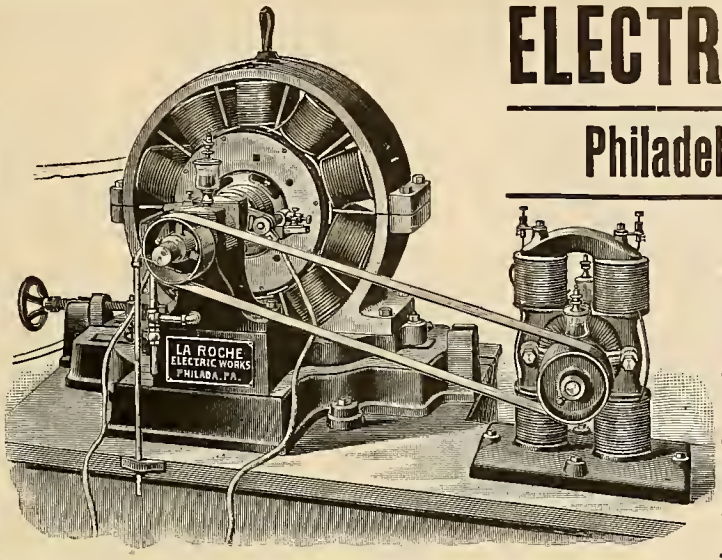

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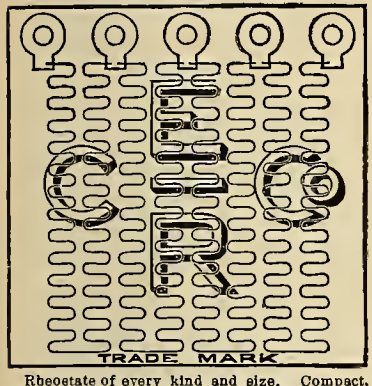

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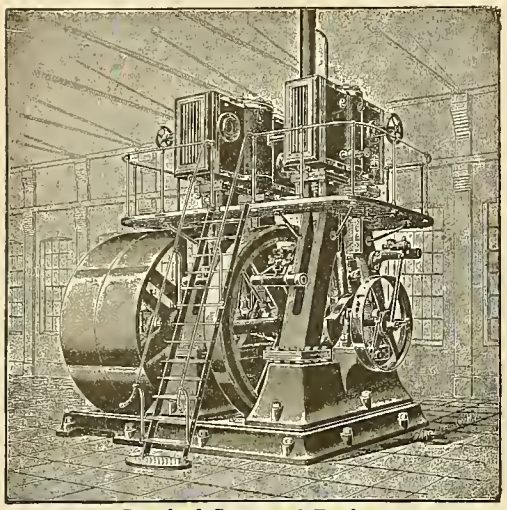

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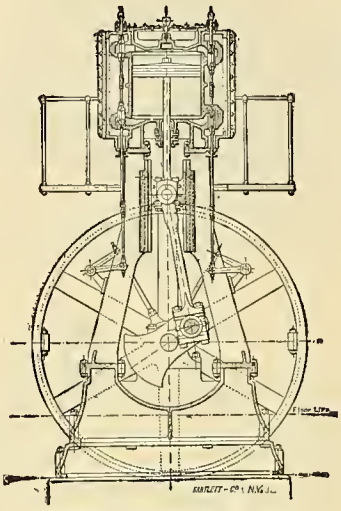

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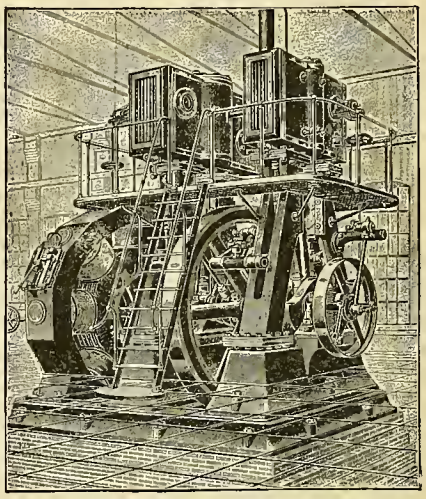

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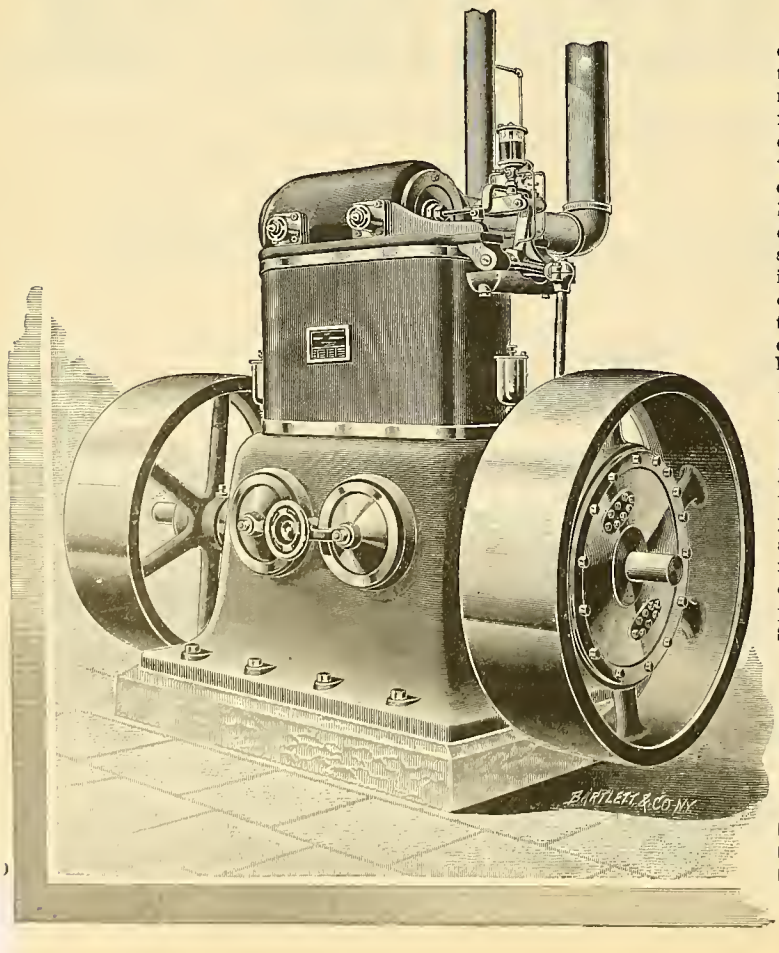

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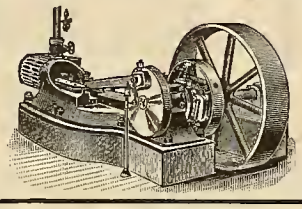

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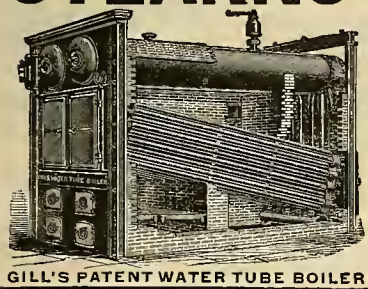

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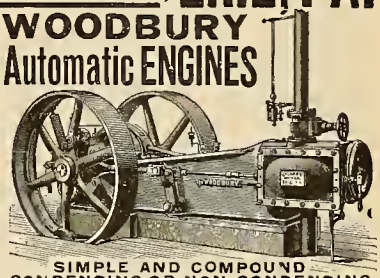

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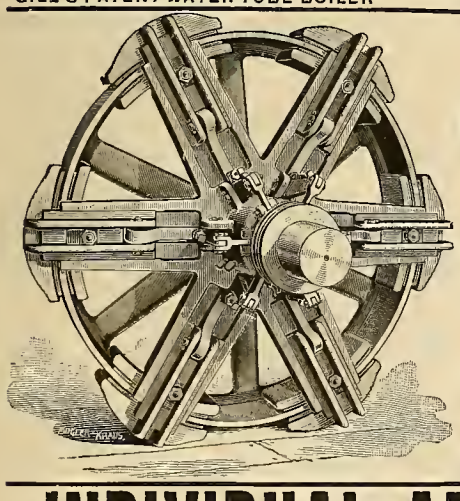

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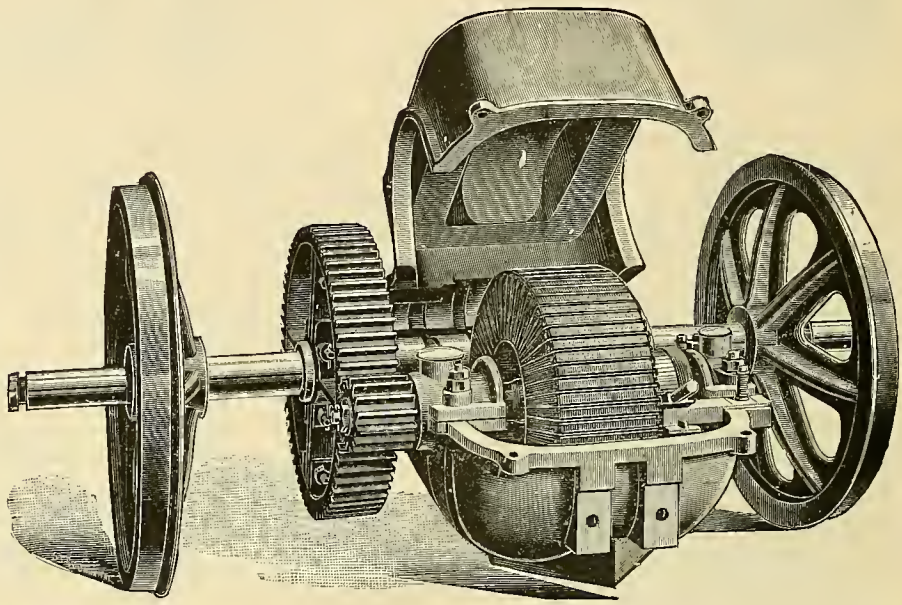

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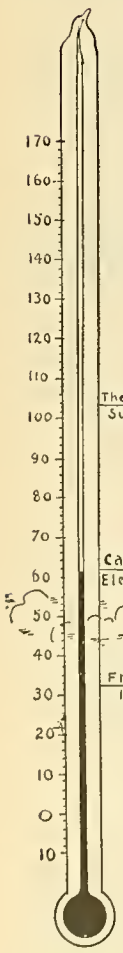
FRITZ: "Yah!"
MISS B—: "Ah!"

× × × × × ×



The Freezing Point

Is not a thing to contemplate with any great degree of satisfaction. Particularly not to the benumbed passenger who has paid his fare, and justly expects in return, not only transportation, but some element of comfort as well.

There is no attraction in an ice-box with wheels; it is pleasanter to walk, than to ride in a refrigerator on a cold day.

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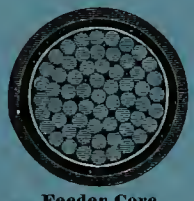
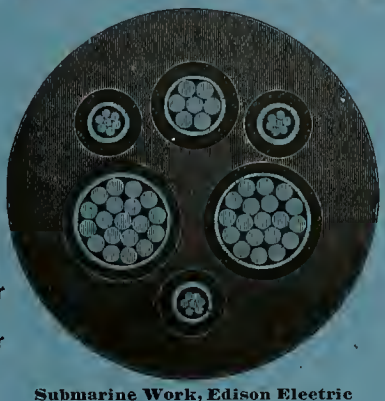

Feeder Core. Broadway Theater.


Submarine Work, Edison Electric Light Co., Easton, Pa.

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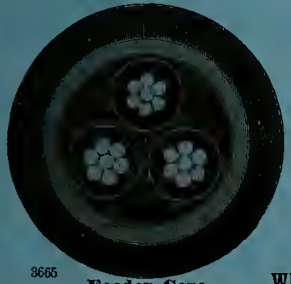
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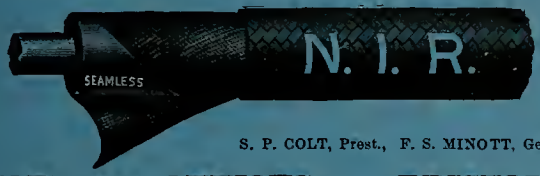

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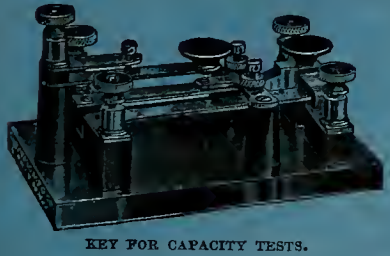

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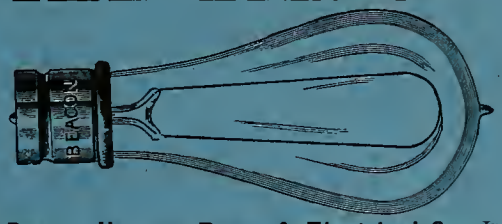

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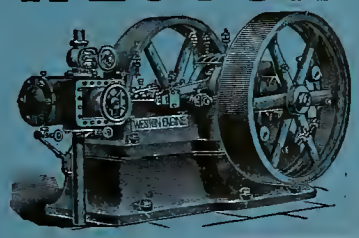

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INDEX AND CLASSIFICATION OF ADVERTISEMENTS.

ALPHABETICAL LIST.

American Battery Co..... xi
American Desk & Seating Co.. xvii
American Electrical Mfg. Co..——
American Engine Co..... xiv
Andrews & Co., A. H..... xiv
Babcock & Wilcox Co., The.... i
Baggot, E..... xvi
Baker & Co..... xiv
Ball Engine Co..... xxiii
Ball & Wood Co., The i
Beacon Vacuum Pump & Elec. Co.i
Becker Mfg. Co., John .....——
Beggs, J. E , Mch. & Supply Co.xvii
Bernstein Electric Co..... iv, xv
Blanchard, Albert... xxiii
Boston Braid Mfg. Co..... xvii
Bowers Bros..... xxi
Bradbury-Stone Storage Battery Co..... xvi
Bridgeport Mach. Tool Wks.. xiv
Brookfield, Wm..... xiv
Brush Electric Co .....viii, xxi
Bryan, W. H.. xvii
Bryant Electric Co.....——
Buckeye Electric Co , The..... xi
Carpenter Enamel Rheostat Co. xxi
Central Electric Co..... v
Chicago Rawhide Mfg. Co.... xvii
Columbia Inc Lamp Co..... i
Columbia Mfg. & Supply Co..——
Crescent Ins. Wire & Cable Co. xv
Crocker-Wheeler Electric Co.. xv
Cushing, F. W..... vii
Cutter, Geo.....——
Cutter Electrical & Mfg. Co... x
Dayton Globe Iron Works Co.. xix
Densmore Typewriter Co.....——
Detroit Electrical Works.... xxviii
Detroit Motor Co..... iv
Diamond Electric Mfg. Co....—
d'Infreville, G.....xvii
Dixon Crucible Co., Jos..... xvii
Dudley & Co., W. W..... xxi
Duplex Electric Co., Ltd..... xiv
Eastern Electric Cable Co..... xv
Eastman Kodak Co..... xvi
Electric Appliance Co xiv
Electric Cons. & Supply Co... vi
Electric Engr'g & Supply Co.. x
Electrical Mfg. Co., The..... x
Electric Secret Service Co.... xxiii
Electrician Pub. Co ..... x, xxii
Electrical Construction Co. The. xv
Electrical Eng. & Supply Co. The..v
Electrical Supply Co., The ... xxvi
Elektron Mfg. Co.....——
Empire China Works..... xvi
Enterprise Electric Co..... xxi
Falls Rivet & Machine Co..... xi
Ferracute Machine Co.....——
Ford-Washburn Storelectro Co.. x
For Sale Advertisements xiv, xv, xvii
Fort Wayne Electric Co... .xxviii
General Electric Co .....ii, xx, xxiv
Great Western Elec. Supply Co xi
Greeley & Co., The E. S.....i
Gregory, Chas E..... xv
Hart & Hegeman Mfg. Co..... xvi
Heisler Electric Co..... xx
Hill Clutch Works..... —
Hine Eliminator Co..... xiv
Holmes, Booth & Haydens.... xii
Hood & Co., Wm..... x
Hughes Bros. Mfg Co..... xvi
Ide & Son, A. L xv
Illinois Electric Lamp Co..... xii
India Rubber & G. P. Ins. Co. xxvii
Institute of Technology..... xv
Interior Conduit & Insulation Co. xii
International Okonite Co..... i
Jewell Belting Co..... i
Johns Mfg. Co., H. W.....——
Kartavert Mfg Co..... xxi
Klipstein, A xv
Knapp Electrical Works..... xxv
Lake, J H. & D., Co .....——
Lake Erie Engineering Works. xxii
Lane & Bodley Co..... xvii
La Roche Electric Works .....——
Lasell & Co., Edw..... xvii
Leclanche Battery Co., The .. xii
Lefmann, Julius xvii
Leffel, & Co., Jas xix
Link Belt Machinery Co..... xv
Loud, H. M. & Sons Lumber Co xvii
Mather Electric Co iv
Midland Electrical Wks..... —
Moore, Alfred F..... i
Morse & Co., A. M..... .. xiv
Mosher Electric Co.... ix
Munsell & Co., Eugene..... xiv
National Carbon Co. xvi
National Electric Mfg. Co.... v
National India Rubber Co i
New York Insulated Wire Co.. xxi
N. Y. Safety Steam Power Co xxiii
New York & Ohio Co..... I
Otto Gas Engine Works..... xxiii
Osborne Steam Engineering Co xiv
Ostrander & Co., W. R..... xxiii
Page Belting Co..... —
Partrick & Carter Co..... —
Pearson & Co., W. B..... xxii
Pelton Water Wheel Co..... xvi
Penn. Electric Engineering Co. xii
Perkins Elec. Switch Mfg. Co. xii
Phoenix Glass Co..... —
Porter-Leavitt Elec. Motor Co.——
Queen & Co..... xv
Racine Hardware Mfg. Co..... xiv
Railway Equipment Co.....iv, xl
Redding Electric Co..... xix
Ries Electric Specialty Co..... xii
Roehling's Sons Co., J. A xi
Rose Elec. Light Supply Co...——
Samson Cordage Works. xlv
Sawyer-Man Electric Co..... xviii
Schuyler Electric Co..... xx
Sechrist, Albert..... xix
Shawmut Fuse Wire Co..... xii
Shultz Belting Co..... x
Siebert, G..... xiv
Siemens & Halske Electric Co. vi
Sioux City Elec. Supply Co... xvi
Sioux City Engine Works.... xxiii
Smith, A. T..... xvii
Smith, Thos. G. Jr.....xxiii
Sperry Elec. Mining Mach. Co. xxi
Standard Electric Co..... vi
Standard Paint Co xii
Stanley Electric Mfg. Co.....——
Stearns Mfg. Co..... ... xxiii
Steuben Lamp Works..... xv
Sterling, W. C..... xvii
Stilwell & Bierce Mfg Co . xvi, xvii
Sunbeam Incand. Lamp Co.. xxvii
Taylor Engine Co.....xxiii
Union Hardware Co..... xv
Utica Elec. Mfg. & Supply Co. xii
Van Nuis C. S.....——
Vulcanized Fibre Co..... xvii
Waddell-Entz Company..... xiv
Wannopee Pottery Co..... xvii
Washburn & Moen Mfg. Co.. —
Western Electric Co.....xvi
Westinghouse, Church, Kerr & Co..... xix
Westinghouse Elec. and Mfg Co..... xiii, xviii
Weston Engine Co..... i
Woodhouse & Rawson, Ltd....——
Worthington, Henry R.....——

CLASSIFIED LIST.

Annunciators.
Central Electric Co.
Detroit Electrical Works.
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Detroit Electrical Works.
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Ford Washburn Storelectro Co
Greeley & Co., The E. S.
Knapp Electrical Works.
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Greeley & Co., The E. S.
Knapp Electrical Works.
Partrick & Carter Co

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Cables, Electric. (See Insulated Wires), **Copper Sheet and Bar**
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Knapp Electrical Works.
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General Electric Co.
Great Western Electric Supply Co.
Heisler Electric Co.
Ide & Son, A. L.
Lake Erie Engineering Works.
Lane & Bodley Co., The.
La Roche Electric Works.
Lefmann, Julius.
Mather Electric Co.
Morse & Co., A. M.
N. Y. Safety Steam Power Co.
Osborne Steam Engineering Co.
Pearson & Co., W. B.
Racine Hardware Mfg. Co.
Siemens & Halske Electric Co.
Sioux City Engine Works.
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Detroit Electrical Works.
Electrical Supply Co., The.
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Knapp Electrical Works.
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Diamond Electric Mfg. Co.
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Schuyler Electric Co.
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Standard Electric Co.
Waddell-Entz Company.
Western Electric Co.
Westinghouse Electric & Mfg. Co

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Smith, A. T.

Electric Railways.
Detroit Electrical Works.
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Electrical Supply Co., The.
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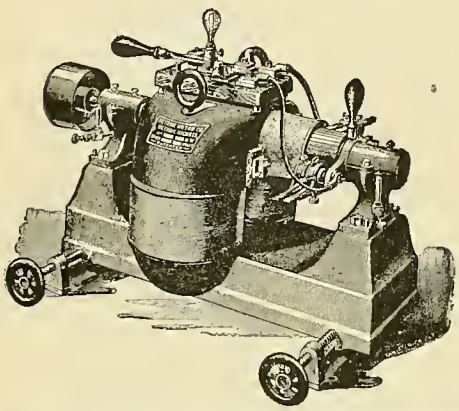

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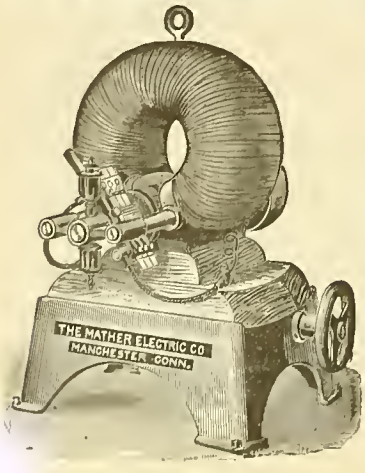

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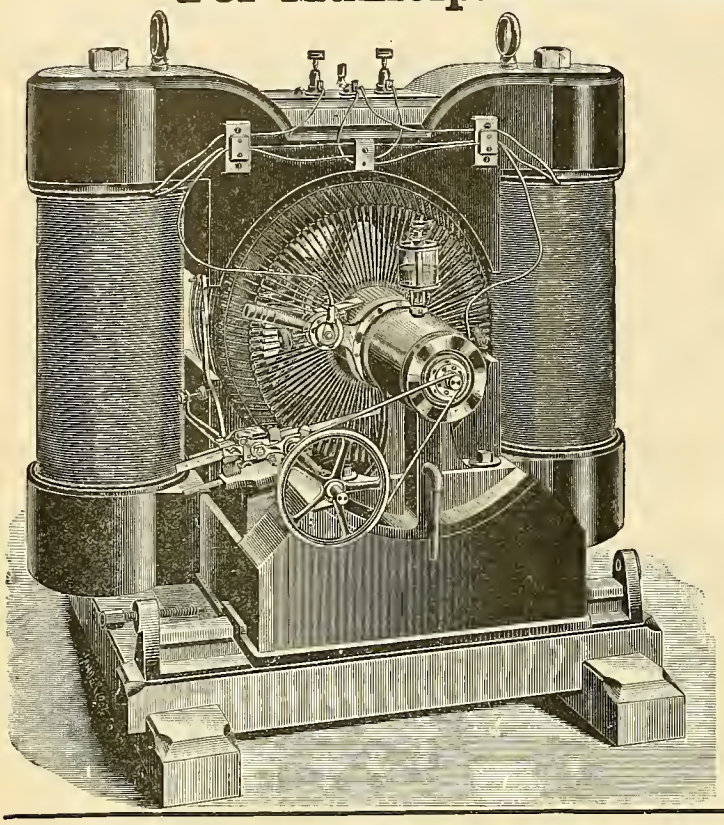

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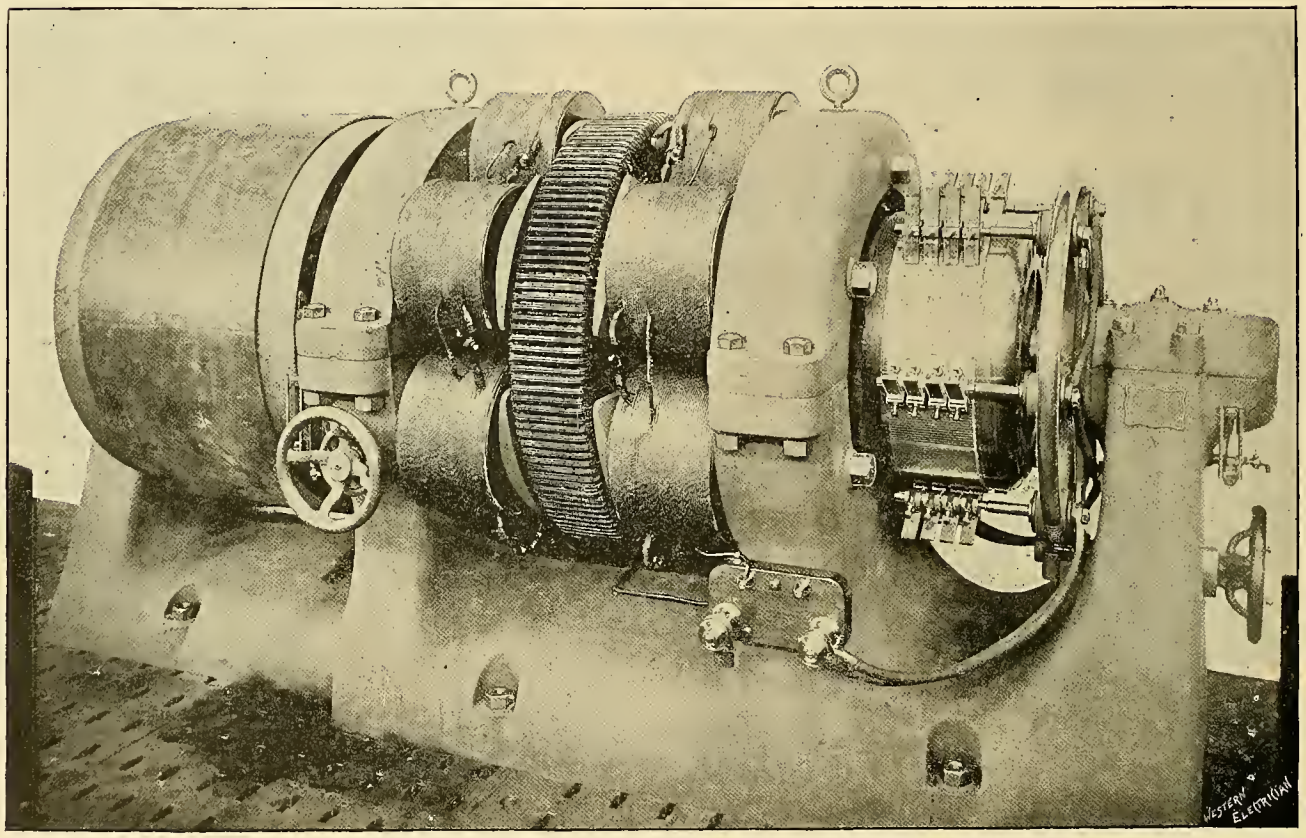

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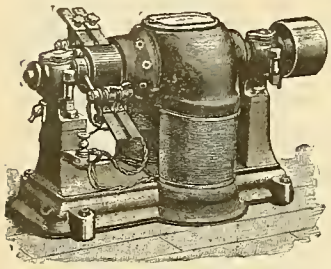

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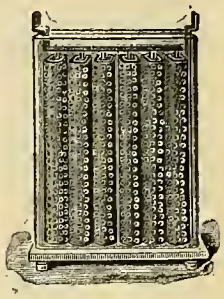

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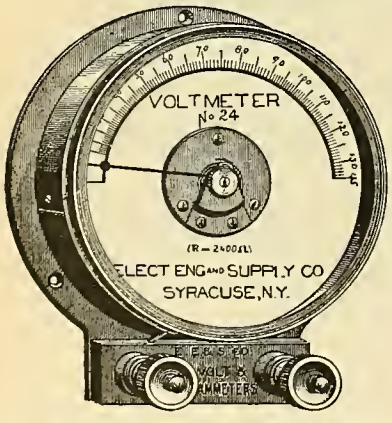

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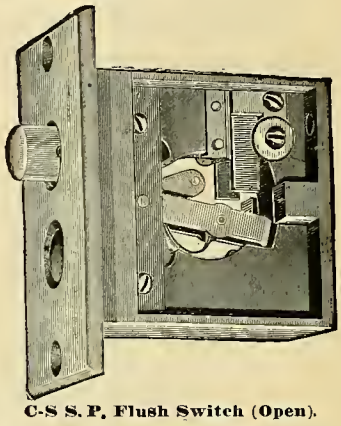

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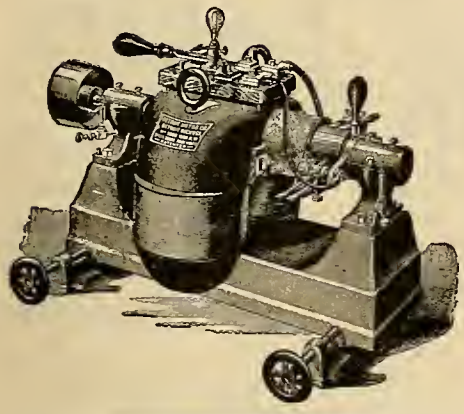

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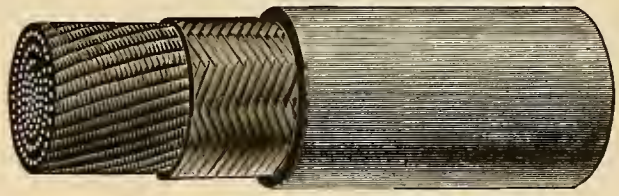

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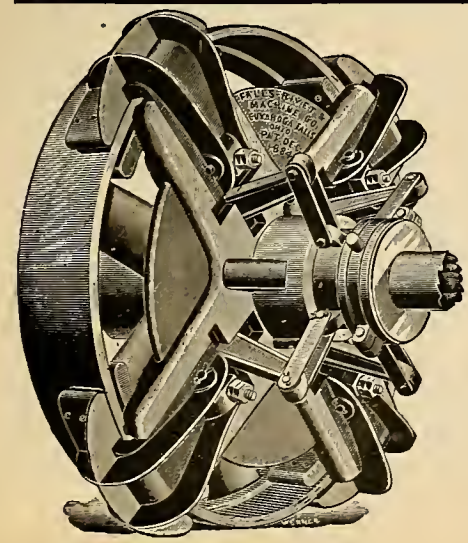

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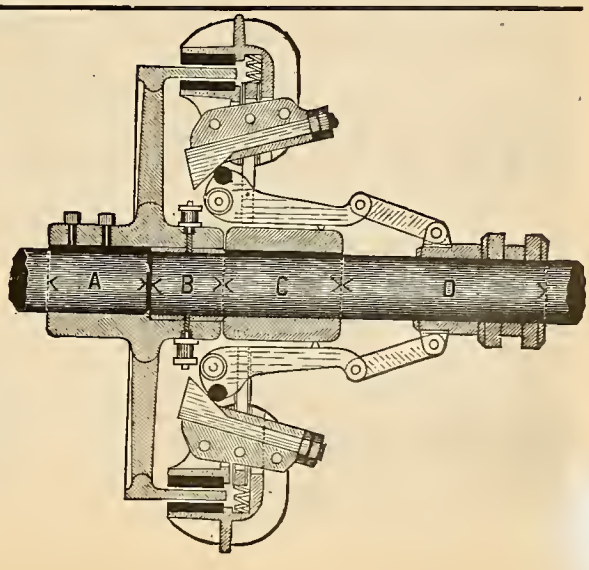

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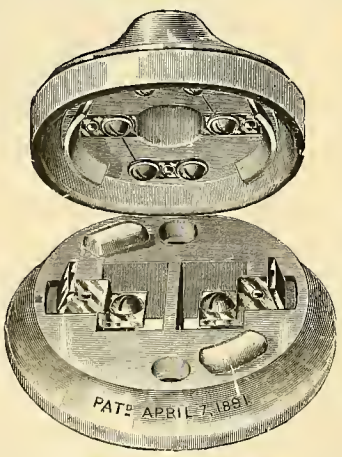

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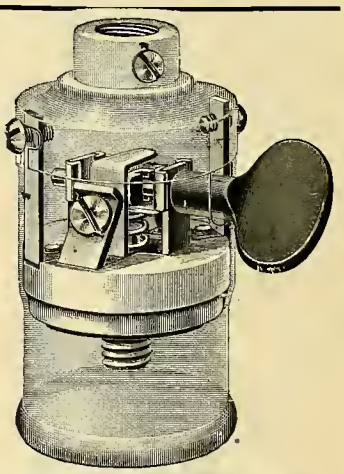

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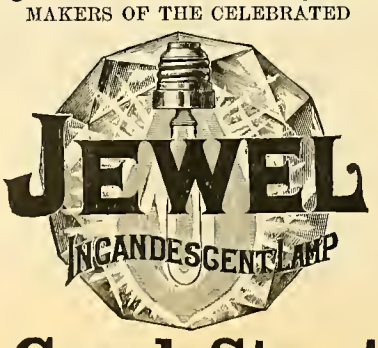

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The prices for our new incandescent lamps and sockets will be a surprise and satisfaction to all users.

OUR PRICE LIST WILL BE FURNISHED IN NOVEMBER.

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The efforts of the agents of the General Electric company to induce our customers to exchange generating apparatus of our make for Thomson-Houston generating apparatus is fully explained by the fact that

THE THOMSON-HOUSTON COMPANY PAYS US,

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While we do not sell our new lamp for use in connection with Thomson-Houston generating apparatus, the present users of the same may avail themselves of our new lamp by substituting our generating apparatus, the quality and efficiency of which will fully warrant the cost.

NOTE.—We are in receipt of numerous letters from all parts of the country congratulating us upon the perfection of a new and better lamp, and we are abundantly assured that the tactics employed to secure exorbitant prices for apparatus as illustrated in connection with the World's Fair lighting, by threatening not to supply lamps unless all apparatus was purchased from "The Trust," will not prove effective. We are also assured that the competition resulting from our independent course is widely appreciated.

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We shall be prepared to supply these lamps in large quantities, beginning December 1st.

STANDARD SCREW GLASS INSULATORS

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WHY?

Because we can sell all we can make without

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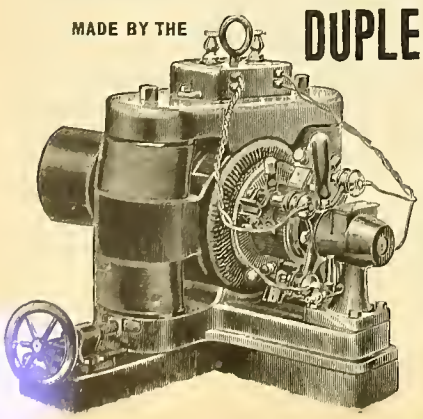

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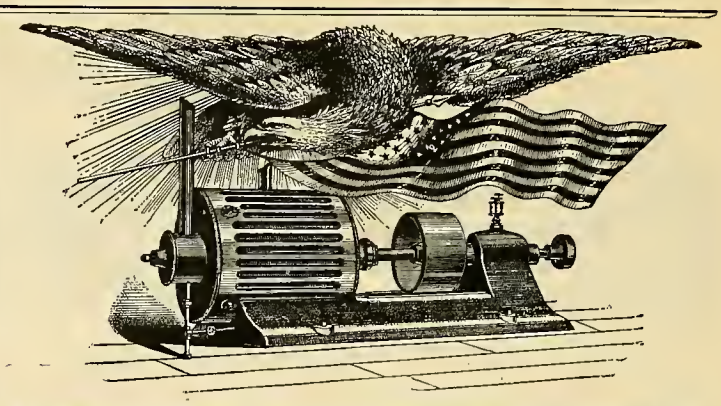

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SPEED, SIMPLICITY AND ECONOMY,

this Engine has no equal. It possesses many striking advantages over all other Engines, either slow speed or so-called high speed. Its speed is closely regulated by a sensitive and reliable automatic governor. Built of any required size,

FOR ALL STATIONARY AND MARINE PURPOSES.

It can be **coupled directly** to dynamos, fans, blowers, fire engine and other rotary pumps; in fact, to **any** machine requiring great velocity. It is smooth running and **noiseless.** Being light and compactly built, it takes up less room than any other Engine of equal power. No heavy foundations are required. This Engine is

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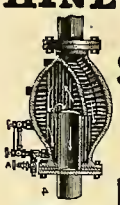

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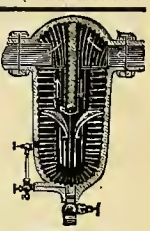

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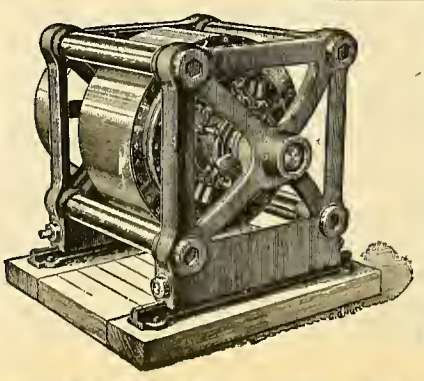

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Western Electrician.

EVERY SATURDAY.

Vol. XI. CHICAGO, OCTOBER 29, 1892. No. 18

Electrical Features of the Dedication of the World's Fair in Chicago.

To say that Chicago was enthusiastic in its efforts to do honor to the discoverer of America inadequately describes what took place during the three days of last week devoted to the World's Fair dedicatory ceremonies. The people as a whole celebrated with the greatest enthusiasm. Thursday, the 21st, was not a legal holiday, but as far as the prosecution of general business was concerned it might as well have been. The banks were open, but along the route of the procession the windows of these institutions of finance showed that the ledger and money counters had been forsaken for the pleasanter occupation of viewing the great parade. Generally speaking the ceremonies were such as to leave the impression upon visitors to the city that Chicago had in this case, as in many other instances, done itself proud in the usual energetic manner. And such indeed was the case so far as the processions and ceremonies proper were concerned. But to the electrical man there was one cause for regret, and that was that Chicago fell so far behind both St. Louis and New York in the line of electrical illumination. There was good reason, though, for the city being backward in this respect. Undoubtedly the trouble that the various construction companies have been experiencing with the striking wiremen made them reluctant to undertake work which it was felt they might not be able to finish. In fact it was stated by one of the engineers in the construction department of the Chicago Edison company that a number of good contracts for electrical decorations had been refused by his company for this reason Among the Chicago firms which would have made good displays were the "Bee Hive" and Carson, Pirie, Scott & Co. The former would have expended $400 on a 300 lamp installation and the latter would have used about 200 lamps to decorate its establishment.

Although the city, taken as a whole, was found wanting in respect to electrical decorations, there were nevertheless a number of creditable displays.

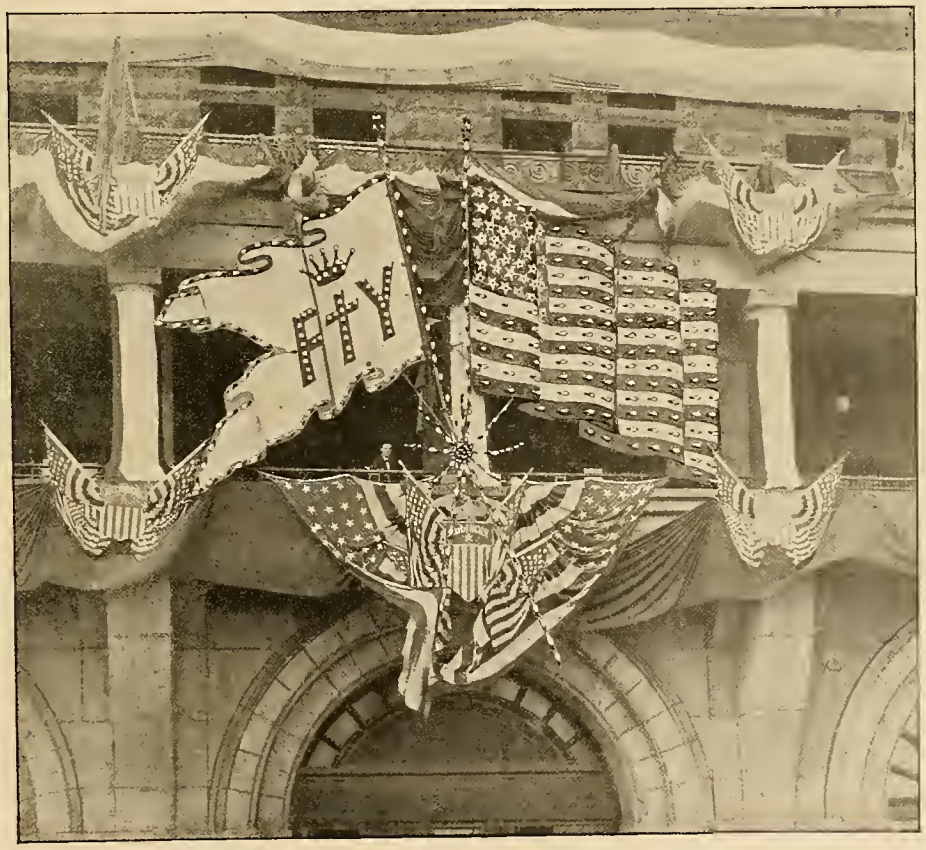

FIG. 1. ELECTRICAL FEATURES OF THE DEDICATION OF THE WORLD'S FAIR IN CHICAGO.

To the Auditorium Hotel must be given the credit for the most unique lamp decoration. Above the main entrance on Michigan avenue were arranged two flags, as shown in the accompanying cut, Fig. 1 one was the royal standard of Ferdinand and Isabella, while the other was the flag of the United States. In themselves and to an observer in the day time these two flags constituted a very ordinary building front decoration. At night, though, these flags were very much of a revelation. Both were studded with incandescent lamps, the total number on the two flags being estimated at about 280, 180 on the American flag and the remainder on the Spanish standard. These lamps were strung and wired on the wooden background of the two flags in such a manner as to give the impression to an observer on the ground that the stationary flags were in reality waving in the wind. This effect was produced by a motor-driven commutator on the balcony above the flags. This commutator was so wired to the lamps on the flags that its revolution by a little electric motor served to throw the perpendicular rows of lamps on the face of the flags out of circuit in rapid succession, producing the peculiar wave effect referred to. The flags had to be seen, however, to be appreciated. The remaining Auditorium decorations may be seen in Fig. 2. Strings of red, white and blue lamps—in all about 250—were festooned from the tops of four poles at the four corner of Michigan avenue and Congress street, and across Congress street on the west side of Michigan avenue 200 lamps in a solid bank, visible from the east and west, brought out the word "Auditorium" in letters of red, white and blue. The Auditorium hotel plant, it is said, on the night of the reception, Wednesday, carried a load of very nearly 4,500 lamps.

Siegel, Cooper & Co , State street, made a striking display, as will be appreciated from the central view in Fig. 2. This picture tells its own story so well that few words of explanation are necessary. Counting in those distributed in the windows as well as those about the main doorway, this firm displayed about 650 incandescent lamps. There were over the door an illuminated arch, a star and an eagle. On all except the eagle the lamps were white; the eagle was decorated with red, white and blue lamps and a few amber lights. The national colors, with a fair share of terra cotta, and all illuminated by the numerous lamps made a very attractive display. Siegel, Cooper & Co. furnished current from their own plant.

While "The Leader" electrically speaking did not merit its name, this firm nevertheless did its share in the way of illuminating its store front. On the State street side near the Palmer house there was a shield and eagle covered with white lights, Fig. 2. White lights, too, framed Columbus' portrait, topped with the word "Welcome." At the corner of the building a red, white and blue star lighted with white lights and over it a small emblematic picture framed in colored lamps completed "The Leader's" electrical decorations. The local Edison company furnished current for this display.

At Jackson Park the principal electrical feature of the dedication was the display made from the large Schuckert projector mounted on the tower of the transportation building. From this a great beam of light was sent circling about the horizon, up and down, fast and slow, concentrated and diffused, every evening after Tuesday until the close of the week. The light excited general attention from visitors and Chicagoans alike, and the exhibition was one of the most attractive features of the week's festivities. The projector used is one of the largest in the world, the diameter of the lamp being four feet. The largest search lights used on warships have a diameter of about three feet, and the projector used in Chicago last week is principally designed for coast defense purposes. The light was very powerful. On Thursday night it was easily seen at Evanston, Ill., a distance of twenty miles from Jackson Park, and it is probable that the beam was visible for a considerably greater distance. An idea of the flood of light poured on near-by objects may be gained by a reference to Fig. 3, which is a reproduction of a photograph taken about ten o'clock at night by the light from the projector. The picture represents a log cabin on the wooded island, about 600 feet from the search-light. The intense white light and the blackness of the surrounding gloom are vividly portrayed.

In the Schuckert projectors the normal position of the carbons is horizontal, or, rather, parallel to the beam of light thrown out. The feeding mechanism is automatic and is ingeniously arranged. The positive carbon is placed in front of the negative, and the light from the crater of the former is thus thrown back in the lamp, where the rays strike a parabolic reflector, which serves to concentrate them and project them out of the lamp. In the lamp used last week the positive carbon was 1½ inches in diameter and the negative one inch. The exact focus of the light from the arc on the mirror is a matter of great nicety, and upon it the brilliancy of the light largely depends. The current used averaged 140 amperes at 59 volts, an equivalent of about 11 horse power. Although the lamp stands over seven feet high, it can be turned in any direction, elevated or depressed, with but little effort, by the aid of mechanical appliances. By changing the focus the light can be concentrated for long distance work or spread out in greater volume when thrown on objects near at hand.

On Monday the great projector was taken to pieces, and it will shortly be packed away until next April. At that time Mr. Tischendoerfer says that he will return with the largest search-light in the world, which Schuckert & Co. will exhibit at the World's Fair. This projector will be six feet in diameter and will be provided with the very latest adjusting and regulating appliances. It will be turned by an electric motor instead of by hand. It is possible that this great lamp may be mounted on the tower at the entrance to the basin, which would be an advantageous position for lighting effects. It is thought that the light could be easily seen across the lake and perhaps at Milwaukee. But 150 amperes will be used, as it has been found inadvisable to use a current of greater strength than this for the production of an arc. The improvement over the four foot projector will be mainly in the parabolic reflector, and Mr. Tischendoerfer says that it is in

this direction that the future improvement of the searchlight must be looked for.

Much extra labor was thrown on the electrical department in order to provide temporary lighting for the dedication exercises of last Friday. This was accomplished by arc lamps, the total number on the grounds being about 500. About half of this number were in the great manufactures building. Fig. 4 gives an interior view of this building, from a photograph taken on Friday, when it was thronged with the vast multitude that attended the exercises. The temporarily adjusted lamps can be seen over the speakers' stand to the left. At the time the picture was taken the building probably contained over 100,000 people. A glimpse of the temporary plant in machinery hall from which current was secured is given in Fig. 5.

St. Louis Electric Club.

On the evening of October 14th twenty-three gentlemen interested in electrical affairs in St. Louis sat down to a supper at the Mercantile Club in that city. Among those present were: E. H. Abadie, W. L. B. G. Allen, B. C. Alvord, James I. Ayer, J. L. Boogher, R. H. Bohle, H. P. Broughton, Wm. H. Bryan, F. W. Churchill, H. C. Henley, Capt. Robert McCullough, W. N. Mathews, E. V. Matlack, A. W. and C. R. Merston, Ben. Nahn, H. L. Parker, S. B. Pike, E. Ruebel, C. E. Sharpe, J. A. J. Shultz, J. H. Siegrist, Jr., and H. A. Wagner. This meeting was an adjournment of the one held on September 16th, when the first steps were taken toward the formation of an electric club. After the supper had been disposed of, Mr. Ayer, the temporary chairman, submitted a report from he committee on permanent organization. The committee recommended that immediate steps be taken toward the forming of a club, and that efforts be made to secure the names of one hundred gentlemen as members. The committee also recommended that when this had been accomplished a permanent organization be effected, and that a suitable location be secured, near some restaurant if possible, so as to obtain its service.

It was recommended that the initiation fee be placed at $10, and the annual dues at $20, the rooms to be kept open at all times, and to be in charge of an attendant. The committee's recommendations met with hearty approval, and it was directed to proceed in the manner proposed. At the suggestion of the chairman, the committee was increased to ten, and it is now made up as follows: J. I. Ayer, chairman, and Messrs. Allen, Bohle, Bryan, McCullough, Matlack, Nahn, Shultz, Siegrist and Wagner. This committee has already had a preliminary meeting to map out its plan of work, and will report as early as possible, not later than the second Friday in November. Steps are to be taken immediately to secure the names of one hundred gentlemen interested in electrical industries, so that the club will be in good working order previous to the next annual convention of the National Electric Light association, to be held in St. Louis in February next. Capt. McCullough's paper regarding the changes now being made in the construction of the Cass avenue system of street car lines was postponed until the next meeting.

The new electrical laboratory to be erected at Johns Hopkins University will be a roomy one-story structure of corrugated iron, illuminated from the roof by large skylights. The heavy machinery will be set up in the new quarters, thus providing more room for delicate experiments in the physical laboratory.

Telephoning from Chicago to New York.

The successful transmission of speech for 950 miles, the distance that separates New York and Chicago, is surely one of the most wonderful feats of nineteenth century civilization. The completion of the long-distance telephone line of the American Telephone and Telegraph company made this accomplishment possible, and the event excited wide attention. A test of the line was made on Tuesday of last week in the presence of a number of invited guests. About sixty gentlemen gathered in the Chicago office of the company, on Quincy street, and nearly one hundred were present at the office in New York, which is located at 18 Cortlandt street. At each end about forty receivers were connected with the circuit. After some informal talk between E. H. Lyon, of New York, electrician of the Metropolitan Telephone company, who was at Chicago, and General Superintendent A. S. Hibbard of the American Bell Telephone company, at New York, Mr. Lyon lowered his voice to a whisper and then held his watch up to the transmitter of the instrument through which he had been talking. All of these tests were successful, and the listeners were greatly impressed.

Then Mayor Washburne, of Chicago, talked to Mayor Grant, of New York. After some difficulty the mayors were enabled to communicate to each other. Mayor Washburne said:

The city of Chicago greets the city of New York.

To this Mayor Grant responded:

New York sends her congratulations to Chicago on the completion of this wonderful line of speaking communication, which will undoubtedly bring the two great cities into closer commercial and fraternal union; and also congratulates Chicago and wishes her all possible success in the great celebrations of the present week.

Mayor Washburne spoke again as follows:

The city of Chicago extends and returns greeting to the city of New York and congratulates the nation on the American invention which shall supplement the telegraph and enable the people of this continent to communicate orally where they now resort to the post and telegraph.

By this exchange of courtesies the line was considered as formally opened. Prof. Alexander Graham Bell afterward talked with W. H. Hubbard, of Chicago, who assisted Prof. Bell in his first public exhibition of the telephone at the Philadelphia Centennial in 1876, at which the Emperor of Brazil and Lord Kelvin, the well-known English electrician, were present. This conversation was very satisfactory, being clearly heard by all guests who had receivers. After this a test was made by the playing of a patriotic air by a cornetist in New York. Similar music was played in Chicago. During the receiving of this in New York there was attached a magnifying receiver, by means of which it was possible to hear the music from six to ten feet from the instrument. After this numerous tests were made by those present.

A big map, stretched across the wall of the exhibition room showed that the line over which the greetings were exchanged extended from New York through Easton, Pa., Harrisburg, Pa., Altoona, Pa., Pittsburgh, Pa., Youngstown, O., Cuyahoga Falls, O., Maumee, O., South Bend, Ind., to Chicago. It is made up of 50,000 large poles on which are strung two lines of No. 8 copper wire. There are about 50 poles to the mile, while the ordinary telegraph construction is about 35 light poles to the mile.

The American Bell Telephone company was represented by F. A. Pickernel, W. A. Hovey and H. G. Bates. Among the other members of the electrical fraternity present at the New York end were Edward J. Hall, E. P. Meany, Melville Eggleston and W. R. Driver of the American Telephone and Telegraph company, C. F. Cutler and E. L. Parker of the Metropolitan Telephone company, A. C. White of the Providence Telephone company, Ralph W. Pope, Prof. S. S. Wheeler, W. J. Hammer, Geo. M. Phelps, Chas. W. Price, H. W. Frye, E. R. Colvin, T. C. Martin, Joseph Wetzler, G. B. Muldaur and W. F. Osborne.

Among those who witnessed the test in Chicago were: Norman Williams, E. R. Meeker, S. E. Barrett, Enos M. Barton, president of the Western Electric company; C. E. Mosely, local superintendent of the American Telephone and Telegraph company, and Tracy C. Drake.

A unique souvenir was presented to the guests. It consisted of a coil of No. 8 highly polished copper wire, flattened at each end upon which were the words "New York and Chicago," and from which was suspended a model of the latest type of receiver.

American Institute of Electrical Engineers.

The seventieth meeting of the American Institute of Electrical Engineers was held at the headquarters of the Institute, 12 West Thirty-first street, New York, on Tuesday evening, October 25th. The three electrical railway papers read at the Chicago meeting came up for discussion in accordance with the vote taken June 8th. The discussion was opened by Dr. Cary T. Hutchinsan. The titles of the papers are as follows: "Series Electric Traction," by Nelson W. Perry; "A New System of Electric Propulsion," by H. Ward Leonard; "Electric Railway and Motor Tests," by Prof. Geo. D. Shepardson and E. P. Burch.

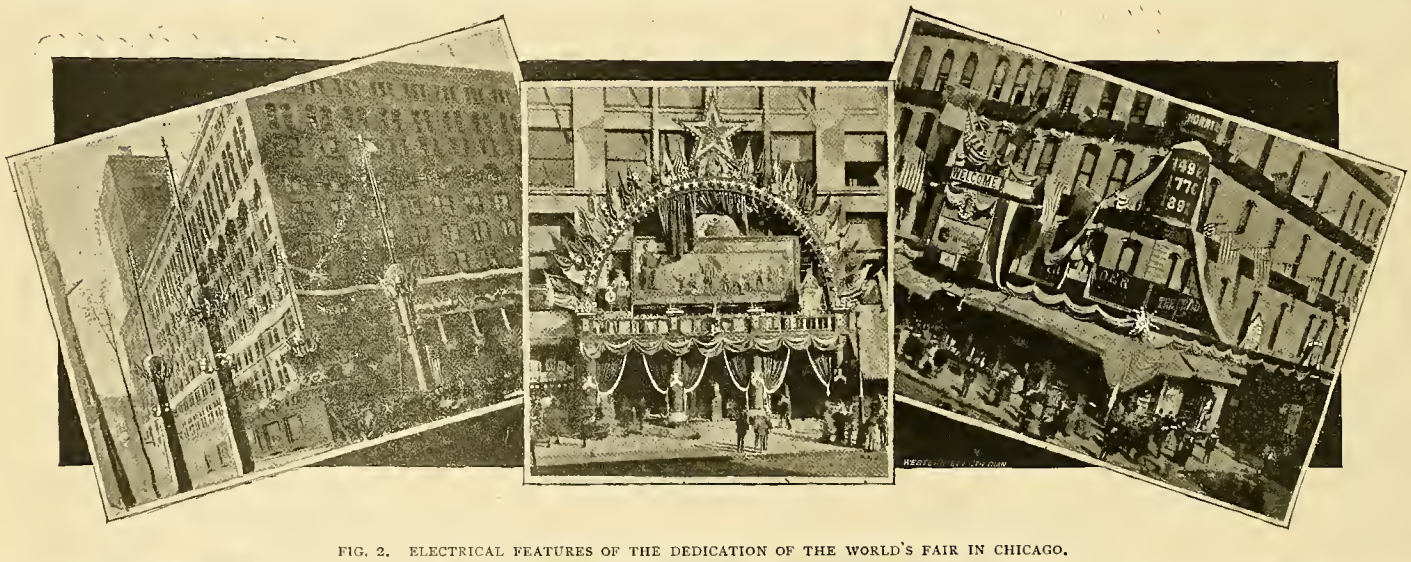

FIG. 2. ELECTRICAL FEATURES OF THE DEDICATION OF THE WORLD'S FAIR IN CHICAGO.

Electricity at Niagara.

Among the plans under consideration for the electrical machinery necessary to transmit the power developed by the great hydraulic scheme at Niagara Falls are those of the Oerlikon company of Zurich, Switzerland; Brown, Boverie & Cie. of Baden, Germany; Cie. del'Industrie Electrique of Geneva, Switzerland; the General Electric company of New York, and the Westinghouse Electric & Manufacturing company of Pittsburg, Pa. No decision has been made in regard to the system to be used or the methods of distribution.

Wisconsin Electric Club.

At a well attended meeting of the Wisconsin Electric club on Thursday evening, October 20th, at its rooms in the Loan and Trust building, Milwaukee, a joint paper on "Underground Conductors" was read by H. F. Boggis of the Edison Electric Illuminating company and W. H. Hyde of the Wisconsin Telephone company. On Thursday evening, October 27th, the third annual banquet took place at the Pabst hotel.

The following is from the Montgomery, Ala., *Advertiser* of October 15th: "Edison has patents on the electric light lamps that are now being used," said D. P. West, "and it is the greatest thing in a business way imaginable, representing millions of dollars. I have been using electric lamps and never knew before that I had no right to use them. A representative of Edison is here now looking into the matter. They are not disposed to be hard on us, however, and the company will make liberal and satisfactory terms with those who have been innocently infringing on their patents, and using their lamps without authority."

THE CONVENTION

Of the American Street Railway Association at Cleveland, O.

The eleventh annual meeting of the American Street Railway association was held in the hall of the Young Men's Christian association, Cleveland, O., October 19, 20 and 21, 1892. The first business session was held on Wednesday morning. President John G. Holmes, of Pittsburg, Pa., introduced Hon. William G. Rose, mayor of Cleveland, who made an address of welcome, in which he said:

Cleveland is highly honored by your presence, and in behalf of her citizens it affords me pleasure to extend to you a cordial greeting, a hearty welcome and the liberties of the city. I doubt if it would be possible to get together a body of men more representative of American life than those I see before me. Coming from the different cities of this country you embody in your collective capacity a system which has developed from small and crude beginnings into fifteen hundred street railway companies. You are fast taking harness off horses and putting them on lightning and steam. The words "grip" and "wire pulling" have received from you a new and enlarged meaning. You propose to divide the use of the streets with the people, but you take your half out of the center.

This address was followed by the annual address of President Holmes, which follows:

The President's Address.

This city offers a fine opportunity to study practical street railroading. Here we see the most advanced ideas of construction, the highest development of the electric system, and a splendid new cable plant, as near perfect as capital, invention and engineering skill have been able to make it. And by the way of contrast and historical interest, we find a few horse car lines to remind us of the meetings a decade ago, when we used to grow excited over discussions of the relative merits of the horse and the mule as a street railway motor.

The street railway interests of the United States are assuming wonderful proportions Every day some new company is born, and every morning paper brings us rumors of consolidations, absorptions and syndicate purchases, until the statistician lays aside his pencil and sheet in despair, utterly bewildered by the mass of accumulating and shifting figures. Definite data are out of the question, and I shall not attempt to tell you how great we are even in round numbers. But while the street railways are legion, there is but one American Street Railway association, and I know you will be glad to learn that D. F. Longstreet, one of the founders of this body, in compliance with the request of the executive committee, has prepared an historical paper, detailing the motives which led to the formation of the association, and giving due credit to the gentlemen associated with him in the movement. We shall be favored with this paper a little later.

This is pre-eminently an electric age, and most of us believe that as yet we are only standing on the threshold. The horse and his half-brother the mule, are destined to disappear. The cable system, from its very nature and cost, must be confined to the thickly populated districts of large cities, but there seems to be no limitation to the electric railway. It leaps over the city lines wherever there is a large suburban town calling for rapid transit; it girds the summer lakes; it is forcing its way through the scenic splendors of the Niagara gorge, close beside the water's edge, and when the convention goes to California, as no doubt it will some day, we may expect to ride around the Yosemite on a train of trolley cars. And how rapidly it has all come about!

It was just ten years ago that the president of this association, at the Chicago meeting, with a foresight which must have been born of intuition, ventured to predict that the lightning would some day be harnessed to the horse car. We laughed at his visionary prophecy, and dismissed it from our minds as a piece of optimistic nonsense. But the prophet of a decade ago is with us to-day, and can take revenge by saying, "I told you so."

So accustomed have we become to rapid strides and the complete overturning of the existing order of things in our business that I do not believe that one among you would venture a doubtful smile were I to assert that before the close of the nineteenth century the three successive convention cities, Buffalo, Pittsburg and Cleveland, will be joined together by a triangular electric belt line, with an immense power house at Niagara Falls, where they are even now just on the point of developing 160,000 horse power.

But this is an assembly of practical men who have come together not to vie each with the other in making extravagant predictions, but rather to contribute each to a common fund the results of his observation and experience. The congestion of traffic in our business centers, the increasing throngs of passengers of the working class nights and mornings, as the day of tenement houses gives way to the age of suburban cottages, the safeguards against accidents required by the exigencies of rapid transit, the labor question, the unjust and burdensome taxation of corporations, the ways and means of increasing traffic and reducing the cost of maintenance and operating expenses, give us plenty of things to talk about. The principal subjects for discussion cover a wide range of practical matters having an important bearing upon street railroading as a business conducted for profit rather than for philanthropy, and the reports of the special committees will be worthy of your closest attention and most careful consideration.

The report of the executive committee, of which the following is an abstract, was presented:

It will be seen that it was the judgment of your committee that electricity, having come to stay, should be considered carefully and largely at this meeting, and we therefore provided for the preparation of reports on a number of subjects of vital interest to the members of the association in regard to electrical construction, equipment and operation. The subjects were selected with great care and assigned to gentlemen in every way competent to treat them understandingly and profitably. It is the desire of the committee that all subjects shall be thoroughly discussed in order that the fullest and best information relating to the operation of street railways by electrical power may be obtained by all present.

With scarcely an exception, pleasant and harmonious relations between the employes and the managers in the street railway business in America have been undisturbed. The community of interest of both parties has been fully appreciated, and with the desire to work together harmoniously, with the purpose of furthering the best interests of the companies with which we are connected, but little friction has developed. May this state of affairs long continue. The financial outlook for our business was never better. With peace at home and abroad, the people prosperous and happy, we look forward to the future with brightest hope.

Wednesday Evening Session.

The following named companies applied for membership: Roanoke Street Railway company, Roanoke, Va.; Washington, Alexandria & Mt. Vernon Railway company, Washington, D. C.; Wilmington City Railway company, Wilmington, N. C.; Worcester, Leicester & Spencer Street Railway company, Worcester, Mass.

Most of the evening was occupied with a discussion of improvements in rails and chairs and the relative merits of several types. The construction of roadbed was also considered.

The treasurer's report showed a balance of $1,524.77. The receipts during the year were $7,574.31. The report was approved.

D. F. Longstreet of Denver, Colo., read a paper in which he traced the successive steps that were taken to create an organization among the street railway men, and which culminated in the formation of the American Street Railway association in Boston, Mass., December 12, 1882.

The next paper was that of George W. Baumhoff of St. Louis, Mo., entitled "A Model Electric Street Railway Roadbed and Underground Wiring." Following is an abstract:

A Model Electric Street Railway Road-bed and Underground Wiring.

BY GEORGE W. BAUMHOFF.

The mistake is sometimes made in designing and equipping a new road, or in changing from animal traction to electricity, of neglecting the track construction by apportioning the amount to be thus expended to such a sum that, in order to make both ends meet, it becomes necessary to weaken that portion of the investment where, above above all others, strength and permanency are required.

FIG. 3. ELECTRICAL FEATURES OF THE DEDICATION OF THE WORLD'S FAIR IN CHICAGO.

In the selection of the rail depends largely the success of perfect construction; and a road, whether built for speculative purposes or as a permanent investment by the projectors, should not be slighted in this respect.

The requirements of a rail for electric traction are strength, joint connections, durability. In some localities there are municipal requirements specifying what the head of the rail shall be.

For strength we rely chiefly on the weight of the rail and the thickness and depth of the web.

For joint connections, that rail which affords the best method of keeping both ends of the rail in perfect alignment is the best, and as the girder rail possesses peculiar advantages in this respect, its almost universal adoption is due to that fact.

For durability we depend on the height of the head of the rail at the gauge line over the lower flange, and the quality of the metal. The former is invariably considered by the purchaser, but your committee is not aware of a single instance in which the quality of the metal has been specified, other than the mere mention of whether the same shall be of iron or steel.

In former years, when the old style stringer construction was in vogue, when a good stringer and cross-tie would outlast two or more flat rails, iron was chiefly used, owing to its higher market value as scrap. In the construction of an electric railway, where the girder system has superseded the flat rail, steel is more extensively, if not exclusively employed; therefore, when we have closed our contract, having duly specified steel, we feel assured that the best possible rail has been provided for.

The subject of underground wiring is one that is usually entrusted to the contractor securing the electrical equipment, and by him sometimes sublet together with the overhead line work. As all this work is underground, out of sight, and with paved streets made inaccessible without incurring large expense to repair and renew, the most practical method of workmanship and material should be adopted.

The object to be accomplished is to form a perfect connection from each rail along the road to the poles of the generator at the power house; the ground wire being connected to the negative pole, and the overhead wire to the positive pole of the machine, although we have read of the reverse being the rule on some lines, but, as the matter is foreign to the subject now under consideration, we will not further digress therefrom.

A large sized insulated copper wire is generally adopted to form the connection between the generators and such points along the track as it is deemed advisable to reach. The return circuit, for by that name it is known, may be completed, either by connecting said wire to the rail or to a supplementary wire extending the entire distance of the track. The latter is in all cases recommended, and should invariably be soft copper wire, not smaller in size than number 0. In either event, however, all rail joints should be bonded with a soft copper wire not less in size than No. 6,

and if the supplementary wire is laid, a connection thereto should be made to at least every fifth rail; and it will also be of great advantage as a safeguard against any possible break in the circuit, to connect both sides of the track with a No. 6 wire, and if a double track, to cross to the opposite track and to the supplementary wire in said track at least every thousand feet.

We have heard of instances being cited where copper wire laid underground was more susceptible to electrolysis than that of galvanized iron or steel; but, after a thorough trial of upward of three years, during which time we have used both, the conclusion reached is that copper, being not only a better conductor, but less liable to corrode and break, is therefore the best wire to use for underground work. Galvanized soft steel or iron wire used for this purpose have not proved durable, and we have found the same to be entirely eaten away by electrolysis where it had come in contact with the cross-tie, and in perfect condition elsewhere.

The only theory we can advance for this is, that a chemical action takes place between the gases of the earth, precipitated by the sap contained in the timber and salt water—the latter from the use of salt for the purpose of melting snow and ice—although such results have not been noticeable in the use of copper wire. In addition to cross-wiring, as above mentioned, as a precautionary matter, to insure a complete circuit, it will be found advantageous to the economical operation of an electric railway, to excavate or bore in the earth, to a sufficient depth, to secure continual moisture, and while iron is usually adopted, owing to its cheapness, yet we believe the use of copper will, in time, prove the most economical metal to adopt for this purpose; for we beg leave to repeat: "The best is none too good."

Where such grounds are located, care should be taken to make the best possible connection to the supplementary wire and the track.

By a careful examination of the ampere meter at the power house during dry weather compared with that of rainy weather, it will be noticed that there is a marked decrease in the amount of current used, in favor of the latter; hence it follows that the more connections to the rail and the opposite poles of the generator with the moist earth the more economically is the system operated. It must also be remembered that the increased saving in current in wet weather over that of dry weather, is not attributable to the increased moisture of the earth alone, but to the fact that the dust and dirt which readily finds lodgment on the rail are washed off, and many roads now in operation by electricity have found the use of a car equipped with a tank having one down spout, about ⅝ inch in diameter, on each side, so arranged as to permit a stream to flow over the head of each rail, most advantageous. These down spouts should be located as near the wheel as possible, in order to insure the same being directly over the rail at all curves as well as on the straight track.

In conclusion, we have only to say as to the construction of "A Model Electric Street Railway Roadbed and Underground Wiring," its successful accomplishment will involve the comparison and investigation of a wide range of personal experiences, coupled with the patient study of those engaged in the manufacture of rail and track supplies, who are constantly endeavoring at great expense to improve the material and method of construction.

Invitations Accepted.

The secretary read a letter of invitation from the Short Electric Railway company to visit the works of the company and take luncheon on Wednesday afternoon. A letter was also read from the Walker Manufacturing company of Cleveland, inviting the delegates and others to visit the works on Friday, and take luncheon as the guests of the company. Both invitations were accepted.

The following named gentlemen were appointed a committee to consider the question of a permanent industrial institute for the exhibition of all inventions and supplies relating to the street railway business: H. C. Payne, Milwaukee; D. F. Longstreet, Denver; O. T. Crosby, Boston; William Wharton, jr., Philadelphia; H. A. Everett, Cleveland.

The report on "A Perfect Overhead Electric Construction" was then read, as follows:

A Perfect Overhead Electric Construction.

BY CHARLES H. SMITH.

Iron or steel poles have proved to be the most desirable. I would therefore recommend the following: The poles to be of tubular iron, thirty-two feet in length, and made in three sections, in the usual way. The lower section should be at least seven inches in diameter, and the other two sections six inches, and five inches, respectively. The poles should be set in concrete, and at least six feet in the ground, and should not be more than 125 feet apart. The top of the pole should have about two per cent. of rake away from the curb, and should be fitted with a suitable pole clamp, so that the span wire can be easily adjusted to the required height, which should be twenty-two feet above the track. On top of the pole should be a malleable iron cross-arm to carry the feeder wires, and guard wire spans. This cross-arm should be insulated from the pole by means of a wooden plug inserted in the top of the pole. The insertion of the joints of the pole should be at least eighteen inches, and the joints should be made solid throughout their entire length by means of shims or other contrivances.

If these joints are not properly made, the poles will not stand the strain. For curves, or extra strain, there should be larger poles of the same make.

Span wires should be of No. 4 B. W. G. silicon bronze wire, and should be fastened to pole clamps by means of insulated turn buckles. Great care should be taken in insulating these turn buckles from the poles.

All well-built lines should be sectional, and the trolley wire should not be of too great a size, as it would then call for clumsy supports. As it is not the main current wire, it can be of a smaller size. I would therefore recommend No. 4 B. W. G. silicon bronze wire, which affords sufficient carrying capacity, and has great strength and durability.

Sections should not be of a greater length than two miles, and should be separated by trolley breakers, of which there are now a number of good ones in the market. In cities and villages, where there is a great liability of fires, it would be advisable to put trolley breakers at shorter intervals. Trolley wire hangers and pull off brackets should be of the lightest make possible, and still have the required strength and the very best insulation. There is a variety of such hangers and brackets now in the market.

As it is important to have as small a number of joints as possible in the trolley wire, it should be put up in mile lengths, and twisted splice joints should be made, and brass cone-shaped tubes slipped over the wire before the splice is made. After completing the splice, the larger ends of the tubes should be brought together over the splice and a little solder dropped through a small hole made in the tubes for that purpose, in order to keep the joint in place.

Overhead switches or switch pans should be avoided, if possible, as they become a source of great annoyance. I would strongly recommend a double trolley wire for a single track road.

Great care should be taken in erecting the guard wire spans. They should be properly insulated from the cross arm by means of a strain insulator, or something equally as good, and should be of at least No. 6 best galvanized iron wire. There should be two guard wires over each trolley wire at least three feet apart and four feet above the trolley wire. The guard wire must be well insulated from the guard spans; in case of other wires falling, this would be of great importance.

Pull-off and anchor guy wires, or other wires for the same purpose, must be of the very best material, and of at least No. 8 galvanized iron wire.

Feed-in taps must not be more than five poles apart and should take the place of the trolley span wire at that point. They should be of at least No. 0 insulated wire.

The trolley wire being sectional, it is necessary to run a feeder wire to each section. I would therefore recommend that the feeder wire be at least thirty per cent. larger than the occasion demands. It will be found that this is money well invested. The insulation on the feeder wire should be the best that can be procured, and I would advise using locust or iron pins with mica insulators or something equally as good, for the purpose of fastening the feeder wire to each pole, and great care must be taken to protect it from trees and other obstructions.

A cut-out box should be located on the pole at each trolley breaker, and should not carry a fuse. It should have the same wire running through it as there is on the outside. The fuses should be at the station, with ampere meter and cut-out switch for each section; then, in case of trouble on any section, the location can be easily seen, and that section cut out, if necessary, until repaired.

Lightning arresters are of great importance on the line, and I would strongly recommend using them at least every thousand feet. They can easily be attached to the poles, and can be protected by means of a box.

In conclusion, I would say that no matter what expense is incurred for material, or care used in constructing, a good line cannot be insured without a thorough daily inspection.

It is to be hoped that in the near future a perfect overhead electric construction will be realized in some of our large cities, for the example or fact will be of much more value and interest than any paper on the subject.

Thursday's Meeting.

In the absence of the president, who had been called away by the receipt of a telegram, the first vice-president, Thomas H. McLean, of New York, presided at Thursday's morning session.

Committee on Nomination.

The secretary announced the committee on nomination as follows: W. W. Bean, St. Joseph, Mich.; Charles Cleminshaw, Troy; W. A. House, Baltimore; A. L. Johnson, Cleveland; J. E. Rugg, Pittsburg; G. W. Baumhoff, St. Louis, and V. Cronyn, London, Ont.

The report of the committee on "Economy of Electric Street Railway Machine Shops" was then read. Following is an abstract:

Economy of Machine Shops for Electrical Street Railways.

BY JOHN H. BICKFORD.

Let us look for a moment at the change which has taken place in the last five years, and, if possible, discern whether, according to good reasoning, it is wise to pursue the long established methods. We have equipped our cars with delicate machinery, and have put complicated mechanism in our power stations, and have obstructed (so the public says) our highways with a multiplicity of wires.

What shall we do now? Still employ the same class of help? Is it wise to place this apparatus in the hands of men who do not understand the first law of mechanics? No; emphatically, no; it would be the height of folly, yet I am sorry to say that such was the case with some of our roads in the early days of electrics. The laboring man is all right in his place, and is a necessary adjunct to a rail road, but until he educates himself to the level of the mechanic, he should not be allowed to handle, much less repair, the delicate mechanism of an electric motor. Heretofore, then, we have been dealing with muscle, now we must have brains; hence we must turn our attention to the mechanic and the engineer.

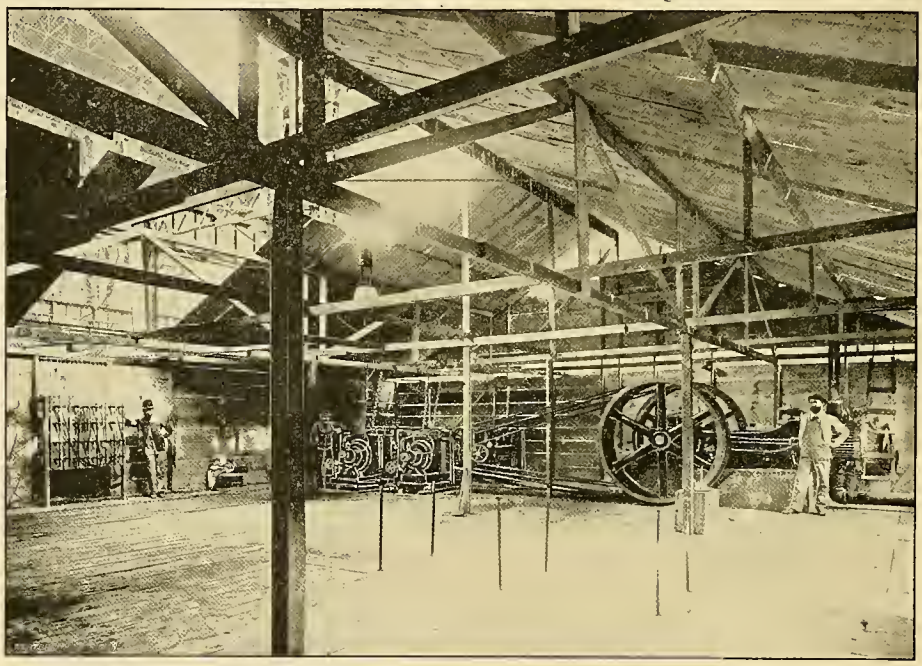

FIG. 5. ELECTRICAL FEATURES OF THE DEDICATION OF THE WORLD'S FAIR IN CHICAGO.

Having thus arrived at the conclusion that skilled help is necessary to success, let us look still farther into the subject and ascertain what else is needed to bring about true economy. Just here is where opinion will divide, and is what renders this subject difficult of elucidation. Whether it is economical to maintain an equipment of machinery will still remain as a doubt in the minds of many, notwithstanding what I may say or what others, more experienced than myself, may write upon the subject. Nevertheless, we are all here to get information, and as this is brought about by discussion, perhaps what I am about to say will bear fruit later on.

There is no denying the fact that to do a piece of work of any kind properly we must have proper tools; a makeshift in such a case only leads to the abominable temporary hitch. We would be much better off if this word "temporary" and all its modifications were left out of the English language. To do a thing half way results in gross extravagance in the end. There is no denying this; we have examples of this already on the electric railway. If this be true, what conclusion follows, in view of our previous conclusion, that we must employ the skilled mechanic? Simply that we must provide him with the requisite tools and machinery to do the work in a skilled manner.

Now that we have arrived at this latter conclusion, there is yet another step, the last but by no means the least. It is this: How far shall we carry this equipment of the machine shop? Shall we make it a manufacturing establishment? There is surely a point here where we must draw the line. There is a distinction between repairs and renewals, but for all this the question arises whether, if we go so far as to establish a shop for repairs, is it best to go a little farther and manufacture supply parts?

In attempting to write upon this subject, I found that in order to present unbiased information it would be necessary to gather as much practical knowledge as possible from roads other than those with which I am connected,

therefore I prepared a list of questions covering the most important points of this branch of the business, and sent them to over 250 of the more prominent electric street railway companies, asking them to co-operate with me in the preparation of this paper, by answering as many of the questions as pertained to their respective methods of operation and maintenance of line and car equipment. I am sorry to say that I received answers from but sixty-six roads, notwithstanding I prepared the circular so that it was only necessary to write yes or no after many of the questions, beside inclosing stamp and envelope for return.

It occurred to me that perhaps many thought that this information was for me personally, or else reasoned that if I was to present this subject, I ought to know enough about it without their help. However, the sixty-six answers which I did receive gave me valuable data to substantiate my own experience and enable me to write much more intelligently; and I wish to extend my thanks to those who did interest themselves in the matter sufficiently to give me the information asked for.

Among these answers I have found many things to strengthen my belief that it is economical to maintain a machine shop, not only for repairs, but for the manufacture of supply parts. It turns out to be a fact that no less than twenty-four roads are maintaining machine shops, doing all of their own repairs and manufacturing many supply parts. They say unhesitatingly that there is economy in so doing. They give as their reasons: First, that they can make better material than they can buy; that they are perfectly familiar with the requirements and conditions of the business; they are operating the roads and are in a position to know just what is needed, and are better able to judge of the strength and durability of the apparatus than those who have never been in a similar position. Is not this a natural consequence?

In presenting this I do not mean to cast reflection on the earnest efforts of my good friends in the manufacturing business, but I must say from personal experience that there is much material on the market to-day that is not up to the standard. Why? Simply because the makers of it do not understand thoroughly the requirements of the business. Some may be unscrupulous enough to put goods upon the market just for what is in them for awhile, regardless of their stability; but I hope this is not the case, for surely we had much rather believe the contrary.

A second reason given is, that there is a saving of from 25 to 50 per cent. by manufacturing the majority of parts.

What further, then, can we say? Is not this, coupled with the experience of the steam roads, sufficient to enable us to conclude that there must be economy in machine shops for electric street railways?

I have shown you, then, first, by reasoning, and, second, by actual fact, that this subject must be treated affirmatively; therefore, it will be wasting time to dwell longer upon it except, perhaps, to give a few examples taken from information gathered, and add a few recommendations which naturally arise from a study of the whole.

I have made a sort of classification of the answers received, and the result is as follows:

10 *Cars or Less.*

Received answers from 16 roads; 14 of these buy all supplies and repair parts, and have not a machine of any kind; the other two have a drill press, small lathe and blacksmithing outfit.

10 *to* 20 *Cars.*

Received answers from 13 roads; seven of these have partially equipped machine shops, do all ordinary repairs, and manufacture many parts for renewals; the other six have not a machine of any kind.

20 *to* 30 *Cars.*

Received answers from 10 roads; six of these have well equipped machine shops, do all repairs, and manufacture most parts for renewals; the other four have not a machine of any kind.

30 *to* 50 *Cars.*

Received answers from six roads; of these one has not a machine of any kind; one has only a wheel press; two have a drill press, lathe and blacksmithing outfit; the other two have fully equipped shops, and do all repairs and make nearly all supply parts.

50 *or More Cars.*

Received answers from 12; two of these have only a drill press, lathe and blacksmithing outfit; nine have complete shops equipped with machines of all kinds, and manufacture about everything necessary to maintain the equipment; one has a very extensive manufacturing establishment, outside of a complete repair shop, and also maintains a brass foundry.

The remaining roads from which I received answers had no definite information to give. One or two said that they were getting ready to establish shops, and others were undecided what they would do.

Out of the 66 roads heard from, 36 were winding their own motor armatures and field coils, and the cost of armatures varied from $17, the lowest, to $75, the highest; the average was about $35, including all labor and material.

Fifteen roads had wood-working machinery, consisting principally of saw table, band saw, surface planer and mortising machine.

Seven roads are cutting their gears, but some of them find it no cheaper than to buy. They think, however, that the work and material are better, and for that reason it pays them. Others make all gears, and think there is a saving in cost.

Eight roads are building their cars, while several are rebuilding old cars, but make no new ones.

I will give now a few of the prices for which supply parts are being made in the shops of the different roads. These figures are an average taken from 11 roads which are using Sprague, Thomson-Houston and Westinghouse double reduction motors:

Refilling commutator (copper bars)	$18.50
Two halves armature bearing, T. H., $3.96; single Sprague	1.85
Two halves axle bearing	3.50
Brush holder	1.35
Rocker arm, T. H., $1.00; Sprague	3.00
Int. shaft (steel), T. H., $10; Sprague	3.00
Int pinion (steel)	4.20
Int. gear	3.88
Axle gear	5.66
Armature pinion (steel)	3.58
Trolley wheel (brass)	1.06
Line frog	1.90
Clips for line hangers (brass)	.15
To bore and press on 30-inch wheel	.95

The average price for which roads sell scrap car wheels is $13.65 per gross ton; the lowest being $8, and the highest $20.

Some roads have kept no account of cost of making repair parts, and therefore could give no prices. It is unnecessary to say that it would be wise to do so.

Being anxious to know myself, and thinking it might be of benefit to many others, I asked the roads to give an opinion as to which of the different types of motors gave them the most trouble. With but two exceptions the single reduction costs less to maintain.

Nineteen roads are employing an electrical engineer, and four have a superintendent and electrical engineer combined.

In regard to my own experience I will say simply that it fully coincides with the information just presented to you. I have no doubt whatever that there is economy in maintaining repair shops, and even manufacturing supply parts. Of course what will apply to some roads will not to others. Some roads are too small to think of its being profitable, but many others will find it to their advantage if they will look at the matter in all its parts.

I will not attempt to recommend the number and kind of machines a road ought to have, as it will depend largely on the number of cars they operate, but I have made up a list of machines which I find the majority of those having machine shops are using, and should judge that it covers those most necessary for the work:

One 20 inch swing, 10 foot bed, engine lathe.
One 16 " " 6 " " " "
One 16 " " 6 " " speed lathe.
One 24 inch x 24 inch iron planer.
One No. 3 or No. 4 universal milling machine.
One 45 inch upright boring mill.
One 24 " " drill press.
One 12 " " " "
One 100 ton hydraulic wheel press.
One open die bolt cutter and nut tapper.
One medium sized shaper.
One tool grinder.
Two forges with power blower.
One set of emery grinders.
One grindstone.
Necessary bench tools and fittings for machines.
One 10 horse power motor to run machinery.

Of course roads with a great number of cars would need to duplicate some of these machines, and add some others not mentioned.

After having considered this subject and shown you what conclusions have been arrived at, both theoretically and practically, I want to add that in order to make a success of running a machine shop in connection with an electric road it will be necessary to employ an electrical engineer. By this I do not mean a handy man, or a man who styles himself an electrician just because he has had a few months' experience in the electrical business, but one who has a theoretical, as well as a practical, knowledge of mechanical and electrical engineering.

In conclusion I wish to say that I have endeavored to be as impartial as possible in what I have said, and have tried to present the subject in a comprehensive manner. I hope that discussion will follow the reading of this paper, for, although some of us are fully persuaded that machine shops are economical, yet I think none of us are so prejudiced that we could not be convinced should it be proven to the contrary. Let us get at the truth, whatever it is.

FIG. 4. ELECTRICAL FEATURES OF THE DEDICATION OF THE WORLD'S FAIR IN CHICAGO.

DISCUSSION.

C. W. WASON: I think there is one point outside the machine shop that should be taken into consideration in the repairs of motors: namely, the pits in which you do your work, the manner of handling motors to facilitate putting them on and taking them off. The number and length of the pits should, of course, be in proportion to the number of cars you operate. There is such a thing as having a pit too long; for it will generally be found that the car which requires only simple repairs, and which is first needed, is invariably the last one on the line. In our shops the pits are so arranged that you can put four cars over them, but three is all we take over each pit. We have an hydraulic lift underneath the car, running on the track, which we have found very serviceable; and when I tell you that we have taken off two motors and put on two, and had the car running out in thirty minutes, you will be sure it is a handy pit. We have taken an armature out and put one in, and had the car running on the road in five minutes. We have ninety motor cars, and I do not think we have any superfluous machines. I am sure that we have more than paid for all our machinery in the saving over what we would have had to pay to have the work done, especially taking into consideration the saving in the matter of cartage.

I am confident that taking the motors from underneath the car rather than raising the car bodies up is preferable. We have found this system very advantageous and complete.

G. W. BAUMHOFF: We do a great deal of manufacturing, but we sometimes find it more profitable to buy of the supply dealers. When we started in about three years ago we found the prices for the various materials connected with electric railways so high that for our own protection we were compelled to inaugurate a machine shop system. In doing so we found it profitable to press on our own wheels. We also found it profitable to manufacture our commutators and to cut our pinions and gears, and in the matter of gears it is not so much a question of the cost of the cutting as the quality of the metal used.

On motion of Wm. Richardson a resolution was passed expressing sympathy for President Holmes in the bereavement he had sustained in the death of his father-in-law.

The report of the committee on the "Relative Cost of Operating Horse, Cable and Electric Roads" was then read, as follows:

RELATIVE COST OF OPERATION OF HORSE, CABLE AND ELECTRIC ROADS.

BY WILLIAM M. RAMSEY, FRANK R. GREENE, JOHN L. HEINS.

The work which the committee had to perform was to ascertain from leading horse roads, cable roads and electric roads such information regarding the cost of operation of each as the existing methods of accounting in each case made possible. They recognized in the early stages of their work that any attempt on their part to shape the accounts of the companies to suit the purpose of the committee would be fruitless, for reasons which must be obvious to all. A series of questions was framed comprehending the information desired, and with such subdivisions of operating expenses, as it was thought would meet with most ready reply. Our experience has proved that the subdivisions were well selected, for many of the replies were as full and concise as could be desired.

As to the greatest difficulty encountered—the lack of uniformity in methods of keeping accounts—enough has

[*Continued on page* 223.]

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CORRESPONDENCE relating to electricity, or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

PAGE.

Electrical Features of the Dedication of the World's Fair in Chicago. Illustrated 217, 218, 219, 220, 221
St. Louis Electric Club 218
Telephoning from Chicago to New York 218
American Institute of Electrical Engineers 218
Electricity at Niagara 218
Wisconsin Electric Club 218
The Convention of the American Street Railway Association at Cleveland, O.
President's Address 219
A Model Electric Street Railway Roadbed and Underground Wiring. By George W. Baumhoff 219, 220
Invitations Accepted 220
A Perfect Overhead Electric Construction. By Charles H. Smith 220
Committee on Nominations 220
Economy of Machine Shops for Electric Street Railways. By J. H. Bickford. Discussion 220, 221
Relative Cost of Operation of Horse, Cable and Electric Roads. By W. M. Ramsey, F. R. Green and J. L. Heins. Discussion 223, 224
World's Columbian Exposition 224
Standards for Electric Street Railways. By O. T. Crosby and H. L. Bettis 224, 225
Experiments on the Expansion of Continuous Rails. By A. J. Moxham 225, 226
Delegates and Visitors 226, 227, 228
The Banquet 228
Exhibits, Convention Notes and Personals 228, 229
The d'Infreville Battery. Illustrated 9 230
The S. R. F. 30 Railway Motor. Illustrated 230
New Hand Lighting Burner. Illustrated 230
Spencer Spark Arrester. Illustrated 230, 231
The Acorn Sunbeam Lamp. Illustrated 231

DEPARTMENTS.

Correspondence 231
New Incorporations 231, 232
Electric Lighting 232
Electric Railways 232
Trade News 232
Business 232
Electrical Patents 232

THE familiar project of standardizing the nomenclature and dimensions of street railway apparatus was again before the Cleveland convention. Several valuable reports on this subject have been made by Mr. Crosby and others, but the proposed remedy for the existing diversity, which is generally conceded to be highly desirable, makes but slow headway among men so busily engaged as street railway managers. Mr. Crosby's suggestion that a competent man be engaged especially to gather and collate information on this subject is a good one, and one that should be heeded. With a permanent committee and an officer of the convention devoting himself to the furtherance of the project, it should be possible to bring about the desired uniformity in a few years.

A. J. MOXHAM'S convention paper on "Experiments on the Expansion of Continuous Rails" was undoubtedly one of the most valuable contributions presented to the street railway men. Without reviewing in detail the paper, an abstract of which is presented elsewhere in this issue, it may be said that its author made a report upon some experiments carried out with the view of determining the practicability of a track without joints—or at least with very few joints. Mr. Moxham's conclusions are very interesting, as he demonstrates that, although expansion and contraction of the rail take place, it is restrained in place, and held practically rigid by the surface friction of the roadbed. In fact, Mr. Moxham found during his experiments that a track could be made so as to have absolutely no movement, even at the ends. He was led to the further belief that not only can the roadbed be made to hold the track as a complete structure but that it can be constructed to do so consecutively. This report contains a number of other interesting points and merits a careful reading.

THE great World's Fair dedication celebration in Chicago has come and gone, and the business of the city has resumed its wonted channels. While it is to be regretted that the electrical decorations were not more numerous—a fact attributed very largely to the strike of the wiremen—some consolation is to be had in the reflection that the few notable displays of this character shone all the more brightly in their isolated brilliancy. The electrical companies displayed their patriotism in flags and bunting and in a general cessation of business on Thursday and Friday. Of course the big search-light on the grounds attracted much attention, and some of the effects obtained by it were very striking, although the atmosphere of Chicago is not favorable to displays of this character. On the whole, it may be said that the electrical features of the celebration were excellent in quality although deficient in quantity.

GENERAL gratification will be felt by all members of the electrical fraternity on the occasion of the completion and successful opening of the all-metallic telephone circuit that connects Chicago and New York. The transmission of the human voice a thousand miles over slender copper wires is a wonderful thing, and one well calculated to excite the question, Where will the extension of telephone lines end? Already there is talk of a circuit between New York and San Francisco, a distance of 2,700 miles, and who shall say that, with proper line construction, the project is not an entirely feasible one? Prof. Alex. Graham Bell is reported to have declared his belief that the time is coming when the telephone will be as widely extended as the telegraph is to-day. At present there seem to be almost insuperable obstacles in the path of transatlantic telephony, but it may be possible that the coming years will witness conversations between New York and London, perhaps San Francisco and Melbourne, as readily as between London and Paris to-day.

AN eastern electrical paper last week engaged in a fishing expedition and as a result produced patent specifications and drawings covering three distinct styles of incandescent lamps, among which it evidently hoped was the Westinghouse lamp. The journal in question evidently had some misgivings, for, despite its flaring headlines, it had very little to say about the new lamp and practically acknowledged its inability to determine which of the patents applied to the lamp which is now the object of so much interest. It may be added that none of the illustrations presented by our contemporary bore any resemblance to the Westinghouse lamp. The only authentic cut of this lamp that has thus far appeared is that which was presented exclusively in the last issue of the WESTERN ELECTRICIAN. While referring to this matter it may not be amiss to call attention to the fact that another eastern paper last week published cuts of the special Westinghouse generators for the World's Fair which were recently illustrated in the WESTERN ELECTRICIAN.

IN a report to his government Mr. Sadler, the British consul at Chicago, makes some pertinent reflections on the scope of the World's Fair. "As the enterprise develops," he writes, "the more convincing it appears that the Chicago Exposition of 1893 will be by far the most extensive and important which has yet taken place. The effect on the avenues of trade will probably be wide and far spreading. Considerable changes and diversions may result, new connections will be made, and old ones lost. Commerce does not stand still nowadays, nor is trade in these times of great competition won or retained without continued exertion, and however greatly this exhibition may benefit manufacturing and commercial enterprises in the United States, it undeniably offers the best possible opportunity of advertising by means of exhibits to the manufacturers of other countries."

Consul Sadler's estimation of the value of the fair to foreign industries should receive careful attention from English manufacturers, including those who make electrical machinery and electrical appliances. The author of the report has, of course, only the best interests of his countrymen at heart, and he has had, in addition, an excellent opportunity for forming an unbiased judgment. He points out the importance of the exposition as a medium for advertising the products of other countries, and his reasoning is correct. English electrical manufacturers who do not profit by it will undoubtedly have cause to regret their short-sightedness.

ADVERSE action on the part of city councils and prejudiced mayors may for a time serve to retard the advancement of the overhead system in some of the larger cities, but the electric railway nevertheless keeps forging ahead in a manner that leads one to believe that the people at large are beginning to weigh intelligently its advantages against its supposed dangers. The ignoramuses who wrote misleading articles to help the New York daily papers in their efforts to turn popular opinion against the electric system appeared in very much the same light as a boy who does not want to take medicine that would cure internal congestion and sets up a terrible howl and resorts to falsehood rather than accept relief through approved methods. The best improvements, though, often meet with the greatest opposition. New York in this instance at least has acted very much like the celestials who objected so strenuously against the introduction of the steam locomotive into their land. It is only a question as to how long the great city can hold out in view of the growth of sentiment among street railway men favorable to the electric system. That this sentiment is quite general and that it is shared by the leading street railway managers of the country is shown by the action of the American Street Railway association at its Cleveland convention. The report of the committee on the "Relative Cost of Operation of Horse, Cable and Electric Roads" concludes with the following paragraph:

We believe that cable road practice has reached the stage where but little room is left for improvement. They have been developed, improved and operated by the best engineering skill which the country affords. Nearly all are on a good dividend paying basis; but whatever the past experience of the two systems has been, or whatever the present status of the two may be, we are only voicing the convictions of well-informed engineers when we say that electric systems will continue to increase in efficiency (by which is meant earning capacity) until all rivals are distanced, and only one method of rapid transit is recognized—the electric car.

Such an endorsement as the above, coming, as it does, not from an enthusiastic electrical manufacturer or an inventor, but from a committee selected from the managers of street railways, means but one thing, and that is that the electric system will lead all others.

IN point of numbers the Cleveland convention of the American Street Railway association last week ranked with former meetings; but there was a notable absence of many prominent men who have heretofore figured in the councils of the association. Of course the supply men were out in force, and all of the large manufacturers of street railway apparatus were represented. Most of the eastern men were present, at least for a day, but the attraction at Chicago proved too great even for them. A large number of the most active men from the West did not appear at Cleveland. They believed that they could spend the time to better advantage in the World's Fair City, where the methods employed by the street railway companies for handling the immense throngs during the dedicatory exercises would prove a liberal education in the management of street railways. Of course the vast majority of street railway men who were in this city during the opening exercises will never be called upon to handle any such crowds as those which confronted the Chicago companies; but it is needless to say that every one of them gained valuable information and received suggestions which will enable them in their own sphere to improve their service.

When it was learned that the convention at Cleveland conflicted with the dedicatory exercises, those who desired to attend both events endeavored to have the convention adjourned, but without avail. A perusal of the list of delegates and visitors at the convention, presented elsewhere in this issue, will show that there was a good attendance. An attractive display of street railway apparatus was made, and, as a matter of course, the electrical system took the lead. For all practical purposes the meeting was an electrical convention. There were a few cable roads represented, but even these did not seriously dispute the supremacy and superiority of the trolley. The executive committee in its report says that recognizing that the electric system has come to stay, the subject of electrical construction, equipment and operation has been given prominence, as the committee believed it "should be considered carefully and largely at this meeting." In view of this fact almost the entire convention was devoted to the discussion of electrical topics. The committee and the association are to be congratulated upon the excellent judgment displayed in reaching this conclusion. The papers presented are printed elsewhere in this issue and are worthy careful consideration.

THE CONVENTION

Of the American Street Railway Association at Cleveland, O.

[*Continued from page* 221.]

been said at former conventions. The difficulty, however, still exists; and it might be observed, another difficulty was brought prominently to the notice of the committee; that is, the woful lack of acquaintance with facts, and the need of scientific study and research into the economics of one's own road.

Correspondence was opened with every cable road in the United States by Mr. Greene, and by myself with the representative electric and horse roads. It is with regret that the committee announces that the information received from horse roads, for various causes, is meager and unsatisfactory. It was not the intention of the committee to pass superficially over the horse roads, as our report would seem to indicate.

Many of the replies sent to the committee were given for the personal consideration of the committee alone, and not for publication or public reference in any way. We have, however, chosen a few of the representative roads of each class, and have tabulated the replies in such a way that reference can be made to them by number if desired. Names, location, amount of stock and bonds, and other marks by which a road might be identified, are necessarily omitted.

A comparison of the reports from these roads does not reveal the characteristics which we should expect to find. We see results which are as varied as could be imagined. Why should cable road No. 1, earning only 18 cents per car mile, have within 8 cents per car mile as much to divide among its stockholders as road No. 3, having nearly 12 cents per car mile more receipts? Let us refer to the reports of these two roads and make a few comparisons.

The first noticeable difference in the condition under which the two roads operate lies in the fact that road No. 1 operates daily an average of 298 trail or tow cars, while road No. 3 operates only grip cars. Road No. 1 operates 1.54 tow cars for every grip car operated or a daily mileage of 203.2 for every train of one grip car and 1.54 tow cars to every 100 miles made by a train of one grip car only, which road No. 3 operates. Now if the expense of operating increased *directly* as the mileage, whether made by grip or by tow cars, a direct comparison of these two roads would be possible; but such is not the case. Road No. 3 is evidently at a disadvantage. The same difficulty occurs in the comparisoo of certain electric roads with one another.

A very excellent method of correcting this error has been formulated by Dr. Cary T. Hutchinson, and is here presented by his kind permission. It is evident that what is wanted is a formula which will represent the ratio of cost per car mile, as ordinarily counted, to cost per motor car mile, for any item of expense.

Dr. Hutchinson's method is as follows:

Let "t" = No. of miles a train of two cars runs per day.

Let "m" = No. of miles a motor car alone runs per day.

Let "a" = cost per train mile for any special item, *e. g.*, cost of fuel.

Let "b" = cost per motor car mile—the same item.

Let "N" = $2t + m$, equals "car miles" as ordinarily counted.

Let "r" = a/b, equals ratio of cost per train mile to cost per motor car mile for any given item.

Let "c" = cost per car mile, counting trailers same as motor cars. This is the figure ordinarily given.

Let "CN" = total cost of operating line per day—for that item.

Then $a\,t + bm$ equals C N for any item of expense.

but a " br

$\therefore b(tr + m)$ " C N

$$b \text{ equals } \frac{C\,N}{tr + m}$$

$$b \text{ equals } \frac{C\,1}{\frac{t}{r} + \frac{m}{n}} \qquad (1)$$

$$a \text{ equals } rb \qquad (2)$$

Now $\frac{t}{n}$ and $\frac{m}{n}$, the ratios of train and motor to total mileage, are known.

Then r must be determined for each item of expense.

I take for "r" the following values:

First.—Maintenance of roadbed and track, r = 1.5; although there are two cars instead of one, yet the trail car is by no means as hard on the rails as is the motor car.

Second.—Maintenance of line—r = 1. It is the same whether there is or is not a trail car.

Third.—Maintenance of power plant—r = 1.4. Because I have found by experience that under average conditions a train requires about 1.4 times the power of a motor car, and maintenance should be assumed proportional to power developed.

Fourth.—Cost of power.

(a) and (b) Fuel and supplies, r = 1.4, as above.

(c) and (d) Attendants, r = 1. Because for a good size plant no more men would have to be employed in the power house if all the cars hauled trailers; the force required is not proportioonal to the output, but is constant within pretty wide limits.

Fifth.—Maintenance of rolling stock.

(a) and (b) Repairs to motors, r = 1.

(c) Repairs to cars and trucks, r = 1.25.

Repairs to trail cars are very much less than to motor cars.

Sixth.—Transportation expenses.

(a) Car men, r = 1.5; 3 men on a train and 2 on a motor.

(b), (c), (d), (e) and (f) may all be bunched at r = 1.25.

Seventh.—General expenses. r = 1.

Referring again to our table of statistics:

No. 1 road expends .925c. per car mile for the item of cost of power, and No. 3 road expends for the same item 1.07c., and this notwithstanding the fact that road No. 3 only pays $1.21½ per ton for fuel, while road No. 1 pays $1.47 per ton.

Using for r the value assigned above for cost of power, 1 4, our equation reduces to b = 1.07c. or, in other words, .925c. should be multiplied by 1.07 to bring it on a basis of comparison with No. 3 road. This gives us .99c. for No. 1 road against 1.07c. for No. 3.

The difference which still exists may be accounted for either by reason of a possible difference in the efficiency of the two power plants, or by the possibility that one road may operate more cars to do the same amount of business than the other road.

This method of comparison can be used satisfactorily for any roads, cable or electric, providing the necessary data have been obtained as to motor car miles and train miles, and providing experience and careful observation have enabled the investigator to assign approximately correct values for "r," which will differ in different cases. But there are yet many discrepancies to explain, for which we must seek other reasons. Why should the gross operating expenses of No. 3 electric road exceed the gross receipts per car mile of No. 4 electric road by nearly 100 per cent. and yet both roads still have a fair percentage of their receipts left for dividends? No. 4 road is a small road and No. 3 is a large one, but we cannot argue that small electric roads have a better chance for profits than large ones. It is fair to assert that study of No. 3 report would lead to the conclusion that either there is more in the road than is brought out of it, or that the only thing that justifies the outlay of 25½c. per car mile (trail car mileage included), is the receipt of over 40c. per car mile to do it with.

The quality of the management which any of our roads receives is an uncertain quantity, but must be assumed to be good in our arguments. The management of roads Nos. 1 and 3 in the cable list are known to the writer to be excellent. The other conditions under which the two roads operate are nearly the same. Yet a "figure of merit"—obtained by multiplying the total daily mileage by net earnings per car mile, and dividing by the amount of capital stock paid in—shows vastly in favor of No. 3 road, and this notwithstanding the gross operating expenses of No. 3 road are about 50 per cent. higher than the operating expenses of No. 1 road, both being placed on an equal basis of grip car miles. We see, therefore, that still another method of comparisoo must be resorted to in order to give an intelligent idea of the comparative earoing power of two roads—namely, the comparative earning power per day of each dollar invested in each road. This ratio, when stated, comprehends all of the conditions under which the two roads operate; it is the final result of a compound proportion of which the ingredients are the investment, the outlay and the income—"outlay" comprehending the management and efficiency of the road, and "income" comprehending, among other things, the comparative value of the territories through which the roads pass.

Operating expenses per motor car mile, or per grip car mile, afford a satisfactory basis on which to compare expense of operation, but net earnings per motor or grip car mile tell us nothing of the value of a road as an investment unless we know also the total iovestment necessary to earn so much per car mile; and we take occasion to remark here that future committees on this important topic will find it discouragiog work to follow the usual lines of investigation into receipts, cost of operation and net earoings of street railways, and may find it necessary to look to some method of comparison by arbitrary "figures of merit," as has been suggested by several of our thinking engineers.

For a comparison of an average cable road with an average electric road let us take this same No. 3 cable road and compare it with No. 7 electric road. The cable road has been shown to be something better than the average, and the electric road is koown to the writer to be at least up to the average. These two roads afford us a better opportunity than any other two which we might select, for the following reasons:

1st. Both are located in the same city, where climatic and other local conditions are the same.

2d. Both roads are of the same magnitude.

3d. Fuel and labor cost the same in each case.

4th. Neither road operates trail cars.

The cable road has the advantage in route as to grades and curves; otherwise, the roads offer excellent opportunities for comparison. It might be added that the investment in each case is up to the average; that is, is not extravagantly large, and yet is ample for the business transacted. Each road may be regarded as typical of its class. We see upon examination that the cable road has the greater fixed charges by 1.7c. There is a difference of

TABLE NO. 1. OPERATING EXPENSES OF EIGHT CABLE ROADS.

No.	Average No. of Grip Cars operated daily.	Average No. of Trail Cars operated daily.	Daily Mileage of Grip and Trail Cars. Grip.	Trail	Receipts per Car Mile, including Mileage of Trail Cars	Fixed Charges per Car Mile.	Interest on Funded Debt.	Taxes, Tolls—State, County and Municipal Taxes, except Water Taxes.	Gross Operating Expenses per Car Mile, exclusive of Fixed Charges	Maintenance of Road-bed and Track.	Maintenance of Cable Rope and Underground Machinery.	Maintenance of Power Plant, including repairs to engines, boilers, etc.	Maintenance of Plant in general, Buildings, etc.	Maintenance of Rolling Stock.	Maintenance of Grips, including inspection and shop work.	Cost of Power—Fuel—water, oil, waste, and wages of employees.	Cost of Transportation—Conductors and Motormen, lighting and heating cars, etc.	General Expenses—Salaries, Legal, Accidents, etc.	Net Earnings per Car mile.	Wages of Conductors and Grip-men per hour.	Kind of Fuel used.	Cost per ton.
1	193	298	80	80	18.054	1.024	1.069	.555	8.810	.401	.086	.530	.132	.594	.084	.925	4.702	.750	7.620	28c.	Screenings.	1.47
2	30½	.....	127	....	18.300	4.700	4.200	.500	13.700	.500	2.300	.100	.030	.300	.400	1.700	9.400	2.000	4.900	17c.	Slack & Nut.	2.02
3	54	.....	100	.....	29.840	5.440	3.200	2.240	16.000	1.910	1.720	.190	.580	1.030	.570	1.070	7.450	1.480	8.400	18½c.	Coal.	1.21½
4	6	6	90	90	15.10	.....	.....	.....	41.000	.....	.....	.....	.....	.....	.....	.....	7.000	3.000	.....	17½c.	R. O. M.	2.00
5	7	7	70	70	19.80	.....	.659	1.210	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
6	29	58	104	104	.....	1.230	.930	.....	6.750	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	19½ and 20½	.....	.....
7	8	5	90.40	105 65	.....	1.884	1.532	0.352	10 715	.448	.734	.055	.....	.480	.263	2.530	4.984	1.221	.....	22½c.	Petroleum.	5½c. per gal.
8	70	70	123.54	123.54	.....	6.610	5.700	0.910	20.050	.400	3.000	.420	.100	.860	540	3.240	9.890	1.900	.....	22c.	Soft Coal.	6.20 net ton.

TABLE NO. 2. OPERATING EXPENSES OF SEVEN ELECTRIC ROADS.

No.	Average No. of Motor Cars operated daily	Average No. of Trail Cars operated daily.	Average Daily Mileage of Motor Cars.	Average Daily Mileage of Trail Cars	Receipts per Car Mile, including Mileage of Trail Cars.	Fixed Charges per Car Mile.	Interest on Funded Debt.	Taxes, Tolls—State, County and Municipal, except Water Taxes	Gross Operating Expenses per Car Mile, exclusive of Fixed Charges.	Maintenance of Roadbed and Track.	Maintenance of Line work, including underground wiring.	Maintenance of Power Plant, repairs on engines, boilers, etc.	Maintenance of Plant in general, Buildings, etc.	Maintenance of Rolling Stock. Car bodies Trucks, etc.	Maintenance of Motors inspection and shop work, electrical and mechanical.	Cost of Power—Fuel, oil, waste, etc. Wages of employees.	Cost of Transportation—Wages of Conductors, Motormen, Dispatchers, etc.	General expenses—Salaries, Legal Accidents, etc.	Net earnings per Car Mile.	Wages of Conductors and Motormen per hour.	Kind of Fuel used.	Cost per ton
1	39¼	.....	127	.....	Cents. 19.360	Cents.	Cents.	Cents.	Cents. 9.600	Cents.	Cents.	Cents.	Cents.	Cents	Cents	Cents.	Cents.	Cents.	Cents.	Cents.	Slack at 1.90;	Lump 3.00.
2	17	.....	89½	.....	25.263	7.222	6.861	.361	17.974	.773	.203	.....	.....	.....	.....	.....	.....	.....	9.670	15½		
3	280	5	70	56	40.280	3.360	1.000	2.360	25.440	2.520	.720	.411	.040	3.405		3 301	8.750	1.091	.0067	24	Wood	by the year
4	10	4	120	120	13.500	9 000	.....	.....	9.000	.....	.....	.360	.330	1.590	2.720	3.560	17.420	2.220	14.3400	22½	Lump Coal	3.92
5	10	.....	100	.....	15.000	6.400	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1 500	.....	4.0000	12½	Soft Coal	1.25
6	5	.....	96 6	.....	.....	.....	.....	.....	16.900	.111	.070	.420	.....	1.230	2.360	3.200	.....	.....	3.4200	13	Soft Coal	1.32
7	37	.....	100	.....	28.880	2.560	.....	.....	13.530	2.500	.520	.....	.....	.740	.....	3.840	8 740	.620	5.2300	14	R. O. M.	3.00
												.....	.....	2 360	2.380	2.840	6 900	2.210	6.6100	20½	Slack	1.21

1c. in the gross receipts in favor of the cable road; one cent of which may be said to be due to the larger gross receipts; but resorting again to the comparison by "figure of merit," we find a ratio of .00015 to .00020, or nearly 3 to 4 in favor of the electric road. This simply means that each dollar invested in the cable road will earn .00015 in one day, whereas each dollar invested in the electric road will earn .00020 in one day. The total investment in the case of the cable road in this case is 2½ times the total investment in the case of the electric road. The capital stock alone, exclusive of bonds of the cable road, is 2.4 times the capital stock of the electric road. What is our conclusion from these facts, or can we draw a conclusion on which we can stand? We have not been conservative in our statements thus far, but are, of course, not infallible. "One swallow does not make a summer"—nor do the examples we cite determine the whole matter once for all. The cable road has its place firmly established in the transportation business of the Pacific slope, and we, who are unacquainted with the conditions met with there, cannot presume to say that the electric railway would do the same work better and more efficiently. We are tempted to say rivals are distanced, and only one method of rapid transit is recognized—the electric car.

Discussion.

B. L. Baldwin of Cincinnati said that it was found that as to the actual cost of operation per car mile the cable road was far cheaper to operate than electric cars over the same route. It required more than double the number of men to clean motors and make the usual repairs to electrical apparatus. Most of these men were high priced men in place of ordinary mechanics, as in the case of the cable, so that when the cost of this labor was taken into account it was found to be fully three times that necessary to keep the cable cars in good order. Mr. Baldwin recommended that a committee be appointed to prepare suitable blanks and learn the operating expenses of the different roads in the country and report at the next meeting.

The recommendation was referred to the executive committee.

W. H. Ramsey: I would say in answer to the gentleman who has just spoken that he is in line with our committee in the position he takes. The committee in its investigation came across several cases similar to his own. Our report was presented to the second largest cable railroad in this country for a preliminary reading, and it was returned with the statement that 'our views on this important subject are fully expressed in the attitude which our board has taken in regard to further extensions of some thirty miles of electric railroad which we are about to build."

Mr. Lawless of Paterson: I was connected with one of the first cable lines built in this country, and have been connected with the construction of a number. I was always a strong advocate of the cable and still am in its proper sphere. The cable railroad sphere is limited, but in that sphere it holds its own. There are some districts where I claim cable railroads can be operated more economically than any electric railroad. As regards car mileage I find that some roads have made wonderful results in the operating expenses per car mile. In those districts where the electric cars are run into sparsely settled sections the results are better than cars run in thickly populated portions. Where you can run at the rate of about twenty miles an hour you can make about 130 miles per day; but in the heart of the city you can only make from 85 to 90. If you pay the same wages per day, the results are better in the former case; so that it is pretty hard to get at accurate figures in that respect. The results were rather in favor of cable lines three or four years ago; but since the single reduction motors have come in and the cost of repairs has come down, in thickly populated sections, even the electric line is going to press the cable pretty hard. We have no reason to expect that we have come to the end of improvements in the motors, and as these progress the conditions will be increasingly in favor of electric traction.

TABLE SHOWING STATISTICS OF SEVEN ELECTRIC AND ONE CABLE ROAD.

By permission of Dr. Cary T. Hutchinson.

Operating Expenses.	Mileage 4,750,000 No. 1.		Motor miles No. 2		704,913. No. 3.		1,345,149 No. 4		1,500,000		2,744,000 No. 6.		1 098,000 No. 7.		2,725,000 No. 8	
	Cents	%	Cents	%	Cents	%	Cents	%	Cents	%	Cents	%	Cents.	%	Cents	%
1. Maintenance of Roadbed and Track	....	....	....	....	1.040	8.45	2.51	12.66	.....	.....	.....	.....	1.516	10.80	.505	4.60
2. Maintenance of Line.	....	....	....	....	.100	.81	.53	2.67	.145	.204	.....	.....	.516	3 82	....	.....
Total	.159	2.05	.200	2.10	1.140	9.76	.....	15.33	.....	.....	.300	2.80	.....	14.62	....	.....
3. Maintenance of Power Plant:																
(a) Repairs of engines and boilers	.....	.....	...	.....	.050	.40	.....	.....	.....	..	.....	.....	.....	.....	.....	.....
(b) Repairs of dynamos	....	.....	...	.....	.007	.01	.....	.....	.....	...	.....	.....	.....	.....	.....	.....
(c) Miscellaneous repairs	...	.....	.....	.....	...	...	.....	.....	...	.....	...	.....	.....	...	.....	...
Total	.....	.....	.....	.....	.057	.41	.....	.....	.....	.....	...	.....	.....	...	.....	...
4. Cost of Power:																
(a) Fuel	.....	.....	.....	....	.830	6.75	...	.....	.675	9.40	1.280	11.90	.....	.....	...	.....
(b) Oils, waste, water and other supplies	.331	4.26	.391	4.12	.200	1.63	.....	.....	.412	5.64	.440	4.10	....	.....	.....	.....
(c) Wages of engineers and firemen	.162	2.09	.223	2.35	.700	5.70	.....	.....	.168	2.35	....	....	.....	.....	.....	.....
(d) Wages of dynamo tenders, etc	.....	.....	...	...	....	.....	.....	.....	.....	.....	500	4.65	.....	.....	.....	.....
Total	.493	6.35	.614	6.47	1.730	14.08	2.84	14.80	1.255	17.39	2.220	20 65	1.304	8.72	2.83	25.80
5. Maintenance of Rolling Stock:																
(a) Repairs on motors; except gearing	.....	....	....	.....	.905	7.35	.....	.....	.244	3.40	.....	....	1.402	9.40	.....	.....
(b) Repairs on gearing and trolleys	1.040	13.40	1.430	15.10	.234	1.90	2.38	12.00	.....	.....	.....	.....	.....	.....	.....	.....
(c) Repairs on car bodies and trucks	.435	5.60	.542	5.70	.528	4.30	2.35	12 00	.315	4.40	.....	.....	.....	.. ..	.....	.....
Total	1.475	19.00	1.972	20.80	1.667	13.55	4.73	24.00	.559	7.80	1.800	16.80	....	.....	.715	5.50
6. Transportation Expenses:																
(a) Wages of conductors and motormen	.....	.....	.....	.....	4.560	37.14	6.98	35.30	4.678	65.50	4.650	43.29	4.815	32.00	4.00	36.40
(b) Wages of starters, switchmen, track sweepers, etc.	4.330	56.00	4.930	52.00	.485	3.95	.....	.....	.103	1.44	.515	4.80	.....	.....	.....	...
(c) Cleaning and inspecting cars and motors	.. ..	...	...	.....	.290	2.35	.....	.....	.383	5.35	.....	.....	.....	....	....	.....
(d) Oil, waste and other supplies	.....	.....	....	.....	.485	3.95	. .	.....	.036	.50	....	.....	2.693	18 00	.....	...
(e) Accidents to persons and property	....	.....	.....	...	.007	.01	.....	.....	...	...	.....	.....	.....	.....	...	.....
(f) Miscellaneous	.172	2.05	.215	2 26	.477	3.90	....	...	.....	..	.100	.93	.....	.....	.....	...
Total	4.502	58.05	5.145	...	6.304	51 30	...	...	5.200	7.29	5.265	.....	7.508	.....	5.62	51.30
7. General Expenses:																
(a) Salaries of officers and clerks	.437	5.65	.600	6.34	.....	...	.....	.....	...	.....	.132	1.23	1.051	7.00	.....	....
(b) Office expenses	.132	1.70	.182	1.92	.....	...	.....	.....	...	...	.....	...	.....	.....	.....	.....
(c) Advertising and printing	.....	.....	.....	.....	.....	...	....	....	.....	.....	.250	2.32	.....	.....	.....	.....
(d) Legal expenses and damages	.174	2.25	.240	2.54	.....	....	...	...	.....	.....	.102	.95	.291	1.95	.....	.....
(e) Insurance and taxes	.384	4.96	.530	5.60	.....	...	.....	.....	.....	.....	.153	1.43	.184	1.23	.....	.....
(f) Miscellaneous	.....	.....	...	.....	.....	...	.....	.....	...	....	.523	4.90	1.090	7.30	.....	.....
Total	1.127	14.55	1.552	16.40	1.402	11.40	2.21	11.2	.....	.....	1.160	19.83	2.616	17.48	1.30	11.80
Grand total	7.756	100	9.483	100	12.30	100	19.60	100	7.159	100	10.75	100	14.915	100	11 00	100

Appended to Dr. Hutchinson's Table.

Therefore, for

1. b=1.14 c, r=1 5
2. b=1.36 c, r=1.
3. b=1,18 c, r=1.4
4. (a) and (b). b=1.18 c, r=1.4
   (c) and (d), b=1.38 c, r=1.
5. (a) and (b), b=1.38 c, r=1.
   (c) b=1.25 c r=1.25
6. (c) b=1.14 c, r=1.5
   (b) (c) (d) (f) and (e), b=1.25 c, r=1.25
7. b=1.38 c, r=1.

These are the figures used in computing cost per motor car mile in the case of the No. 2 railway. No other line used trailers.

World's Columbian Exposition.

A report of the World's Columbian Exposition committee was presented stating that all arrangements had been made for a most creditable exhibit of street railway supplies and equipment under the auspices of the association, and urging upon those who had not already made arrangemeots for an exhibit, and desire to do so, to make application for space. The report was accepted.

Mr. Crosby then read his report, an abstract of which follows:

Standards for Electric Street Railways.

By O. T. Crosby and H. L. Bettis.

At the date of the preparation of this report H. L. Bettis had made no special report on the subject of accounting and, perhaps, indeed, little remains to be said save to insist upon the importance of preserving the three separate headings, namely, transportation, maintenance, and construction, while at the same time referring to the particular forms which were largely prepared by Mr. Bettis, and which appeared in the paper read by the undersigned last October, the discussion of which resulted in the appointment of your committee.

While awaiting any further special treatment of the subject from Mr. Bettis, I beg also to call special attention to the recommendation that a car mile be adopted as the unit of operation in regard to the item of motive power. The introduction of the double truck cars into street railway service makes this unit, however, somewhat inaccurate unless the distinction between the various kinds of cars be carried along with the use of this term. We have thought that the distinction should rest rather as between double truck cars and single truck cars than between cars of different specified lengths. Furthermore, and especially relating to the question of motive power, we recommend that it will be reasonably safe to class two standard 16 foot cars with double truck cars, experience having shown that the consumption of power in the two cases is nearly equal under given conditions as to track, grade, etc.

One of the chief difficulties heretofore standing in the way of determining accurately the cost of one mile of service has been the inaccuracy in the determination of the amount of power consumed for such unit service. The perfection of recording wattmeters that has taken place during the past year will go far toward remedying this difficulty. This, like any other mechanical assistance, will, however, be of no avail if the books be not kept accurately with respect to all expenditures going to motive power. For such accuracy there must be paid a reasonable sum for clerical labor. The object of the blanks above referred to is to reduce that labor to a minimum for a given degree of accuracy. It will, of course, be possible to arrive at satisfactory results by means somewhat differing in detail, but it is strongly urged that the general lines indicated in the recommendation of this committee be followed so closely that it will at least be possible to feel sure in discussing reports of operating expenses from any two roads, that the same items of cost have gone into the headings of transportation, maintenance and construction. We do not feel it necessary to enlarge upon the importance of careful bookkeeping looking to the determination of these three headings. We assume that all intelligent railway men appreciate the importance of knowing what they are doing.

In regard to standardizing of specific dimensions, I take pleasure in inserting herewith the report of C. N. Wason, sub-committee on this subject.

"In order to better determine the sizes of the several parts given me, as a member of the standardizing committee, I sent out circular letters to two hundred of the leading electric railway companies requesting them to give their opinion as to the sizes of the several dimensions.

"I would state right here that from the small number returned, namely, about thirty out of two hundred, that the street railroad companies do not realize the benefit to be derived from such a movement, else they would take the trouble of answering such questions of general information, thus enabling the committee to much better arrive at a satisfactory conclusion. I know myself as an officer of a street railroad company, my first inclination upon opening a letter containing questions is to throw it into the waste basket, but upon a second consideration, I conclude it best to send what little information I may be able to give to the party making the inquiry, thinking possibly that the general result therefrom obtained will be of benefit to the whole street railway fraternity

"One of the objects, as I understand it, of the street railway convention is to enable the street railway men from different parts of the country to get together and exchange their views relative to various matters, with the idea of the mutual benefit to be derived from the discussion, and which would be impossible for the individuals to obtain did they not come together in this manner. Members of a committee like the standardizing committee have much work attending the bringing together of the matter desired, and it surely seems to me that each individual company should do all in its power to assist the committee by answering to the best of its ability any inquiries put to it by the members of such a committee through the mail.

"In order to obtain the dimension of the car journals, such as the committee may think best to recommend, I corresponded with the several truck manufacturers, who kindly gave me blue prints and drawings of their journal boxes. If the electrical manufacturers continue to increase the weight of their motors, these dimensions should

so, but the interests concerned are too great to be trifled with in so dogmatic a manner. We recognize that the greatest value will be obtained from this report by members taking it home with them and studying the figures analytically. Another year may develop such improvements in methods of accounting that definite conclusions can be formed; but to do more than merely produce figures from typical roads the committee is not prepared at this early stage of electric railroad practice. The cable roads have their methods pretty well digested, and their figures are, as a rule, reliable. The electric roads are as yet, with few exceptions published in this paper, in the dark as to what they are doing—except that they have enough left to satisfy stockholders; in fact 89 per cent. of the electric roads heard from report dividends of from 5 to 12 per cent.

We believe that cable road practice has reached the stage where but little room is left for improvement. They have been developed, improved and operated by the best engineering skill which the country affords. Nearly all are on a good dividend-paying basis; but whatever the past experience of the two systems has been, or whatever the present status of the two may be, we are only voicing the convictions of well-informed engineers when we say that electric systems will continue to increase in efficiency (by which is meant earning capacity) until all

be increased. The data I here present have been gathered from railroads using possibly a lighter equipment than that which is now being put upon the market. It is absolutely impossible to standardize an appropriate size, considering the change of weight, but the following seems to be the best in the opinion of those from whom I had answers to my inquiries:

Diameter of axle, 3½ inches.
Diameter of car axle journal, 3 inches.
Diameter of axle wheel seat, 3⅝ inches.
Length of car axle journal, 8½ inches.
Diameter of car wheel, 33 inches.
Weight of car wheel, 350 pounds
Diameter of trolley wheel, 4½ inches.
Width of trolley wheel 1½ inches.
Depth of groove in trolley wheel when new, 1½ inches.
Size of key way for axle gear, ¾ inch by 6 inches.
Distance between hubs of wheels measured along the axle, 48 inches.

"It is essential that the groove and depth of the trolley wheel be the same if the cars run over the same style of switches, as it is almost impossible to put up an overhead construction that will carry all sorts of trolley wheels. This remark may at first look a little absurd, but when one has had much experience with several different sized trolley wheels he will at once appreciate the necessity of all being alike."

The dimensions above recommended as standard have been approved by the other members of the committee to whom they have been submitted, except that Mr. Rugg prefers a 30 inch wheel instead of a 33 inch to be considered as standard. It will be seen in studying the articles above referred to that those have been chosen which, if of varying dimensions, interfere most with the interchangeability of parts in an electric railway equipment. The object held in view was so to standardize dimensions as to produce as little inconvenience as possible when apparatus such as trucks, trolleys, motors, etc., are obtained for use on the same railway from different manufacturers.

The first condition, which, in my opinion, should be connected by implication with any motor rating whatever is this: that the machine in question shall be able to perform its rated work indefinitely and under any condition of atmospheric temperature. There is, of course, room for honest differences of opinion in regard to this point. It is well known that the maximum demands for power in street railway service are not those which last for a considerable length of time. A certain manufacturer may thus argue to himself: "This machine which I am about to advertise is able to do twenty horse power of work for half an hour, when the atmospheric temperature is ninety degrees. In my opinion this rate and time and temperature will not be exceeded in the conditions of regular service. Why, then, may I not call this a twenty horse power motor? It is true, if I were building it for stationary work, in which generally the load to be carried is much more constant, I should adopt a different rating."

It would be possible to express this condition thus: that whatever the rate, it shall be possible to maintain that rate indefinitely under all conditions of atmospheric temperature by stating that the windings of the armature shall never show more than a given excess of heat over atmospheric temperature.

There is again room for honest differences of opinion in regard to the efficiency with which a motor can do its rated work. Suppose the manufacturer has produced a machine which can do its maximum work for an indefinite time without undue rise of temperature. There is to day no custom of the trade distinctly understood which would prevent him from rating the machine by this maximum capacity. And, again, in stating that the machine is of fifteen horse power capacity, even if there be agreement concerning efficiency and durability, there might be disagreement of much importance in regard to the speed at which work can be performed by the motor. If it has been so constructed that it can do fifteen horse power of work only at some armature speed corresponding to a linear speed of the car, either much above or much below the average speed of the car, then the information and motor may both be of little value for street railway service. Indeed, the use of the term "horse power" then has necessarily this uncertainty in it: the total number of foot pounds per minute, namely, 33,000, may be made up in an indefinite number of ways by an infinite number of combinations of feet of travel and pounds of pull, but for hour service we should have some known relation between these two.

It seems to me that that which the purchaser has in mind to obtain is such horizontal effort exerted at such a speed and at such an efficiency as will do the work in view. Now, the work in view varies very widely, and we cannot, therefore, obtain a convenient rating which will express this relation throughout the range of the total capacity of the motor. We may, however, select some particular condition, say that approaching as nearly as possible to the average, and tell, by a method of rating which I will propose, what the machine can do for such condition.

Let us first consider the speed at which it is desirable to know the capacity of the motor. I think ten miles per hour is not far from the speed at which cars will be found most frequently running. If, then, we state concerning a motor that it can develop so much horizontal effort at that speed, we at once have a pretty close approximation as to what load of a car and passengers it can handle at that speed, since we know that twenty-five pounds per ton is a fair approximation to the average traction co-efficient. Suppose, then, we are told that a motor can produce a horizontal effort of 500 pounds at ten miles an hour; it is, then, a quick inference that a car weighing twenty tons can be carried by such a motor at the rate of ten miles per hour on a level. We may then conscientiously call this motor a "50x10."

It may, of course, at once be objected that such a method does not distinguish between efficiency of motor proper and the efficiency of its gearing. For a great many reasons this is not very objectionable. We buy the motor with its gearing, and I can see no particular reason why the manufacturer should not get the benefit or the blame of the good or bad gearing which he may use with his efficient or inefficient motor. Furthermore, in the single reduction motors now so widely used for ordinary street railway work, the loss by gearing transmission is very small, and probably not widely variant as between the different manufacturers, and again, in whatever high speed work which it may be feasible to do by gearless motors, the question of the efficiency or inefficiency of the gear is eliminated.

Again, it may be objected that such a method supposes uniform diameter of wheel which must be known to the manufacturer in order that he may calculate what his motor is doing for a given car speed. Should there be no considerable variation from the thirty-inch wheel now so largely used, such a diameter might be taken for granted as having entered the calculation, and if a different wheel, say thirty-three inch, becomes general, then that diameter may be assumed in the rating.

It would, of course, in any such rating be assumed that the machine is working under a pressure of 450 volts, which is not far from that found on most of the lines throughout this country. In the necessary regulation to which these motors are subjected, a part of this pressure is practically applied to some resistance, external or internal, with respect to the motor, but I can see no convenient way of taking this into account in determining upon a rating. Indeed, the action of a series motor in street railway service is very complex, and it is much more difficult than sometimes supposed to determine upon a rating which shall give the greatest amount of available information. The very difficulty, however, is warrant for approaching the subject seriously and industriously.

In spite of the fact that many objections may be urged against any suggested method of rating, that which is preferred by your committee and by many persons consulted in regard to the question is this, that a motor shall be known as to its capacity by the horizontal effort which it can apply to a car at a speed of ten miles per hour, the standard 33-inch wheels above recommended being used on the car, and whatever gearing may be preferred by the manufacturer. It is plain that the horizontal effort that may thus be produced from a given motor whose armature is running at a given speed, may be made to vary by this change of gearing, but for the reasons above stated it has been thought best to consider the motor and its gearing as one piece of mechanism. While this recommendation would at first involve the use of two terms in the name of a motor, namely, horizontal effort and speed, the term for speed would soon disappear after it has become generally understood to be ten miles per hour. Thus for the present calling a given motor 600x10, this meaning that at a speed of 10 miles per hour the motor in question will develop a horizontal effort of 600 pounds. Later, however, the same machine would be satisfactorily designated as a 600 pound motor, the standard speed being taken for granted. At the same time, as street railway men begin to go into suburban enterprises, in which higher speeds than those now familiar must be attempted, it will be easy to revive the expression for the speed at which a motor is rated, and we may thus expect to see motors described as 600x20, 600x30, etc. This high speed extension of electrical motor work, and especially its extension in the same hands as those now directing ordinary street traffic, makes it especially important that some rating should be adopted which will take speed into account, as otherwise confusion will inevitably result. It goes without saying that much remains to be told concerning a motor after its horizontal effort at a given speed shall be expressed, and a part of the recommendation of your committee is that an implied part of the rating of a motor lies in this, that it shall be able to perform its rated work continuously without a rise of temperatures exceeding 75 degrees C. over the atmospheric temperature.

In regard to the efficiency, desirable as it is to be informed on that point, it seems too difficult to be involved in any rating which shall be frequently and properly used.

Another method of rating motors which is presented as the second choice of your committee is as follows: That two terms should be used, one giving the horse power of the motor at which it can work continuously at a safe temperature, the other its maximum horse power. As has been explained, it is a feature of all electric motors that their maximum rate of work is done at a 50 per cent. efficiency. Nothing is more essential to be established, therefore, than the maximum work the motor will do. Following this method, which was suggested by Chas. A. Lieb, a given motor might be known as 15x33 or as 20x40, etc. Concerning the first machine named, it would be understood that it could do 15 horse power of work all day long without undue heating, but under stress it could perform work at the rate of 35 horse power, the efficiency being at once known to be down to 50 per cent. It would also be understood, and go almost without saying, that the motor would be unable to do 35 horse power of work continuously; indeed it would be expected to perform such a rate of work safely for only a very short time, say from two to five minutes.

Uninviting as is the discussion of such a subject in a large assembly like this, your committee urges that serious consideration be given to this matter, and that one or the other of the methods here recommended be adopted.

In conclusion, while urging that all definite action possible shall be taken on the recommendations now made, we further urge most strongly that steps be taken to carry on permanently the work of standardizing, especially the work of standardizing the nomenclature and dimensions, since in regard to these there can never be any cessation of demand. To further this object we recommend that this association employ a salaried official to be known as the statistical secretary or clerk; that such employe shall give his whole time to obtaining data bearing on the work of the association, direction to be given him in obtaining and collecting such data by the permanent executive officers of the association at their discretion, and especially by the standardizing committee, which we further recommend shall be made one of the permanent committees of this association. It is exceedingly difficult, as all who hear this will know, for men engaged laboriously in their private affairs to give to such work as that in question the detailed attention it deserves. If, however, some competent person were at hand who could be asked to obtain the necessary information, then such men as would properly be chosen as officers of this association, or as members of important committees, would certainly be able to digest the information and present it in useful form to the association.

Another important work which could be assisted by such an official and by such a permanent committee is that which has been much before us; namely, the furthering of the actual use of whatever standards this association may adopt. Little has been gained in what we believe all recognize as a useful work, if we stop at a formal adoption of names and dimensions. A constant and well directed presentation of the association standards by some proper official will do much to increase the value of whatever action you may take. Some presentation should be made not only to members of the association, but also to manufacturers interested in the standards that may be adopted. As a preliminary step to the extension of this work, we recommend that copies of this report and of your action upon it be sent broadly to manufacturers, contractors and dealers in electrical railway supplies. We further suggest that in so far as you may adopt any of the standards herein recommended, that you should urge manufacturers and dealers to make their catalogues conform with your recommendations in the details touched upon; and we further urge that the association shall urge its members to keep before them the standards that may be thus adopted, and that they shall insist upon the obtainment of the use of these standards by the manufacturers and dealers in so far as possible.

As stated in the minutes of the first meeting of this committee, we consider that the work has been only begun by the presentation of this report. To be of value, it must be continuous. This report will be insufficient and faulty in many particulars, yet we feel that we have given perhaps as large a share of time and attention to this matter as it would have received at the hands of any other four or five men that you might have chosen. The cure for the insufficient report is, we feel, perhaps to be had in the appointment of some official as above suggested, more than by any other means.

Mr. Holmes of New York presented the following resolution, which was adopted:

Resolved, That it is the sense of this convention that the standard rating of railway motors shall be the horizontal pull which the motor can exert when running the car at ten miles per hour with thirty-three inch wheels, and that when so running the temperature of the motor shall not be raised more than sixty-five degrees centigrade above surrounding atmosphere after a ten-hour run.

The executive committee was empowered to appoint an other committee on standards.

The committee on nominations then reported the following names of gentlemen nominated for the officers of the association for the ensuing year:

President—D. F. Longstreet, Denver, Colo.
First vice-president—A. Everett, Cleveland, O.
Second vice-president—Joel Hurt, Atlanta, Ga.
Third vice-president—W. Worth Bean, St. Joseph, Mich.
Secretary and treasurer—W. J. Richardson, Brooklyn, N. Y.

Executive committee—John G. Holmes, Pittsburg, Pa.; J. D. Crimmins, New York city; T. J. Minary, Louisville, Ky.; J. R. Chapman, Grand Rapids, Mich.; B. E. Charlton, Hamilton, Ont.

The secretary reported that the executive committee had considered the matter of the formation of a Supply Dealers' association in connection with the American Street Railway association and that in the judgment of the committee it could see no necessity for the formation of such an association at this time.

A communication was presented from the Massachusetts Street Railway association relative to the subject of the provision of proper interacting signals at crossings of steam and electric railroads. It urged that the association send a circular to every street railway company in America and to the State Boards of Railroad Commissioners, recommending the passage by each state legislature of regulations upon this subject to secure the greatest possible safety to passengers in electric cars at steam railroad crossings. The matter was referred to the executive committee.

Friday's Meeting.

On motion of Mr. McLean the paper on "Experiments on the Expansion of Continuous Rails" was read by its title only. An extract from this paper is presented herewith:

Experiments on the Expansion of Continuous Rails.

BY A. J. MOXHAM.

In the matter of track construction to-day, the question of paramount importance is that of the joint. For many years the question has been the rail. As this has received time and attention, one weak spot after another has been eliminated, and so great has been the pruning process that the one weak spot left, "the joint," is only the more glaring from the absence of many of its brothers in misfortune.

Known to be the weakest point in the structure, the question of the joint has had its full share of attention. It is not perhaps generally known, but is nevertheless a fact, that the joint of the formerly despised street railway has already distanced its heretofore leader, the steam railroad; certainly in its practical application, if not in its scientific development.

The joint of the steam road can be controlled—it is exposed and therefore accessible; that of the street road cannot—it is practically inaccessible. It has been proposed to overcome this by making it accessible by means

of boxes with removable covers. Apart from the objection that this adds to the amount of street taken up by the track, the cost, if properly done, is almost prohibitive. I have been informed by the manager of one of our largest and most progressive street railway systems that, after a careful trial, it was found to be cheaper to take up the paving and tighten the joints once every few months that to pay the interest on the investment of the boxes.

The question of a good joint is embodied in very few words, to-wit: "absence of motion;" and it must be absence of motion of the cars as well as of the rails, particularly in the case of electric roads. If two rails be placed in perfect surface and alignment and closely butted, and so held, the problem is solved. Not only must they be true to surface and line, but they must be abutted. It will not do to leave the usual expansion space. This can be quickly demonstrated by cutting a groove one-quarter of an inch wide in the head of the middle portion of a rail. The surface and alignment are here true, but not abutted. A slight jar can be felt from the first; in a short time it becomes worse, and after continued use, bad and rapid wear, accompanied by a low spot, results. In this case there is no motion of the rails; the evil is resultant from the motion of the cars. This, however, goes without saying, as of course the cars are the destructive agency, and it is only emphasized because it is a very prevalent opinion that if the rails as laid to-day could only be held rigidly level, the problem would be solved.

The joint of to-day is structurally stiff, heavy enough to take up the jar of the blow without transmitting it all to the nuts, a yielding fit that tends to counteract all motion, and large bolts, carefully located with a view to vibration. In itself good, and, as it now stands, to a certain extent capable of economical use, and far ahead of its brother on the steam road, even of the heaviest construction. But even so it will not do. If not, query, "What then?" There is but one answer. No joint at all. While apparently a bold suggestion, it is at least worthy of thought and discussion. That the rail can be made continuous by mechanical means we know, but what of expansion and contraction? We will do without it; and that we can do so, the sequel I think will show.

To the credit of Mr. Philip Noonan, I think, belongs the first practical idea of a continuous rail. His theory, in a nutshell, may be described as gripping the rail at one end and permitting the wave motion or flow induced by passing trains to be, so to speak, rolled out before the train wheels, into a tension device that within certain limits holds what it gets. He provides against danger of rupture by a spring device which limits the strain. He put his ideas to a test; built a considerable stretch of track (some three miles) on the Lynchburg & Durham railroad, at or near Gladys station, Va., and it to-day is in successful use. Expert investigation and report indorses it in all essential particulars, though it is perhaps questionable whether the fastenings he used to make his rail continuous are strong and rigid enough to prohibit all yield. For details those who care to investigate may be referred to a pamphlet on the subject, that can be obtained by addressing the inventor at the above named place.

At a glance, the problem of a street railway differs from the steam road in that the former is surrounded by the roadbed, while the latter is, at least to a great extent, exposed. The effect of the surrounding roadbed is two-fold.

First—By its great surface friction, it tends to hold the rail against change, stops all wave motion, and

Second—It to some extent modifies the temperature.

The problem was to find a measure of value for both.

To this end the following experiment was made.

One rail in a section of track was so connected that it was in reality a continuous rail. One side of the track was taken instead of both, because it was thought the parellelism of the adjacent rail would at once indicate changes that were expected to occur, which perhaps other measurements might fail to disclose. The length was 1,160 feet, and the profile one that embodied level track, up grade and down grade. As the track was laid and in use, it was determined that it was best to make the rail continous by a joint rigid and stronger than the rail, so as not to have to remove the whole roadbed. This because the roadbed, which was macadam, had become solidly packed, and represented normal conditions hard to obtain if once disturbed. Remember that when the experiment was made it was thought questionable whether the rail, when prevented from expansion and contraction, could be at all restrained by the roadbed; hence all the restraining power offered was be to retained. At the end of each separate rail the usual one-fourth of an inch had been left for expansion. This was filled by a carefully measured dog, made of the same section as the rail, cut to fill the space tightly, and then driven into place.

Now for the joints: These were to be stronger than the rail itself, and for connection body-bound, machine-turned bolts were decided upon. The two side bars were of steel, 4x1¼ inches thick, and 5 feet 4½ inches long. The body-bound bolts were 18 in number, and 1¼ inches in diameter.

As is well known, one of the most difficult things in metal working is to secure a real fit between two surfaces. The usual work of a machine tool—be it lathe, planer or what not—is very far from accurate, as the introduction of templet work into a shop soon shows. Out of an ordinary selection of average machinists, it is rare to find one in ten capable of making a real fit, sometimes less To insure an absolute fit was deemed a necessity. It was done as follows: A number of jigs were made having a hardened steel guide for the drill. With this the bars were drilled in pairs, and as drilled each bar carefully tested by the standard. The holes were drilled $\frac{1}{32}$ of an inch smaller in diameter than ultimately needed. The roadbed surrounding a joint being removed, one bar was clamped to the rail, and the holes (also $\frac{1}{32}$ of an inch small) were drilled through the web, using the bar as a guide. After the temperature of the parts was equalized, the adjoining bar was then adjusted and a rose-bit reamer carefully worked through the three holes. As quickly as one hole was completed the gauge was taken, and one of a series of machine bolts (previously turned to a standard slightly large) was accurately turned for this special hole; and so to completion. The accuracy of the work may be shown by the fact that after reaming if anything interfered with the equalized temperature (as for instance one bar being removed and laid in the shade) during the work, the bolts could not be put home. Each bolt was a driving fit. It took twenty-four hours to properly adjust each joint. The track was thus made continuous.

At five points along the line heavy stakes were firmly fixed in the ground, one on each side of the road, in the top of which were set small wire nails. A thin but strong cord was tightly stretched from stake to stake, the tops of which were several inches above the top of the rail. Directly underneath this line a mark was made on the head of the rail with a cold chisel. Measurements were taken from the stake to the chisel mark, and from the top of the rail to the tightly stretched cord. Observations were taken at these five points, in the manner indicated, throughout the whole summer.

The work was started on the 19th of March, and finished on the 25th of April, 1892. The average temperature during the work was 43.04 degrees, the maximum 81 degrees, and the minimum 10 degrees.

The section of rail used in the track is of the girder type, 6 inches deep, weighing 78 lbs. to the yard. The rail is fastened to the ties by means of tie-plates, and the gauge is preserved by tie rods spaced 10 feet apart. The ties are spaced 11 to 30 feet apart, and the roadway is excellent macadam.

Anticipating the unknown, provision was made for a possible sudden stoppage of the line, by means of portable connecting tracks kept in readiness. In order to further explain whatever might occur, careful preparations were made to read the temperature of the rail at different parts above and below ground during the experiment. As the rail was in use, this was done by a special rail in the adjoining roadbed, and in order that the scope of investigation should be fully complete, the temperature was continuously taken at the head of the rail, at the lower flange of a six-inch rail, of a seven-inch rail and of a ten-inch rail, or its practical equivalent, a ten inch I-beam. Simultaneously readings of temperature were taken as follows:

Air in the shade.
" " sun.
Roadbed at a depth of seven inches.
" " " ten "

The experiments prove to the practical railroad man that for all ordinary purposes, the rail may be assumed to be subject to nearly full air temperature, and that the roadbed will not suffice, as has been believed, to keep the rail temperature virtually regular. Steel is a far better heat conductor than earth, and the whole rail (flange as well as head) closely follows the air temperatures. Readings taken over a long period, night as well as day, every fifteen minutes give the whole kaleidoscope of changing temperature for the close student. With this fact before us one element of doubt has been removed, but it also proves that the heating of the sun in the day, and the cooling of its absence at night, leaves the expansion and contraction most certainly there.

Now for its effects. The experiment has proved absolutely and beyond cavil, that it is restrained and held by the surface friction of the surrounding roadbed. From first to last, from a temperature of 22 degrees below freezing point (or 10 degrees), to a temperature of 89 degrees above freezing point (or 121 degrees), extending from March to August, there was absolutely no movement of the track out of place. Even at the ends was this true; proving that not only will the roadbed hold the track as a complete structure, but that it will do it consecutively. Once bedded, it will hold a rail 10 to 30 feet, as well as one 1,100 feet. On this point there is no room for error. The expansion in 1,100 feet, if not neutralized, would equal 5¼ inches, under the conditions here stated, and 5¼ ioches would throw the rail out of line 14 feet, if it were held at the ends and permitted to bow in the center. An expansion of one rail would mean about 6 inches in 30 feet out of line. The query arises, "What has become of it?" It is existent, and, like all force, it would flow to the point of least resistance. In the case of street rail, buried in roadbed, it is reasonable to believe this point is in a minute enlargement and reduction of the sectional area of the rail.

As to its effect upon the steel: Experts teach us that a variation of 7 degrees in temperature, if held, would subject the rail to a stress of 1,000 pounds per square inch. Taking a track laid at the low temperature of 40 degrees and subject to a maximum of 120 degrees, or a variation of 80 degrees, the stress is equal to less than 12,000 pounds per square inch. Much less than the elastic limit, and less than the strain put upon an ordinary bridge, or similar structure. It would therefore appear that the effect on the steel would be harmless.

On the face of it, therefore, there is nothing to prevent us abutting our rails, and this is but the prelude to an absolutely continuous track—one without joints—the rails welded by electricity, or otherwise connected one to the other, up to such lengths as may be deemed best.

As to its practical application, many precautions suggest themselves. It must be remembered that a track so laid will be like a huge spring under tension, absolutely safe and harmless when restrained by the roadbed, but ready to spring like a shot from a cannon if, while in this condition, the roadbed be removed. The part of common sense would appear to be to limit the length of a continuous rail to, say, five hundred or a thousand feet, with specially devised expansion joints at these intervals; or if desirable to take up the paving for repairs on a very short piece, the following would be effective: First remove only a foot of paving, then with a hack saw cut out, say, six inches of rail, thus removing the tension or compression, as may be. This done, the rest of the roadbed could be removed, starting from the cut part of the track, without danger. Be this as it may, it should be borne in mind that chained lightoing is not a nice plaything, and therefore a lightning conductor is sometimes handy.

One important saving that would be effected by a "track without joints" would be in the weight of the rail. A rail of 100 pounds per yard is to-day in use, and next year will be extensively used, perhaps without their knowledge, the cause of this has been the street railroad men's dearly bought and sad experience with joints. The joint being defective, the effort has been made to secure such stability of track as to relieve the joints by means of a heavy rail. In a 100 pound rail there are but 30 pounds of wearing surface, of which not more than 18 pounds can be used before the rail will have to be thrown out; therefore there will be 82 pounds unused. For mere stiffness and rigidity, a 66 pound rail, if supported by the proper number of cross-ties, will answer every engineering demand, even of electric cars at high speed. Anything over this goes to the debit of "bad joints."

Mr. Cronyn of London, Canada, offered the following:

Resolved, That the American Street Railway association sends greeting to the tramway managers and officers of European and foreign countries, and most cordially invites them to attend the 12th annual meeting of this association to be held in Milwaukee, Wis., U. S. A., in 1893, during the World's Columbian Exposition.

Resolved, That the secretary take such measures as in his judgment may seem necessary to carry out the above.

The resolution was adopted.

The secretary was authorized to express to the Short Electric Railway company the appreciation of the association of the courtesies shown by that company to the delegates in attendance at the meeting.

A vote of thanks was tendered the different traffic associations for their courtesy in granting reduced rates to gentlemen in attendance at the meeting.

Messrs. Watson of Buffalo, and Martin of Cincinnati, were appointed a committee to escort the newly-elected president to the chair. Mr. Longstreet fittingly acknowledged the compliment paid him in his election and expressed the hope that he would meet all at the convention to be held in Milwaukee next year.

The association then adjourned to meet in Milwaukee, Wis., the third Wednesday in October, 1893.

Delegates and Visitors.

Following is a complete list of delegates and visitors:

Ackerman, P. C., American Electrical Works.....Providence, R. I.
Adams, W. L., Railway Equipment company.....Chicago, Ill.
Aldrich, H. L., *Electrical Industries*.....Chicago, Ill.
Anderson, A. A., Citizens' Street Railway company, ...Indianapolis, Ind.
Andrews, Payson K., J. G. Brill company..Chicago, Ill.
Angier, G. M., Mather Electric company.. Boston, Mass.
Atkinson, E. P., Charles A. Schieren & Co.....New York, N. Y.

Babcock, E. L., Falls Rivet & Machine company.....Cuyahoga Falls, O.
Baker, Clifford C., Topeka Railway company..... Topeka, Kan.
Bailey, Theo. P., General Electric company.. ..... Chicago, Ill.
Baird, M. E., Eddy Electric Motor & Manufacturing company.....Windsor, Conn.
Bancroft, George W., Jewell Belting company.....Boston, Mass.
Bannister, L. M., Westinghouse Electric & Manufacturing company..... Pittsburg, Pa.
Barclay, J. L..... Chicago, Ill.
Barnard, George A., Buckeye Engine company, Salem, O.
Barr, Harry P., Sperry Electric Railway company.. ..... New York, N. Y.
Baumhoff, George W., Lindell Railway company.... .....St. Louis, Mo.
Bean, W. Worth, St. Joseph & Benton Harbor Electric Railway company.....St. Joseph, Mich.
Beckley, John N., Rochester Railway company.....Rochester, N. Y.
Belden, D. A., Aurora Street Railway company..... Aurora, Ill.
Benedict, Washington G., Boston & Revere Electric Railway company..... .....Boston, Mass.
Benton, C. A., Sprague Electric Elevator company. ..... New York, N. Y.
Bidwell, C. S., Ashtabula Rapid Transit company.. ..... Ashtabula, O.
Billings, Frederick C., Billings & Spencer company, ... Hartford, Conn.
Bole, George M., Westinghouse, Church, Kerr & Co. ..... Pittsburg, Pa.
Bone, W. H., Walker Manufacturing company..... Cleveland, O.
Bostwick, F. H., General Electric company..... .....Pittsburg, Pa.
Boughton, W. E., Johnson company ...Philadelphia, Pa.
Bowman, W. P., J. A. Roebling's Sons company..... .....Trenton, N. J.
Bradford, H. P., City Electric Street Railway company ..... Little Rock, Ark.
Bragg, C. A., Westinghouse Electric & Manufacturing company ..... Philadelphia, Pa.
Break, Samuel R., Toronto Railway company..... Toronto, Ont.
Brill, G. M., J. G. Brill company.....Philadelphia, Pa.
Broadhead, A. N., Jamestown Street Railway company.....Jamestown, N. Y.
Brown, F. Wayland, Youngstown Street Railway company..... Youngstown, O.
Bruce, H. P., General Electric company..Boston, Mass.
Butler, A. E., Merrimac Valley Street Railway company.....Lawrence, Mass.

Candee, W. L., Okonite company.....New York City.
Caldwell, Edward, *Electrical World* .... New York City.
Carey, P. H., Nuttall Railway Supply company....
.....Chicago, Ill.
Chamberlin, James, Ford-Washburn Storelectro company.....Cleveland, O,
Chapman, James R., Consolidated Street Railway company.....Grand Rapids, Mich.
Cicott, Frank X., *Railway World*..... London, Eng.
Clarke, W. J., General Electric company .. ....
.....New York City.
Clarke, F. H., General Electric company.....
.....Washington, D. C.
Clarke, James M., Windsor, Sandwich & Amherstburg Railway company.....Windsor, Can.
Cochran, Henry, Lomakin Works.....Chester, Pa.
Coffman, J. R., Eureka Tempered Copper company,
.....Detroit, Mich.
Coles, Steven L., *Electrical Review* ...New York, N. Y.
Coleman, Jilson J., Johnson Electric company .....
.....Cleveland, O.
Collins, L. W., *Electrical Engineer*.....New York City.
Colvin, F. R., *Electrical Engineer*.....New York City.
Coolidge, Daniel, Johnson company.... Johnstown, Pa.
Coolbaugh, F. W., Coolbaugh & Pomeroy.....
.....New York, N. Y.
Condict, G. Herbert .....Philadelphia, Pa.
Corey, R. B, Electric Construction & Supply company.....New York City.
Crane, W. F. D., H. W. Johns Manufacturing company.....New York City.
Crider, J. S., Washington Carbon company.....
.....Pittsburgh, Pa.
Crossman, T. E.....Brooklyn, N. Y.
Crouse, J. B, Standard Carbon company..Cleveland, O.
Crowley, H. J., General Electric company.....
.....Atlanta, Ga.
Cummins, M., Central Railway company....Peoria, Ill.
Curtiss, C. C., Short Electric Railway company....
.....New York City.

Dalany, W. H., Royaline Manufacturing company,
.....New York, N. Y.
Davies, H. J., Brooklyn Street Railway company..
.....Cleveland, O.
Dean, D. B., McGuire Manufacturing company....
.....Chicago, Ill.
Deoman, C. A., Consolidated Street Railway company.....Toledo, O.
Derr, C. A., Rochester Electric Railway company.
.....Charlotte, N. Y.
Dewar, D. C., Ottawa Electric Street Railway company.....Ottawa, Ont.
Dewey, Mark W., Dewey Electric Heating company,
.....Syracuse, N. Y.
Dickerson, J. W., *Street Railway Journal*.. Chicago, Ill.
Dickinson, Wallace D., Great Falls Street Railway company..... .....Great Falls, Mont.
Dickerman, Alton L.....Seattle, Wash.
Dixon, A., City Electric Railway company.....
.....Port Huron, Mich.
Dodge, S. D., Mehling Car company.....Cleveland, O.
Dorner, H. A , Dorner & Dutton. .. ... Cleveland, O.
Dutton, W. A., Dorner & Dutton.... .... Cleveland, O.
Dutton, A. W., Short Electric Railway company,
..... St. Louis, Mo.

Ellis, George, Ellis Car company.....Amesbury, Mass.
Elwell, John B., Duplex Street Railway Track company.....New York, N. Y.
England, A. H., International Register company,
.....Chicago, Ill.
Eoo, W. G., Wilkesbarre & Wyoming Valley Traction company..... Wilkesbarre, Pa.
Eppley, F. M , Orange, Crosstown & Bloomfield Street Railway company ..... Orange, N. J.
Esmond, E. R., Esmond Steel Rail company .....
.....New York, N. Y.
Evans, H. C , Johnson company.....New York, N. Y.
Everett, A., East Cleveland Railroad company.....
.....Cleveland, O.
Everett, H. A., Toronto Railway company.... ...
.....Toronto, Can.
Everts, D. T., Simplex Electrical company.....
.....Boston, Mass.

Fairchild, C. B., *Street Railway Journal*.....
.....New York, N Y.
Ferguson, J. A., Shultz Belting company, St. Louis, Mo.
Field, Arthur W., Peckham Motor Truck & Wheel company.....New York, N. Y.
Field, C. J., Field Engineering company.....
.....New York, N. Y.
Foot, C. W., Nicholson Electric Hoist company,
.....Cleveland, O.
Ford, George A., Ford-Washburn Storelectro company.....Cleveland, O.
Ford, F. R., Short Electric Railway company
.....Chicago, Ill.
Frederick, C. R., Davenport & Rock Island Railway company.....Davenport, Iowa.
Freinyear, T. C., Cayadutta Electric Railway company.....Gloversville, N. Y.
French, Hollis, Massachusetts Electrical Engineering company.....Boston.
Fuchs, W. C., Cicero & Proviso Street Railway company.....Chicago, Ill.

Gates, J. Holt, Siemens & Halske Electric company of America.....Chicago, Ill.
Gates, C. A., Massillon Electric Railway company
.....Massillon, O.
Geriken, H. J., A. French Spring company. New York, N. Y.
Gheghan, John J., J. H. Bonnell & Co...New York, N. Y.
Godfrey, J. W., New York Insulated Wire company
.....New York.
Gordon, W. H., W. H. Gordon company..New York N. Y.
Graham, John, Wilkesbarre & Wyoming Valley Traction company.....Wilkesbarre, Pa.
Graham, G. H.....Chicago, Ill.
Graves, W. D , W. D. Graves Electrical & Manufacturing company.....Cleveland, O.
Green, Alfred, Rochester Railway company.
.....Rochester, N. Y.
Greene, B. E , *Electricity*.....New York, N. Y.
Groetzinger, W. C., A. Groetzinger & Sons
.....Allegheny City, Pa.
Groves, Samuel, Walker Manufacturing company
.....Cleveland, O.

Hall, John D., Fort Clark Street Railway company
.....Peoria, Ill.
Hall, J. H., Fort Clark Street Railway company
.....Peoria, Ill.
Hamilton, M. H., General Electric company
.....New York, N. Y.
Hamilton, Campbell T., General Electric company,
.....Pittsburg, Pa.
Hand, S. Ashton, Detroit Electrical Works,
.....Detroit, Mich.
Hanna, J. A., McGuire Manufacturing company,
.....Chicago, Ill.
Hanna, J. B., Woodland Avenue & West Side Street, Railway company.....Cleveland, O.
Harrison, H. H., General Electric company,
.....New York, N. Y.
Hart, Chas. E., Central Thomson-Houston company,
.....Cincinnati, O.
Hartman, H. C , Bradley Electric Conduit company,
.....Chicago, Ill.
Hassan, K. D , Short Electric Railway company,
.....Cleveland, O.
Hathaway, W. A , American Electrical Works,
.....Providence, R. I.
Hathaway, A. G..... .. Cleveland, O.
Hathway, Chas..... .....Cleveland, O.
Hawks, J. D., Citizens' Street Railway company,
.....Detroit, Mich.
Hay, Albert E., Robinson Machine company,
.....Altoona, Pa.
Haycox, C. E., Fulton Foundry company...Cleveland, O.
Hazelbrigg, S. F., Citizens' Street Railway company,
.....Indianapolis, Ind.
Hazeltoo, Wm., Short Electric Railway company,
.....Cleveland, O.
Heinrichs, Ernest H., Westinghouse Electric & Manufacturing company.....Pittsburgh, Pa.
Herenden, G. B., Brightman Stoker company,
.....Cleveland, O.
Heulings, Wm. H., jr., J. G. Brill company,
.....Philadelphia, Pa.
Hight, C. B., Baxter Electric Motor company,
.....Baltimore, Md.
Hills, C. I., Perkins Electric Lamp company,
.....Manchester, Conn.
Hoadley, Geo. M., Bemis Car Box company,
.....Springfield, Mass.
Hoover, P. H. Standard Paint company. New York, N. Y.
Hough A. H. Brush Electric company....Cleveland, O.
Huot, W. T., *Street Railway News*.... New York, N. Y.
Hutcheson, J. E., Ottawa Electric Street Railway company.....Ottawa, Ont.

Issertel, Henry G., Alexander, Barney & Chapin
.....New York.

Jewell, W. S., Citizens' Street Railway company
.....Indianapolis, Ind.
Johnson, Tom L., Brooklyn Street Railway company
.....Cleveland. O.
Johnson, Al., Brooklyn Street Railway company
.....Cleveland, O.
Johnston, W. J., *Electrical World*.....New York.

Keiting, G. H., H. M. Loud & Sons Lumber company.....AuSable, Mich.
Kenfield. H. J., *Street Railway Review*....Chicago, Ill.
Kerr, Walter, Westinghouse, Church, Kerr & Co.
.....Philadelphia, Pa
Keyes, O. J., Cleveland Electric Manufacturing company.....Cleveland, O.
Kilgour, John, Cincinnati Street Railway company
.....Cincinnati, O.
Kohler, G. A. E., Kohler Bros.....Chicago, Ill.

Lang, Albion E., Toledo Street Railway company
.....Toledo, O.
Langdon, C. J., Fulton Foundry company
.....Cleveland, O.
Laughlin, F. M., Solar Carbon company...Pittsburg, Pa.
Leach, T. F., Cushion Car Wheel company..Chicago, Ill.
Leonard, H. Ward, H. W. Leonard & Co. New York N. Y.
Leonard, S. S., Hill Clutch Works.....Cleveland, O.
Lesley, H., Electro Dynamic company..Philadelphia, Pa.
LeVake, L. B., Brush Electric company....Cleveland, O.
Lewis, Frank J., Johnson Electric company, Cleveland, O.
Lincoln, F. H., Consolidated Street Railway company.....Toledo, O.
Littell, H. M., Cincinnati Inclined Plane Railway company.....Cincinnati, O.
Littell, H. H.. Buffalo Railway company..Buffalo, N. Y.
Littlefield, A. S , O. W. Meyseoburg & Co..Chicago, Ill.
Lockwood, Joseph E., Detroit Electrical Works,
.....Detroit, Mich.
Longstreet, D. F.....Denver, Colo.
Louttit, W. S., Pullman Palace Car company,
.....Chicago, Ill.
Low, F. R., *Power*.....New York, N. Y.
Ludwig, J. L., Westinghouse Electric & Manufacturing company.....Pittsburg, Pa.
Luhn, Max, Helios Electric company..Cologne, Germany.
Lyon, A. W., Milwaukee Street Railway company
.....Milwaukee, Wis.

McCartney, J. F., Railway Equipment company,
.....Chicago, Ill.
Macquesten, W. J.....New York, N. Y.
Magee, Frank A., E. S. Greely & Co....New York, N. Y.
Mailloux, C. O .....New York, N. Y.
Maltby, Geo. E., Jamestown Street Railway company
.....Jamestown, N. Y.
Manning, A. P., Pittsburg Trolley company, Pittsburg, Pa.
Mark, C. E., Mark & Sterling,.. .....Cleveland, O.
Marker, W. C., Cleveland Electric Manufacturing company,... .....Cleveland, O.
Martin, T. C., *Electrical Engineer*, New York, N. Y.
Mason, J. H., Simplex Electrical company, Boston, Mass.
Mason, W. R., Railway Equipment company
.....Chicago, Ill.
Mayer, Chas. J., R D. Nuttall company, Pittsburg, Pa.
McCartney, Rutherford, Railway Equipment company.....Buffalo, N. Y.
McClary, J. B., Birmingham Railway & Electric company,.....Birmingham, Ala.
McClure, W. O., Short Electric Railway company,
.....Cleveland, O.
McCulloch, Robert, Citizens' Railway company
.....St. Louis, Mo.
McGraw, J H , *Street Railway Journal*.....New York.
McElroy, J. Y., Consolidated Car Heating company,
.....Albany, N. Y.
McKenzie, Wm., Toronto Railway company,
.....Toronto, Ont.
McGhie, J., General Electric company.....
McLane, Thomas H., Houston Street, West Street, & Pavonia Ferry Railway company....New York, N. Y.
McLaughlin, Wm., Paterson Central Electric Railway company..... Paterson, N. J.
McLaughlin, Charles, Paterson Central Electric Railway company.....Paterson, N. J.
McNamara, John W., Albany Railway company,
.....Albany, N. Y.
McQuaide, Jas. P., National Conduit Manufacturing company.... ..... New York.
McRae, J. W., Ottawa Electric Street Railway company..... ....Ottawa, Ont.
McTighe, T. J., Berry & McTighe.....New York.
Meacham, A. M., New Process Rawhide company,
.....Syracuse, N. Y.
Melms, G. J., Milwaukee Electric Railway company,
..... Milwaukee. Wis.
Milhaok, L. A., Holmes, Booth & Haydens...New York.
Minary, T. J., Louisville Street Railway company,
.....Louisville, Ky.
Morris, Elmer P., General Electric company,
..... .Boston, Mass.
Morse, Geo. C., Taunton Street Railroad company,
.....Taunton, Mass.
Morton, N. E., Merrimac Valley Street Railway company..... .....Lawrence, Mass.
Murcer, Robert J., New York Car Wheel Works,
.....Buffalo, N. Y
Myers, L. M , Detroit Electrical Works.....Chicago, Ill
Myers, Garson, Standard Railway Supply company
.....Chicago, Ill.

Neftel, Knight, Neftel & Marsh company,
.....New York, N. Y.
Newton, Chas. E., Jewell Belting company,
.....Hartford, Conn.
Nicholson, L. W., Short Electric Railway company,
.....Cleveland, O.
Nold, L. S., East Liverpool & Wellsville Street Railway company, ...E Liverpool.
Nuttall, R. D., R. D. Nuttall company,
.....Allegheny City, Pa.

Odell, Charles, Newburyport & Amesbury Railway company,.....Newburyport, Mass.
Ogden, D. H., WESTERN ELECTRICIAN.....Chicago, Ill.
O'Hara, J. B , WESTERN ELECTRICIAN.....Chicago, Ill.
Orr, A. M., Piqua Street Railway company.....Piqua, O.
Osgood, C. B.,..... ....Chicago, Ill.
Ostrom, J. F., Pennsylvania Steel company,
.....Philadelphia, Pa.
Oswald, E H., Benedict & Burnham Manufacturing company..... New York, N. Y.
Owen, B. F., Reading City Passenger Railway company,..... .....Reading, Pa.

Pardridge, Arthur S..... .....St. Louis Mo.
Parker, L. H., Trenton Passenger Railway company,
.....Trenton, N. J.
Parker, E., Rochester Car Wheel Works, New York, N. Y.
Patterson, N. H., Bloomington City Railway company,.....Bloomington, Ill.
Payne, H. C., Milwaukee Street Railway company
.....Milwaukee, Wis.
Peckham, E., Peckham Motor Truck & Wheel company,..... .....Kingston, N. Y.
Perrine, Lewis, Jr., Trenton Passenger Railway company..... Trenton, N. J.
Pfetch, J. F., Erie Electric Motor company, Erie, Pa.
Pfingst, L..... .Boston Mass.
Phipps, C W., Brush Electric company, Cleveland, O.
Possons, N. S., Eureka Tempered Copper company,
.....Northeast, Pa.
Potter, W. B., General Electric company, New York, N. Y.
Power, D. L., *Electrical Industries*..... .....Chicago, Ill.
Pratt, Mason B., Pennsylvania Steel company
..... Steelton, Pa.
Pratt, G. E., Lomakin Car Works..... Philadelphia, Pa.
Pugh, D. W., John Stephenson company, Ltd.,
.....New York, N. Y.

Rae, Frank B.....Detroit, Mich.
Randall, F. C., J. G. Brill company.....Philadelphia, Pa.
Randolph, R. J., Central Thomson-Houston company .....Cincinnati, O.
Register, A. L., Pepper & Register....Philadelphia, Pa.
Reid, D., Genett Air Brake company.....Chicago, Ill.
Rice. E. W., General Electric company....Lynn, Mass.
Richards, H. T., *Electrical Review*....New York, N. Y.
Richardson, Wm. J., Atlantic Avenue Railway company..... Brooklyn, N. Y.
Richardson, Wm., Atlantic Avenue Railway company ..... Brooklyn, N. Y.
Ridall, John E., Short Electric Railway company .....Pittsburg, Pa.
Ring, Wm., Paterson Central Electric Railway company.....Paterson, N. J.
Robert, Louis E., Lewis & Fowler Manufacturiog company.....Brooklyn, N. Y.
Roberts, E. P , Swan Lamp company.....Cleveland, O.
Robinson, E. I., Laclede Car company....St. Louis, Mo.
Robinson, Wm., Robinson Electric Truck & Supply company.....Bostoo, Mass.
Robinson, Frank DeH., Cleveland City Cable Railway company.....Cleveland, O.
Roeschlaub, F. H., National Fare Box Manufacturing company..... Chicago, Ill.
Rogers, Frank A., Short Electric Railway compaoy .....Cleveland,O.
Ross, Edward L., Chapman Valve Manufacturing company .....Indian Orchard, Mass.
Rowe, Charles E., Railway Equipment company .....Boston, Mass.
Rusling, F. O , West Bay City Street Railway company.....West Bay City, Mich.
Rusling, C. S , Central Thomson-Houston company ....Cincinnati, O.
Russell, F. D., Rochester Car Wheel Works .....Rochester, N. Y.
Rutherford, J. A., Westinghouse Electric & Manufacturing company.....Pittsburg, Pa.

Sawyer, E. C., Steam Gauge & Lantern company .....Syracuse, N. Y.
Scheffler, Frederick H , Brush Electric company .....Cleveland, O.
Schieren, Charles A. Jr., Chas. A. Schieren & Co. ..... New York, N. Y.
Sharp E. P., American Mica company....Boston, Mass.
Shay, J. H., Munson Belting company.....Chicago, Ill.
Silverman, S. H., General Electric company ..... Philadelphia, Pa.
Smiles, E. M., Edison Manufacturing company .... New York, N .Y.
Smith, Gilbert M., Aluminum Brass & Bronze company.....Chicago, Ill.
Soper, Warren Y., Ottawa City Passenger Railway company..... ....Ottawa, Ont.
Sperry, E mer A.....Chicago, Ill.
Stanley, John J., Broadway & Newburg Street Railway company..... ..... Cleveland, O.
Stanley, Henry D., Okonite company....New York, N.Y.
Stark, E. C., Peckham Motor, Truck & Wheel company.....Kingston, N. Y.
Stearns, C. K., Northwest General Electric company .....St. Paul, Minn.
Strieby, F. H., Central Thomson-Houston company .... Cincinnati, O.
Stuart, John A , Central Thomson-Houston company .... Cincinnati, O.
Stump, C. E., *Street Railway Journal*..New York, N. Y.

Taft, J. A , Babcock & Wilcox company....Cincinnati, O.
Taylor, Wm , Taylor, Goodhue & Ames....Chicago, Ill.
Tolles, Chas. L , Jewell Belting company, Hartford, Conn.

Uebelacker, C. F., Short Electric Railway company .....Cleveland, O.

Valentine, J. W., Short Electric Railway company ..... Cleveland, O.
Van Nuis, C. J.....New York, N. Y.

Walker, John, Walker Manufacturing company ..... Cleveland, O.
Washburn, Geo. A.. Ford-Washburn Storelectro company..... .....Cleveland, O.
Wason, Chas. W., East Cleveland Railroad company .....Cleveland,O.
Waterman, F N., Westinghouse Electric & Manufacturing company.....Pittsburg, Pa.
Webb, H E.. Solar Carbon company .... Pittsburg, Pa.
Webster, E., Stilwell & Bierce Manufacturing company.....Chicago, Ill.
Wells, S. P., Northwest General Electric company .....St. Paul, Minn.
Wessels, Edward J., Short Electric Railway company .....New York, N. Y.
Wharton, Wm., Wm. Wharton & Co...Philadelphia, Pa.
Wheeler, G. K , General Electric company..Chicago, Ill.
Wightman, Merle J..... .. Scranton, Pa.
Wilkes, Gilbert, Detroit Electrical Works..Detroit, Mich.
Williams, Chas. A., Rochester Railway company company.....Rochester, N. Y.
Willson, Frederick J., Battle Creek Electric Railway .....I....Battle Creek, Mich.
Windsor, H. H., *Street Railway Review*....Chicago, Ill.
Wood, E. E., *Electrical Industries*.....New York.
Wright, August W , Siemens & Halske Electric company.....Chicago, Ill.
Wright, A. J., Reliance Gauge company..Cleveland, O.
Wurts, Alexander J., Westinghouse Electric Manufacturing company ....Pittsburg, Pa.
Wyman, Edward B., Dewey Electric Heating company..... ..... Syracuse, N. Y.

The Banquet.

The banquet at the Hollenden was the closing feature of the meeting. Four hundred guests were present, and speeches were made by several members of the association and representatives of Cleveland society. Vice-President McLean presided and introduced the speakers. The program was opened with the national song in which the entire company joined. The event was a most enjoyable one.

Exhibits, Convention Notes and Personals.

The attendance on Wednesday exceeded 400.

The Meaker Manufacturing company, Chicago, showed portable and stationary fare registers.

Among the trucks exhibited was a model of the Taylor electric truck, made at Troy, N. Y., by the Taylor electric company.

The W. H. Peck company of Cleveland showed waterproof trolley cord, rawhide cord for bells and registers, tubing and wire.

The Supply Manufacturing company, of Pittsburg, Pa., showed commutators of all sizes for railway, light and power machines.

Frank B. Roe of Detroit, was welcomed by his old friends. He explained the merits of his new railway system which contains some novel points.

The Hill clutch was shown in the annex to the hall, in which the greater part of the exhibition was held. S. S. Leonard represented the company and entertained visitors.

The Eureka Tempered Copper company, of North East, Pa., was of course represented. This company continues to make a specialty of electric railway supplies.

The W. H. Johns Manufacturing company presented a full line of its specialties. Insulators of every kind and for every purpose were shown in this company's exhibit.

The principal feature of the Jewell Belting company's exhibit was a 48 inch double belt. This company had several other belts on exhibition which were examined with interest.

Stationary registers were shown by the St. Louis Register company. Garson Myers, Chicago representative, and E. F. Wickham, St. Louis, represented this company at Cleveland.

The W. Bingham company, of Cleveland, O., had a well arranged line of samples of machinists' tools, street railway supplies and an hydraulic jack. The exhibit was in charge of E. M. Young.

The Washburn Storelectro company's display consisted of several motors and accumulators. There was one 1½ horse power, one 2 horse power, and one 5 horse power, motor, all driven by accumulators.

Billings commutator bars, drop-forged, of Tobin bronze or pure lake copper, were shown by the Billings & Spencer company, Hartford, Conn. This company also had a fine line of tools for street railway men on exhibition.

The Partridge Carbon company, Sandusky, O , showed carbon brushes for motors and generators. This company's special line of carbon brushes for street railway motors was examined by the delegates and visitors.

Specimens of commutator segments were shown by A. L. Daniels of the Mitchell-Brant Copper company, Erie, Pa. It is claimed by this company that it turns out commutator bars of pure copper, which will fit any system exactly.

The Schultz Belting company, of St. Louis, did not occupy much space at the exhibition hall, but its samples of sable rawhide dynamo belt, leather pulley covering and woven leather belt came in for a good share of attention from the practical men.

A special line of belting for street railway plants was exhibited by Chas. A. Schieren & Co. This company supplied the Brooklyn City Railroad company recently with 116 feet of 72 inch three ply belt, weighing 2,200 pounds, to transmit 1,600 horse power.

Delegates and visitors had an opportunity to compare the cable and electric roads under excellent conditions. It is needless to say the trolley system did not suffer by comparison although the Cleveland cable road is probably the best line equipped with cable in the country.

A very handsome case of standard measuring instruments, illuminated by incandescent lamps, composed the exhibit of the E. S. Greely & Co. Although the display was not large, station men could find in it samples of all measuring instruments required in station work.

An attractive display, consisting of a line of station instruments mounted on a handsome switch-board, was the principal feature of the exhibit of the Forest City Electrical Works, Geneva, O. This included the Cleveland switch, automatic circuit breaker and a new ammeter with other specialties.

Joseph Fischer of Cleveland, who has "invented a conduit system," explained the feature of his "invention" to visitors. He proposes to place the trolley wires in a conduit directly beneath the slot, and he asserts that "all competent electrical engineers" have assured him that his was the only practical system.

The Standard Railway Supply company, Chicago, advised delegates and visitors not to cut car seats to use stoves. This company has a stove which rests on the seat of the car, and which occupies, it claims, but half the space of stoves resting on the floor. The stove is cast iron and can be used on seats of every description.

The Washburn & Moen Manufacturing company had a board on which were arranged samples of bare and insulated copper wires, telegraph and telephone wire, heavy feeder wires and the "Salamander" wire, of which this company is making a specialty. Several interesting tests were made under the direction of Edward Stockwell.

C. T. Bodifield had personal supervision of the exhibit of the Bodifield Belting company, Cleveland. This company is making leather belting up to 60 inches. Its specialty is a new belt for motor purposes. It is a combination of cotton and leather and, it is claimed, will run absolutely straight, cling to the pulley and make very little noise.

The Dewey Electric Heating company of Syracuse, N. Y., was represented by Mark W. Dewey and Edward B. Wyman, general manager of the concern. This company has been conducting a series of experiments which it claims has convinced it that electric heating may be made both cheap and reliable. The company is making a special heater for electric cars.

W. Y. Soper of Ottawa, Ont., was an interested spectator. Mr. Soper made his headquarters with the Railway Equipment company of Chicago, and gave the delegates to the convention much valuable information regarding the progress of electric heating in Canada. He explained the Ahearn heater at the exhibition, and offered some valuable suggestions to those who were studying this question.

The Bradley General Electric company, Chicago, which is exploiting a conduit system for street railways, was represented by Mr. Bradley, the inventor of the system. This company says it can use a conduit somewhat similar to that employed by the cable railway companies of Chicago. The wires are not directly beneath the slot, but a little to one side, in order to protect them from drippings.

The first display that met the visitor at Army and Navy hall was that of the Walker Manufacturing company, Cleveland. This concern had a very attractive display illustrating the principal cable road installations throughout the country equipped with its machinery. J. B. Perkins, president, and John Walker, vice-president and manager, extended courtesies to delegates and visitors at the company's works.

Among the new station instruments shown at the Cleveland meeting were two Edison static voltmeters for straight or alternating current. These are the first instruments of this type manufactured by the Edison Manufacturing company. It is expected, however, that they will be placed on sale within a month. E. M. Smiles, who was exhibiting these instruments, said they would be standard instruments. They are made for 500 or 1,000 volts.

A. H. Englund, secretary and manager of the International Register company, Chicago, had a number of portable fare registers which his company is exploiting. Although this register has been in the market but nine months, it has been adopted by over forty leading railway companies. The fact that it has been adopted by the West Chicago Street Railroad company, one of the largest in the country, is ample proof of its merits. Mr. Englund announced that he would have a stationary register to place on the market shortly.

The Johnson Electric company, Cleveland, O., had an extensive line of trolleys and trolley wheels, gears, pinions, bearings, armature and intermediate shafts, commutators and armatures, armature cores, brush holders and in fact everything that could be classified under the general heading of electric railway supplies. This company lays great stress on the fact that everything it places on the market is made in its own shops. All of its specialties are turned out under the supervision of competent men, and as every part of every machine or device is made in the company's works it cheerfully assumes responsibility.

Anything that serves to check fraud on the part of conductors or passengers always proves interesting to managers of street railways, and it is quite probable that many of the delegates are now engaged in studying a Chinese puzzle which was distributed in the form of a transfer ticket, devised by J. Harry Stedman of Rochester, N. Y. This ticket was gotten up for the Rochester Railway company, and has been adopted and put in use on the lines in Buffalo, St. Louis, Dubuque, Battle Creek, Lima and elsewhere. It has thus far proved an unsurmountable obstacle to that class of individuals who are always endeavoring to get ahead of a street railway company.

The Westinghouse Electric & Manufacturing company was well represented at convention headquarters, and its display in the exhibition hall was one of the most attractive to practical street railway men. Running as a motor, a 150 horse power multipolar railway generator proved quite an attraction. There was also a complete switch-board outfit to attract station men. New automatic lightning arrester, circuit breaker, standard voltmeter, three jaw switch and railway feeder switch were all in position. Included in the display were parts and fittings for complete motor outfits, pinions, gears, armature disks and an improved power controller. Two single reduction motors on a Dorner & Dutton truck, with brake and controller, were also in operation.

The Carpenter Enamel Rheostat company, Bridgeport, Conn., had a number of its rheostats on exhibition. The principle of this rheostat is the conduction and dissipation of heat by holding a resistance wire in close relation to a metal plate so that the heat generated in it, by the passage of a current, is rapidly conducted to the plate, which becomes the radiating surface. This is accomplished by the use of an enamel, which permanently attaches the wire to, but insulates it from, the radiating surface plate, and which also completely surrounds and protects the wire from chemical action. In this way the capacity of a resistance wire is greatly increased. It is claimed that a wire that will carry a certain current when exposed to

the air will carry ten times that amount of current safely in this rheostat.

The Railway Equipment company, Chicago, had secured an excellent parlor at the Hollenden, in which to entertain its guests and patrons. W. R. Mason, general manager of the company, presided here, and gave the matter of entertainment his personal attention. He was ably seconded by Mr. Adams and J. F. McCartney. The parlor was tastefully decorated, and was a center of attraction. Mr. Mason and his associates were kept busy explaining the features of the Ahearn electric heaters, which he displayed, and which were fully illustrated and described in the WESTERN ELECTRICIAN last week. At the company's exhibit in Army and Navy Hall there was also a full line of the electric railway devices which this company is now exploiting. These included line hangers and overhead material of every description.

One of the notable incidents of the convention, or rather of the visit of the delegates to Cleveland, was the exhibition given by the Ford-Washburn Storelectro company of its storage battery car, "The Ideal." An invitation was extended to all present to take a ride on the car, which left the corner of Water and St. Clair streets at 5P. M. and 8:30 P. M. the evening of October 20th. Many visitors had left for home and for the World's Fair parade in Chicago, but all that could be comfortably taken care of accepted the invitation. On account of the recent excitement in storage battery circles there was considerable interest in this exhibition, which proved a decided success. A description of the battery has recently appeared in the WESTERN ELECTRICIAN. This company is now ready to furnish complete motor and storage battery equipments in any number required and to protect the users against all suits for infringement.

Many members of the American Street Railway association and supply men from different parts of the country who were in attendance at the Cleveland convention, last week showed their interest in the national game by attending the Boston-Cleveland games. There were very few street railway men around exhibition hall or convention headquarters during the games. Most of the eastern men were interested in the Boston team, and all were elated over their two victories. About the only friends of the visiting team on the grounds were the street railway and supply men. Although over 7,000 persons witnessed each of the three games, the street railway companies found very little trouble in handling the crowds. Representatives of the local companies were congratulated by visitors upon their excellent facilities for caring for such a large crowd.

The Sperry Electric Railway company of New York had two equipments at the convention. One of these was placed in regular service on the Cleveland street railway lines and the other was shown in Army and Navy hall. In both cases the motors were mounted on McGuire trucks. The equipment consists of a single motor, flexibly mounted on the truck, having a hollow shaft, through which runs the pinion shaft, driving both axles through bevel gears. Between this pinion shaft and armature shaft is a flexible gear. The motor is a 40 horse power single reduction with a slow speed armature. The gears are of special design. The housing for these gears forming the bearings for the pinion shaft are strong and are also of special design. By the method of flexible support and flexible connections employed the maximum tractive effect is obtained with a minimum expenditure of power, throwing the total weight on the wheels for traction and having the minimum weight on the wheels without springs. The company was represented at Cleveland by Elmer A. Sperry and C. A. Pratt of Chicago and H. P. Barr of New York.

The National Fare Box Manufacturing company, Chicago, claimed attention for an exhibit which interested the representatives of the financial end of the road. This company has a fare box from which it is claimed money cannot be extracted. It is certainly a very ingenious device. From the roof of the box hangs an automatic closing door on a hinge. When the door is pushed back it discloses the opening of a spout, into which the fare is deposited. At the same time that the swinging door is pushed back, the platform which is attached to the bottom of the swinging door passes under the lower end of the spout inside of the box, thus closing the bottom of the spout at the same moment that the top is uncovered, so that when a coin or ticket is dropped into the spout it remains there until the swing door is released and falls back into place, by its own weight, over the mouth of the spout; and at the same moment the platform, being attached to the door, swings from under the spout, and the coin or ticket drops to the first dump or hopper. It is so arranged that either the top or bottom of the spout through which the fare passes into the box is always closed, thus preventing the use of the "snake," or any other similar instrument. F. H. Roeschland, who represented the company at the convention, had a very handsome aluminum box of this pattern.

The gathering of street railway men in Cleveland called to mind some interesting reminiscences. Commenting on the progress of the street railway in the Forest City, the *Plain Dealer* says: "Those who can look back to the time when the late Henry S. Stevens and Ellery G. Williams began, under great difficulties, the two single track street railroads from Willson avenue to Superior street below the public square, the one by the way of Euclid, Prospect and Erie, and the other by Woodland avenue (then Kinsman street) and Ontario street, and now see to what dimensions the street railway systems of Cleveland have grown, can form some idea of the extraordinary development of the street railway interests of the whole country. It is now nearly a third of a century since these two roads were built, but the most rapid development of street railroads in Cleveland, as generally throughout the United States, has been within the last decade, and largely during the last half of that period, since the general substitution of electricity for horses as the motive power. That change has revolutionized the character of the annual meetings of the street railway association. In the earlier years of the association the representatives of the different roads met to discuss the care of horses, the construction of stables, and incidentally the improvement in service to the public. The attendance was light, and the meetings of little or no interest to the public. Now all is changed. The horses have gone, or are never mentioned. The price of oats cuts no figure in the discussions. Practical scientists gather from all parts of the country to the meetings, or read the papers on electrical subjects submitted to the members, as condensed in the daily reports or spread at length in the technical journals. The general public also finds much to interest it in the proceedings."

The Short Electric Railway company entertained all comers. It took advantage of the convention to cultivate the good graces of visitors and extend courtesies to its rivals. All were welcome. At the Hollenden it had secured a suite of parlors in which members of the association and friends were entertained and souvenirs dispensed. A general invitation had been extended to the delegates and visitors to inspect the factory, and the company entertained its guests in a royal manner. Here many of the delegates had an opportunity for the first time to see an electric motor in course of construction, and it is doubtful if any one who visited the factory did not bring away some valuable information about handling apparatus of this character. To the general public the Short company's display in the exhibition hall was one of the most imposing features of the meeting. The company's exhibit was arranged at the north end of the hall, directly opposite the entrance, and immediately attracted attention by reason of the illuminated displayed sign, in which appeared the word "Gearless" in incandescent lamps. This was arranged above the company's space, and attracted much attention to the spot. The greater part of the display was arranged on an elevated platform. Dismantled machines, the principal parts of motors and generators, rocker arms with brush holders, and motors split open to show the parts, were conveniently arranged for inspection. In front of this platform were several machines illustrating the evolution of the gearless motor. First of all was the original gearless motor—the first machine of this type turned out by the Short company. Next to it was the Pittsburg motor—an improved type, which was presented to the public a year ago at the Pittsburg convention, and which attracted so much attention at that gathering. There was also another machine familiar to the street railway men. It was placed on the market about eight months ago, and included some important improvements over the old form. The latest type of the Short gearless, which is known as "1892," was also shown. By examining these machines an idea of the improvements that have been made in this line may be gained. The new machine does not occupy more than two-thirds the space of the first type, it is in a much more convenient form, and, altogether, is, from a mechanical view point, vastly superior to the old style. Another feature of this interesting exhibition was the winding of an armature for a gearless motor. One of the men employed at the Short company's works was engaged during the convention to give public exhibitions of armature winding and explain its features to visitors. Taken altogether, the display was one of the most interesting exhibitions of street railway apparatus ever shown in this country.

One of the great events of the week was the reception and lunch at the Short company's works. An invitation had been extended to delegates and visitors in attendance at the convention, and special cars were provided to carry all who accepted the invitation from the Hollenden to the Short company's factory. A temporary track had been laid and overhead wires strung on Bond street from the Hollenden to Euclid avenue, a distance of 500 feet. Exhibition cars were brought into service and about 400 representatives, many of them accompanied by ladies, accepted the invitation, filling six cars. Two of these cars—one with vestibule body—were equipped with Short apparatus; two were furnished by the General Electric company—one vestibule and one very long car with double trucks. Both were finished in elegant designs. The vestibule car was built by the Gilbert Car company with McGuire trucks and W. P. motors. One car was furnished by the Sperry company, showing the new Sperry system of single motor geared to both axles, elastically supported and flexibly connected. Another was built by the Lamokin Car company, showing single reduction 20 horse power Thomson-Houston motor and the Robinson all steel truck. In the Short Electric Railway company's office the furniture had been removed and an elegant arrangement of cut flowers, smilax and potted plants and palms filled the rooms. Prof. Sidney H. Short received the visitors in the front office and was very successful in his efforts to make every one heartily welcome. The crowd passed on through the office and thence through a side door to the street and to the main shop of the Brush company. A band was stationed behind a bank of flowers in the office during the reception. Passing through the main shop and the engine room the visitors came to the testing room, where on each side of the door was a large punch bowl. Another table on the right was filled with cigars, while through the center of the room extended a long table where a lunch was served. There was a profusion of flowers everywhere, and in the center of the table was a very appropriate piece representing a street car, the sides and body of which were made of white and red carnations and smilax, while the top was a mass of Marechal Neil roses. On the sides in small white flowers were the words 'Short Electric Railway Co." The officials of the Short and Brush companies extended special invitations to their guests to visit the different departments of the factories. After the factory had been thoroughly examined the street cars were brought to the door and an invitation was extended to all to attend the ball game between the Clevelands and Bostons which was being played only a short distance away. Advantage of this kind offer was taken by many, while others took the remaining cars and returned to the city. The affair passed off without a hitch, and everyone was pleased with its successful outcome. The reception was conducted under the personal supervision of William Hazleton, third, assistant general manager of the Short company, who made all the arrangements for the affair.

In its exhibition this year the General Electric company has surpassed all previous displays in the old days of the Edison and Thomson-Houston companies. The exhibition was in every way worthy of so large, energetic and prosperous a corporation. The arrangement of the company's exhibits permitted an examination of its entire railway system. A special feature was the motor display. On a Brill truck, two W. P., thirty horse power single reduction railway motors were mounted, showing their lightness, general compactness and ease of adaptation. The W. P. 50 horse power motor, with the hollow field and field coil thrown back, afforded an opportunity to examine the interior parts. The S. R. F., motor, a modification of the old 30, was arranged next to this. Next to this was the Standard S. R. G. railway motor. An Edison No. 14 motor was mounted in the center of the exhibition. There was also shown a gear press for applying or removing gear wheels from motors. The series parallel controller next claimed attention. From this, any objectionable features which were found in those first made had been eliminated, and the series parallel controller, as it now stands, will prove a great economic element in calculations of street railway managers. One of the particular features of the exhibition were the overhead parts. They were arranged on a long, sloping board, which showed them off to considerable advantage. In order to make them still more conspicuous, they were carefully plated and polished, so that this board looked like a jeweler's showcase. By the side of all this glory was shown "ye ancient appliances" of only six years ago. Surely no greater proof of the rapid development of the electric street railway could be given than this—the contrast between these old and obsolete appliances and the gorgeous practical devices of the present day. Another striking exhibit which the company had was its power station switchboard equipped with automatic circuit breaker and current indicator of the latest and most improved type. This stood by the side of a board on which were mounted several of the Thomson wattmeters working in order to show their method of operation and record. Two special car fixtures completed the exhibit. Small electric lamps outlined the name of the company in different positions; and, in the center, as if guarding the entire display, was an American eagle perched on the top of a shield formed of small incandescent lamps of the patriotic colors, rejoicing in the General Electric company's system. The General Electric company ran two magnificent cars over the East Cleveland company's lines—one a special vestibuled car upholstered in deep brown plush, and furnished with easy chairs. This was mounted upon a single truck. The other car was a giant forty feet long, having a double truck. The floor of this was removable to enable the operation of the apparatus to be seen. Recording instruments showed the amount of energy required to operate the cars. The headquarters of the company at the Hollenden were most tastefully decorated with green shrubs, ferns, plants and flowers. W. J. Clarke, the general agent of the railway department, in whose hands the entire management of the General Electric company's exhibit was placed, acted as host, and his cordial greeting of all the visitors won for him the good will of every one at the convention. Mr. Clarke was ably seconded in his efforts by Elmer P. Morris of the railway supply department; G. K. Wheeler, assistant of the Chicago railway department; F. H. Clarke, manager at Washington, and R. T. Randolph, I. Silverman, W. A. Stern, H. H. Harrison, C. S. Rusling and a thoroughly competent staff of General Electric men. O. T. Crosby, general manager of the railway department, was also present.

Water Power and Electricity.

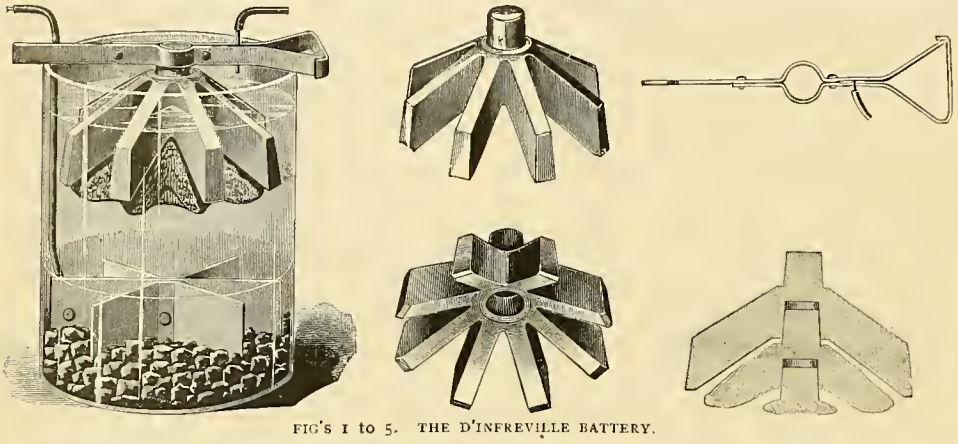
In an article on the subject of utilizing waste water, power, particularly in the South, the *Manufacturers Record* says: Throughout this country there are rivers, streams and brooks which can be utilized and give to the cities and towns near them both power and light. In the South there are hundreds of streams which if harnessed would supply all the electricity needed for years to come. Such power would be cheap, and within the reach of all, the farmer as well as the manufacturer. Few people who watch a stream running in its bed think of the good which might be accomplished by the force which is wasting itself, nor do they realize how much power there may be in it. Suppose a stream twelve feet wide, with an average depth of one foot, runs with a speed of eight miles an hour, if a fall of twenty feet can be secured by means of a flume or canal, 318 horse power per hour would be developed. A brook which would fill a flume 3x2 feet and give a fall of twenty feet would yield 160 horse power per hour, and even though the flume be filled only one foot in depth and three feet in width eighty horse power will be secured. Five miles from a certain town in Tennessee there is a beautiful stream which falls sixty feet in one leap, and during the lowest water would furnish over 200 horse power, while in winter, spring and early summer, or at any time after a heavy rain, over 1,000 horse power could be secured. At Mussel Shoals, on the Tennessee river, over 500,000 horse power could be developed. There is power enough here to operate the Memphis & Charleston railroad from Memphis to Chattanooga and leave enough over to light every town and city along the line. It would be impossible to name every stream in the South which could be ultilized in this way. Some are small and some large, but each could be made to serve in some degree.

The d'Infreville Battery.

There has been up to the present time a great waste of zinc in batteries, owing to the fact that the zinc electrode must be removed before it is entirely consumed. In some cases, with the best patterns of zinc gravity battery, the waste often reaches 45 per cent. of the total weight of zinc purchased.

The object of the d'Infreville "wasteless" zinc is mainly to entirely avoid waste of zinc.

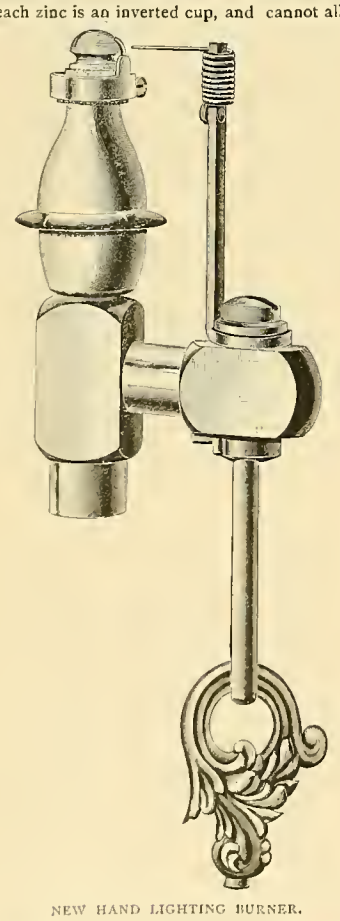
The invention, Fig. 1, consists in using for the zinc electrode a number of pieces adapted to be connected to one another in column by joints which are liquid tight or adapted to preserve the connecting parts from corrosion.



FIG'S 1 to 5. THE D'INFREVILLE BATTERY.

The fastening of the wasteless zincs is obtained through the wedging by a small twisting motion combined with pressure, or by a light blow, the slightly conical socket provided at the bottom of the upper zinc, over the correspondingly tapered shank provided at the top of the zinc to be placed under, Fig. 2.

Corrosion from the solution is prevented, as the socket below each zinc is an inverted cup, and cannot allow, any



NEW HAND LIGHTING BURNER.

more than a diving bell would, the access of liquid against its inside walls.

The conical shank above and the conical socket below each "wasteless" zinc are made to uniform gauge, so as to leave about one-quarter inch distance between two zincs when the branches of the upper one are exactly over the branches of the one below, Fig. 3.

A new feature with the "wasteless" zinc is that the radial branches are slanting downwardly from their supporting trunk, so that they will wear out gradually from their extremities. The branches will thus become entirely consumed before their support be itself too much corroded.

The battery shown in Fig. 1 is one complete gravity element fitted up with the "wasteless" zinc electrode, which consists of a new zinc piece suspended from a hanger connector resting on the rim of the jar, so that zinc pieces bathe about half way in the sulphate of zinc solution of a second piece of zinc partially consumed and suspended from the first one, and of a third piece or stump of zinc almost entirely consumed and suspended from the second piece. The two last zinc pieces are entirely below the upper level of the battery solution.

The zinc hanger, Figs. 1 and 4, does not strain the edge of the glass jar, and does not tend as a hook to break the jar. It renders the connecting and disconnecting easier and quicker than with a screw, an advantage often very important, as in large battery rooms or in emergencies.

The action of this battery is such that in time the lower piece of zinc will have been entirely consumed, then in turn the one directly above it to which it was attached, and so on, so that practically every piece of zinc introduced in the battery will, in its turn, be entirely consumed.

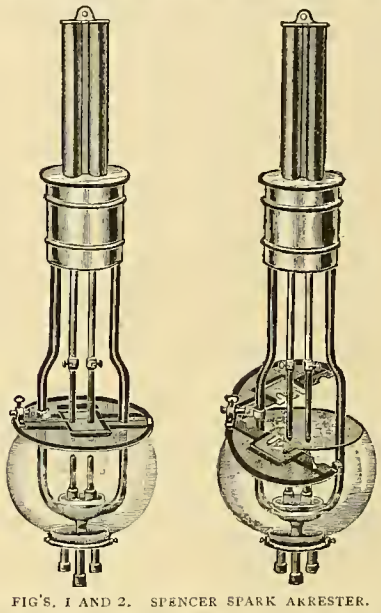
This zinc is made by G. d'Infreville, New York.

The S. R. F. 30 Railway Motor.

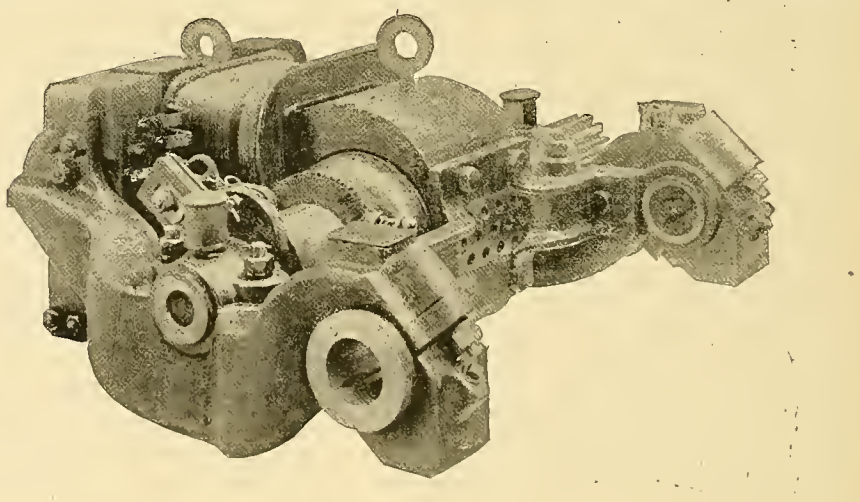
The many advantages of the single reduction motor for electric railway service have during the past year been so emphatically proven that the General Electric company has re-designed its old double reduction F. 30 motor, making it a single reduction machine, and designating it as the "S. R. F. 30" railway motor. In compliance with the demand for the conversion of F. 30 motors, the company is now rebuilding for many of its customers a considerable number of these machines.

In effecting the change the side arms, nose plate, intermediate shaft pinion and gear of the old F. 30 motor have been discarded and replaced by newly designed side arms, which support the motor proper. As will be seen from the illustration, these parts occupy a position exactly the reverse of that in the F. 30; the nose plate becomes a support to the pole pieces, and the pinion and gear are similar to those used on the General Electric company's waterproof railway motor. By doubling the turns or convolutions in the armature winding, and leaving the field spools unchanged, two important improvements have been secured—the armature speed is reduced one-half and the strength of the torque of the motor doubled. An improvement has been effected in the arrangement of the armature bearings, facilitating lubrication. The axle and armature bearings are now similar, and the same kind of grease can be used on both.

The efficiency of the new S. R. F. 30, when compared with that of the F. 30, shows a decided increase in favor of the new type, although its speed under similar conditions of strength of fields is slightly less. The amount of heat developed after a run under full load is also considerably less than in the F. 30. The results of the trial tests of the S. R. F. motor tend to show that the transformation of the F. 30 from a double reduction to a single reduction motor will be satisfactory wherever effected.



FIG'S. 1 AND 2. SPENCER SPARK ARRESTER.



S. R. F. 30 RAILWAY MOTER.

New Hand Lighting Burner.

Illustrated herewith is the Iona hand lighting burner, which is being placed on the market by the Redding Electric company of Boston, Mass. In this device there are no cams or complicated springs to get out of order, and, being operated only by the key, it is safe from leaking gas. This burner, like the Iona safety pendant mentioned in a recent issue of the WESTERN ELECTRICIAN, is carefully made, the valves being hand ground and the stems made in various lengths to suit fixtures.

The Spencer Spark Arrester.

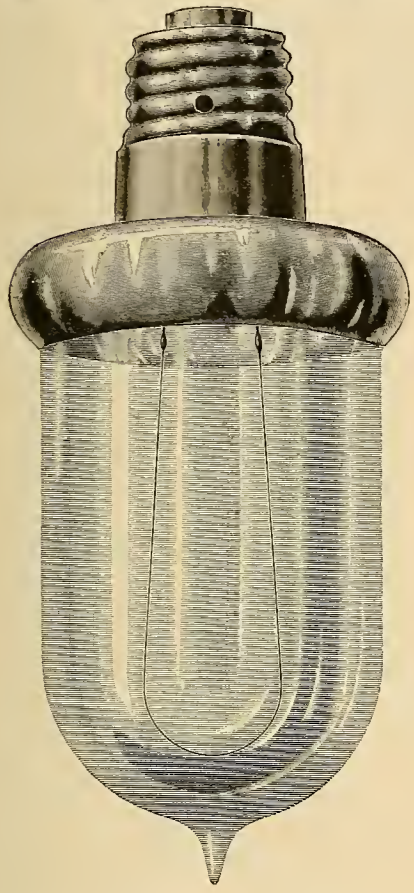
The new electrical firm of Taylor, Goodhue & Ames, Chicago, is placing a new spark arrester on the market which possesses a number of novel features. The new arrester is illustrated in the accompanying cuts. Fig. 1 shows the appearance of the spark arrester when properly adjusted to the lamp; Fig. 2 illustrates the manner of adjusting. The clamp on the side firmly holds the arrester in position by securely clamping on the supporting rod, and as this clamp is adjustable, it will be used on lamps

with either the supporting rod placed inside the globe or outside. The appearance of the arrester is exceedingly neat.

The Acorn Sunbeam Lamp.

The accompanying cut shows the "Acorn" lamp manufactured by the Sunbeam Incandescent Lamp company, Chicago. The "Sunbeam" is a high efficiency lamp, because its manufacturer believes the public appreciates high efficiency, although it will make low efficiency lamps if any prefer to have them. High efficiency is not claimed as a peculiar attribute of the "Sunbeam" further than this: that being a superior lamp it may be run at a higher efficiency and still give satisfactory life.

The following are the cardinal points of a good incandescent lamp and which, it is believed, the Sunbeam lamp possesses: First, full rated candle power; second, uniformity of illumination during the life of the lamp, avoiding the defect of a brilliant light when first started



ACORN SUNBEAM LAMP.

and a sickly red for the longer part of the time the lamp is used; third, a large return of light for the power used; fourth, long life.

The Sunbeam company believes that a lamp of medium high efficiency and moderately long life designed to give the most light for a dollar, all things considered, will give the greatest satisfaction in the long run, and upon this principle it claims the "Sunbeam" has been made.

Sunbeam acorn lamps can be furnished in colors as follows: Red, blue, green, amber and frosted. A peculiarity claimed for the material used to color the Sunbeam lamp is that it will not crack or peel off; it will last, too, as long as a lamp ordinarily lasts. The acorn lamp is especially suited for decorative work.

CORRESPONDENCE.

New York Notes.

NEW YORK, October 22.—After the ceremonies of a week ago and the numerous rumors on change, matters have now quieted down. There has been, though, another rumor that will interest electrical manufacturers. It was announced down town on Monday that it had been decided to shut down the Anaconda copper mines for three months beginning November 10th. This talk made quite a little excitement. Many inquiries were made of J. B. Haggin, who controls the mines. He said that they had been worked for a long time and were in need of repairs and general cleaning.

The opening of the long distance telephone line between New York and Chicago on Tuesday afternoon was a most interesting occasion. Mayor Grant exchanged greetings with Mayor Washburne of Chicago.

Chicago electrical companies which have been having trouble with striking wiremen will be interested in the announcement that there is now a prospect that several New York firms will have a similar experience. On Tuesday last twenty-one of the leading electric light companies in this city, Brooklyn, Long Island and other places in the vicinity gave notice that hereafter they would hire union and non-union men alike. Tuesday night Electrical Union No. 3 468 met in Clarendon hall and agreed to strike in such shops where non-union men are employed. So far the Tucker Electric Construction company is the only one hiring men outside of the union, and a strike has been ordered there. W. F. O.

Milwaukee, Wis.

MILWAUKEE, Oct. 22.—The supreme court of the state has finally rendered a decision in the litigation over the Milwaukee Electric railway. One of the two cases decided was that of Hinckley against Pfister, begun in the spring of 1891. It was the case that had so many prongs and bothered the Milwaukee judges so much. The objects of the suit were to practically cancel all of John A. Hinsey's stock, which had been put up as collateral with Pfister, on the ground that it had been illegally issued by Hinsey himself; to take the control of the road from Pfister; to have a receiver appointed and a claim of Hinckley for $100,000 paid; to cancel the bonds which Pfister held as security; to deprive Pfister of his lien on the property, and to establish Hinckley's lien. Consolidated with that action was another brought in the name of the company itself for practically the same relief. In these actions Hinckley secured an injunction restraining Pfister from transferring any of the stock and from enforcing his securities, and preventing him from doing anything with the road except to operate it. Judge Austin of the superior court dismissed the complaints of Hinckley and the company on demurrer which set up that they did not state a sufficient cause of action. The injunction, however, was kept alive pending an appeal to the supreme court, Hinckley giving a bond in the sum of $25,000. By this decision of the supreme court Hinckley is turned out and Pfister is held to be rightfully in possession of the property. It is further held that Hinckley cannot attack the issue of stock to Hinsey.

In the case of Pfister against the Milwaukee Electric railway the supreme court upheld the judgment of Judge Johnson of the circuit court. The decision is a very interesting one, in that it decides for the first time the question as to the issue of corporate bonds below a stated figure. The statute, in brief, is that bonds issued at less than 75 cents on the dollar are void. In this case bonds to the amount of $250,000 were pledged to Pfister to secure a debt of $125,000. The supreme court failed to uphold the issue of the bonds to Pfister, and on this one point Hinckley came out ahead. Pfister, however, is the master of the situation. He is in possession of all of the stock pledged by Hinsey and Hinckley, and he is still in control of the road. He cannot foreclose the mortgage under which the bonds were issued, to be sure, but his claim of $125,000 is good, and he will be able to recover every cent of it with interest. Just how Hinckley will come out of the transaction it is hard to say. Much will depend upon the price which the property brings when it is sold, as sold it will be. The system will eventually become part of the Villard system.

Work on the First avenue electric line has been commenced. It is the Kinnickinnic line, however, that will be extended to Cudahy.

Some complaint is made because it takes two fares to and from the city of Wauwatosa, or return, via the Walnut street and Wauwatosa electric lines. The Wauwatosa company's line runs into the city as far as Twenty-seventh street, while the municipal boundary is Thirty-fifth street. The cars, however, make through trips, both lines being operated by the Milwaukee Street Railway company. It is claimed that on account of the two lines having different owners, the city is powerless to enforce a one-fare rule which some of the aldermen proposed.

The prospect of the Milwaukee & Wauwatosa Motor Railway company building to North Greenfield is not very bright, no bonus having been raised. The people of that suburb hope to secure an extension of the National avenue electric line.

The new electric line at Madison has been formally opened. Two cars containing judges of the courts, state officials, stockholders and newspaper men made the initial trip. A banquet at the Park hotel followed.

The Milwaukee & Whitefish Bay line is being double-tracked. Early next spring more trains will be run on the road. The officials of the Villard company do not state when the line will be changed into an electric system, but it will probably not be more than a year. It is a question of not a very long time when the Bay line will be extended and electric cars running to Fox Point. A strong syndicate has secured possession of most of the desirable land, about 700 acres in all, at Fox Point, and intends to establish a fashionable residence suburb there. The land lies well, the beach is low, and altogether it only needs rapid transit to and from the city to make it a perfect residence district. The company intends to plat its land, and sell it in not less than acre lots. It is also proposed to establish a country club house at the point. The new suburb lies about two miles beyond Whitefish bay. At present its only means of transportation is via the Milwaukee, Lake Shore & Western railway.

The Merrill Park line of the West Side Street Railway system is to be extended to the Soldiers' Home. The National Board of Soldiers' Home managers, at a meeting recently held in Washington, granted the street railway company the privilege of building a line along the north line of the Soldiers' Home grounds. The extension would be nearly two miles long. It would reach Calvary Cemetery as well as the Soldiers' Home, and be of inestimable convenience to the general public. There is a rapidly growing manufacturing settlement along the line of the proposed extension, and it is predicted that the line would be a profitable investment. All that is necessary now is for the company to secure a franchise from the Town Board of Wauwatosa. The Clybourn street line now extends to the city limits. How far beyond the western line of the Soldiers' Home grounds the extension will be built is not known, but it is not unlikely to reach the State Fair grounds. The nearest parallel lines at present are the Wauwatosa motor railway, half a mile on the north, and the National Avenue electric line, still further away, on the south. The Villard company, having secured control of the City street car system, appears to be losing no opportunity to extend it to any point of importance within reach of the city.

Henry C. Payne, who has been inspecting the street railway systems of St. Paul and Minneapolis, as well as the inter-urban line, speaks quite enthusiastically of them, but says that he cannot see that either city has an advantage over Milwaukee in the matter of rapid transit, unless it is that the systems at those places are nearer completion than is the Milwaukee system. Cars do not run so frequently in those cities as they do in Milwaukee, but the lines are well equipped in every way, and the people of the two cities, Mr. Payne states, are well satisfied.

Mrs. Jennie McAlpine, who appealed from the award of the commissioners appointed to appraise and condemn for the right-of-way of the Wauwatosa motor line, secured a verdict for $19 611. The original award was $6,700.

The opening of the Forest Home-Cambridge Avenue electric line, which was delayed several times, occurred last Saturday. The line extends from the southwest corner of the city to the northeast corner. It is one of the longest lines in the city. Now that the electric cars are running over that line, the Washington Street-Eighth Street line is the only one on which horse cars are running. C.

PERSONAL.

Louis P. Hall, with Jarvis & Conklin, Kansas City, visited Chicago last week. Mr. Hall is now superintending the construction of an electric road in Kansas City.

Ensign N. H. G. Bullard of the navy has been ordered to duty in the office of the naval inspector of electric lighting, navy department, upon the completion of the course of instruction at the Naval War College.

George P. Barton, Chicago, was married at Towanda, Pa., October 12th to Miss Emma Louise Wells. Mr. Barton is senior member of the law firm of Bartoo & Brown, which has acquired considerable prominence as electrical patent attorneys. Mr. Barton has the best wishes of his many friends in the electrical fraternity.

NEW INCORPORATIONS.

Home Electric company, Richmond, Va.; capital stock, $150,000; electric machinery, light, power and heat.

Elmwood Electric Light company, Elmwood, Ill.; capital stock, $30,000; to operate steam and electric light plants; E. L. Brown, Elmwood, Ill.

Lakewood Electric & Investment compay, Denver, Colo.; capital stock, $50,000; to operate an electric car line in Arapahoe and Jefferson counties, Col.

Columbian Light & Power company, Portland, Maine; capital stock, $200,000; to carry on a general electric light and power business; Charles F. Libby, Portland, Maine.

Elwood Electric Street Railway company, Elwood, Ind.; capital stock, $100,000; to construct and operate lines of

railway in Elwood; furnishing electric light, heat and power.

C. H. Lever Manufacturing company, Chicago, Ill.; capital stock, $10,000; manufacturing electrical and small wood work; Reuben Wright, 708 Chamber of Commerce, Chicago, Ill.

Connecting Electric Railway company, of St. Louis, Mo.; capital stock, $2,000; to construct and operate a passenger railway in St. Louis; Geo. W. Taussig, Laclede Building, St. Louis, Mo.

Evansville Electric company, Evansville, Ind; capital stock, $5,000; to manufacture, use and furnish electricity for motive power, lighting and other purposes; Gilchrist & DeBruler, Evansville, Ind.

Norwich Insulated Wire company, Harrison, N. J.; capital stock, $375,000; to manufacture and sell insulated electrical wires and cables, etc.; William J. Fanning, 120 Broadway, New York, N. Y.

Springfield Railway company, Springfield, Ohio; capital stock $1,000,000; constructing and operating street railroads, furnishing electricity for heat, light and power, etc.; Oscar T. Martin, Springfield, Ohio.

Chicago Traction company, Chicago, Ill; capital stock, $1,000,000; to construct, equip and operate electric and horse railways and electric light plants; Edwards, Corse & Co., 122 LaSalle street, Chicago, Ill.

North Shore Heat, Light & Power company, Chicago, Ill.; capital stock, $100,000; to manufacture and supply gas for fuel, light and power purposes, also electricity; J. D. Cameron, Chamber Commerce building, Chicago, Ill.

Okanegan Investment company, Leavenworth, Wash.; capital stock, $250,000; laying out and building towns, construction, operation and owning of irrigation ditches, reservoirs, waterworks, electric light plants, railways, etc.; Charles F. Leavenworth, Olympia, Wash.

ELECTRIC LIGHTING.

Wapakoneta, Ohio, is about to put in an electric light plant.

Vinton, Iowa, has an electric light plant, and its citizens are elated.

A large addition to the electric light station at Salt Lake City is being erected.

The electric light station at Warrensburg, Miss., was lately destroyed by fire.

A company of Stanton, Mich., capitalists is anxious to supply that town with an electric light plant.

The electric light plant at Tipton, Ind., owned and operated by A. S. Nickey, has been destroyed by fire.

The Petersburg, Ill., Electric Light company has sold out to Richard Abbott, of Mason City. The consideration was $10,000.

The Stock Yards company will erect an electric light plant at South Omaha, Neb., with a capacity for 100 arc and 1,600 incandescent lights.

There is a proposition to bond the city of Richmond, Va., $125,000 for a municipal electric lighting plant, but the project is opposed by the *State*.

The Detroit park and boulevard commission has accepted Frank B. Rae's plans for an electric lighting system on Belle Isle with some slight modifications.

The stockholders of the Citizens' General Electric company of Louisville, Ky., have voted to issue bonds to the extent of $400,000. Most of the proceeds will be used for erecting a new plant at Tenth and Monroe streets, and in extending the system.

The Toledo Electric Light company has erected a temporary plant on the site of the burned station. A roof has been thrown over the basement of the old building, and five of the old engines are to be used. The insurance adjusters gave the company $40,000 on an insurance of $55,000.

The Edison Electric Light company of LaCrosse, Wis., has put in a novelty in church lighting in St. Joseph's church of that place. It consists of a small hardwood frame to surround the image of the Virgin Mary and child Jesus, with the name "Maria" below and a large star above. On the frame are thirty-two one candle power electric lights alternating in red, white and blue. The name is in seventy-two all red globes and the star in sixteen pure white ones.

ELECTRIC RAILWAYS.

Reynoldsville, Pa., is raising money to build an electric railroad.

The survey for the electric railway at Sandwich and Amherstburg, Mich., is practically finished.

Work on the Houston Heights electric railway of Houston, Texas, along the extension of Washington street, is being pushed, and in about two weeks the line will be open for travel.

TRADE NEWS.

The Eastern Electric Cable company, of Boston, is building a new addition to its factory, which makes the fourth during the past year. This company is rapidly filling the vacant ground which it owns. It is running the factory 16 hours a day, and has increased the working force one-third during the last year. The call for the Eastern Electric mining cables has increased to a marked degree.

Manager P. G. Fiedler, of the Boston Braid Manufacturing company, of Boston, was in New York during the Columbus festivities and reported the demand for his well known filament as being very brisk.

G d'Infreville, of New York, the well known manufacturer of the "wasteless zinc" batteries, is rushed with orders for immediate delivery from various companies all over the country. Among the recent large contracts received were those from the Postal Telegraph company, the Delaware & Atlantic Telegraph & Telephone company, the Kings county elevated railroad, Prof. Elihu Thompson and the Kinsman block company.

The Detroit Motor company is meeting with marked success in the introduction of its apparatus, the sales being much in excess of those for any preceding year. A. A. Robinson, recently appointed general manager of the company, is infusing new life and energy into the business, and with three men on the road he is able to keep the factory crowded with orders. W. S. Armour, well known in Chicago as the former manager of the local office for this company, now has charge of the Michigan territory and is meeting with most gratifying success.

A new company has been organized in Cleveland to be known as the Universal Electric company, with N. S. Possons president and general manager; Geo. R. Lean vice-president and superintendent, and W. J. Possons, secretary and treasurer. A building 60 by 100 feet, four stories in height, built by the Kimball Manufacturing company, has been rented, and the necessary repairs and changes are now being made. A new boiler room is to be built and an engine of 150 horse power is to be put in service. The company will manufacture a full line of electric supplies, and as a specialty will undertake the repair or rejuvenation of burned out incandescent lamps. In order to repair the lamp it is required that the bulb be intact and that the cap be tight on the bulb. All blackening will be removed and the lamp will be restored to its original grade. This company also owns a new process for tempering copper in its pure state without alloys, claiming that any degree of hardness can be reached. N. S. Possons, through his connection with the Brush Electric company and the Belding Electric Motor company, is favorably known to the electric fraternity.

BUSINESS.

Wednesday of last week was set apart for the entertainment of a few insurance friends and the electrical press by the Electric Heat & Alarm company of Boston. The company exhibited the workings and the various applications of its recently perfected journal bearing and fire alarm systems. The display was made at the Mechanics' Fair, which is now in progress in Boston.

Probably no instrument of so much real importance is so little appreciated as a good pressure indicator. It is a fact that there are many stations operating large numbers of incandescent lamps that either have no indicator or have one that is of no practical value. It would seem as reasonable to expect to operate a 100 horse power boiler without a steam gauge as to run even a 50 light dynamo without a volt indicator. Many complaints of short lived or inefficient lamps can be traced to the absence of an indicator. The Wirt volt indicator made by the Electrical Supply company, Chicago, seems to be one of peculiarly sensitive adjustment and excellent workmanship, and the manufacturers are in daily receipt of letters expressing the greatest satisfaction with their use.

In the last issue of the WESTERN ELECTRICIAN an article was presented describing the extent to which the Ahearo electric heater had been introduced into Ottawa, Canada. It will interest many to know that in addition to the gold medal awarded the Chaudiere Electric Light & Power company of Ottawa for its exhibit in connection with that of the Ahearn apparatus, the directors of the Central Canada Fair at a recent meeting unanimously awarded T. Ahearn a special gold medal for his electric heater. General Manager Mason of the Railway Equipment company, Chicago, has already begun, in a most energetic manner, the work of introducing the Ahearo heater in the United States and abroad. With Ottawa to point to, Mr. Mason holds a trump card, so to speak, in the battle of the heaters.

The Mosher Electric company, Chicago, which controls the patents of J. A. Mosher for arc and incandescent lighting, has elected the following named officers: G. L. Reimann, president; John A. Mosher, vice-president; J. A. Sheriffs, secretary and treasurer. The company has rented an entire floor, 80 by 125 feet, from the Chicago Nickel Works on Ontario street, Chicago, and with largely increased capital is now ready to supply the new lamps at the rate of 500 per month. Mr. Mosher has perfected an arc lamp for alternating current circuits that, it is claimed, works perfectly on any system and up to any number of alternations. The lamp has been fully tested and is claimed to be entirely noiseless, and to have none of the objections that have been urged against other lamps made for the same purpose. The resistance is placed inside of the frame of the lamp, making it very compact and complete. In ordering this new lamp it is only necessary to state the number of alternations of the current which is to operate it. Mr. Mosher has also perfected a high tension arc lamp for direct current constant potential circuits that has many advantages and that should have a very large sale. This lamp has an automatic cut-out for railway circuits that will protect the circuit if one lamp goes out, making it possible to connect the lamps in series with perfect safety. The company has a large capital paid in and its success would seem to be assured

ELECTRICAL PATENTS.

Issued October 18, 1892.

484,386. Electric Fire Alarm. Joaquin J. D'Almeida and Jose V. Da Silva, Lisbon, Portugal.

484,416. Apparatus for Refining Metals by Electricity. Charles R. Fletcher, Boston, Mass.

484,449. Lantern for Electric Lighting. Daniel S. Page, Malden, and Joseph L. Bertsch, Cambridge, Mass.

484,450. Electric Light Fixture. Daniel S. Page, Malden, Mass.

484,466. Lightning Arrester. Lewis Searing, Denver, Colo.

484,469. Fusible Fire Alarm. George B. Smith, St. Cloud, Minn.

484,479. Electric Lighting System. Barton B. Ward, New York, N. Y.

484,480. Hanger Board for Electric Arc Lamps. Barton B. Ward, New York, N. Y.

484,483. Insulating Joint. Charles Wirt, Chicago, Ill.

484,515. Skylight for Electric Cars. Henry Cochran, Chester, Pa.

484,522. Electrode for Medicinal Purposes. Edward H. McBride, Springfield, Mo.

484,530. Electric Arc Lamp. Carl Coerper, Cologne, Germany.

484,532. Electrical Curling Iron. Andrew D. Gardner, Lynn, Mass.

484,535. Apparatus for Electroplating. Frank H. Howard, Irvington, N. J.

484,543. Electrical Inductorium. Lazarus S. M. Pyke and Harry T. Barnett, London, England.

484,544. Electrical Inductorium. Lazarus S. M. Pyke and Edward S. Harris, London, England.

484,545. Electric Fuse Box. William Stanley, Jr., and John H. Kelman, Pittsfield, Mass.

484,549. System of Electrical Distribution. De Witt B. Brace, Lincoln, Neb.

The system comprises means for distributing alternating or periodic and continuous currents over the same mains. An alternator and a continuous current machine are connected in multiple with a common circuit. In circuit with the alternator is placed a device, such as a polarization battery, which renders the circuit opaque to continuous currents, but readily permits the passage of alternating currents, and in circuit with the continuous current machine is placed a device, such as a choking-coil, which renders the circuit opaque to all but continuous currents. Likewise, devices are placed in circuit with the translating devices so that only such currents may be permitted to pass through them as are required for their proper operation.

484,553. Electrode and Incandescent Electrical Conductor. Lewis L. Jones, Brooklyn, N. Y.

484,565. Mast Arm for Electric Light Poles. Alonzo B. Allison and Gabriel B. Scott, Pittsburg, Pa.

484,574. Electrically Heated Hand Stamp. John B. Venker, St. Louis, Mo.

484,577. Combination Lock and Alarm. R. Baumann.

484,580. Lamp Socket and Circuit Closer Therefor. Sigmund Bergmann, New York, N. Y.

484,582. Process of Duplicating Phonograms. Thomas A. Edison, Llewellyn Park, N. J., assignor to the Edison Phonograph Company of New Jersey.

484,583. Phonograph Cutting Tool. Thomas A. Edison, Llewellyn Park, N. J.

484,584. Phonograph Reproducer. Thomas A. Edison, Llewellyn Park, N. J.

484,585. Phonograph. Thomas A. Edison, Llewellyn Park, N. J.

484,611. Regulator for Dynamo Electric Machines. C. E. Scribner, Chicago, Ill.

484,612. Multiple Switch-Board System. Charles E. Scribner, Chicago, Ill.

484,613. Sub-Station Apparatus for Telephone Systems. Charles E. Scribner, Chicago, Ill.

484,614. Electrical Railway Signal. B. C. Seaton.

484,618. Electric Appliance for Canes. Stephen D. Smith, Milwaukee, Wis.

484,626. Telephone Exchange Apparatus. J. J. Carty, New York, N. Y.

484,642. Draft Indicator for Vessels. W. R. Patterson.

484,695. Lamp Shade Support. Max Bauer, Louis Harry and John Bunger, Greenville, N. J.

484,704. Apparatus for the Manufacture of Metallic Articles by Electrolysis. Alexander S. Elmore, Leeds, assignor to Elmore's American and Canadian Patent Copper Depositing Company, Limited, London, England.

The metal is deposited upon a mandrel adapted to revolve in the electrolytic bath, and a traveling arm carries a burnisher-roller adapted to revolve on an axis perpendicular to the axis of the mandrel.

484,724. Electric Motor or Dynamo. Albert W. Smith, San Francisco, Cal.

484,761. Burglar Alarm. Alfred Stromberg, Chicago, Ill.

484,762. Electric Bell. John E. Thron, Philadelphia, Pa.

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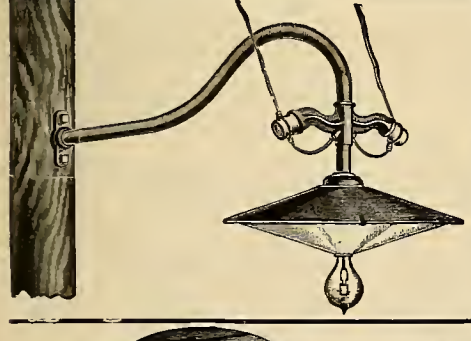

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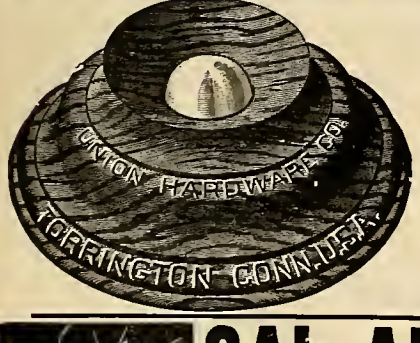

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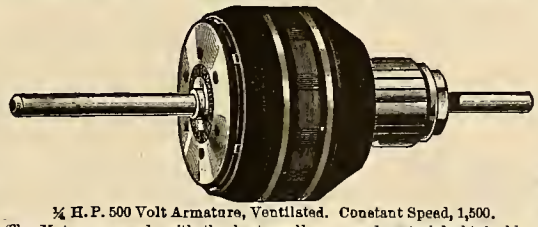

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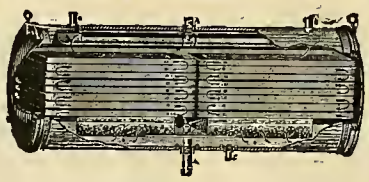

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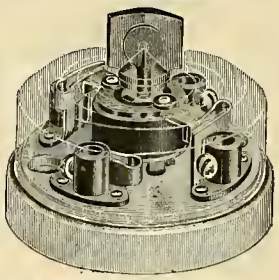

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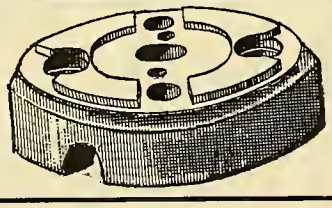

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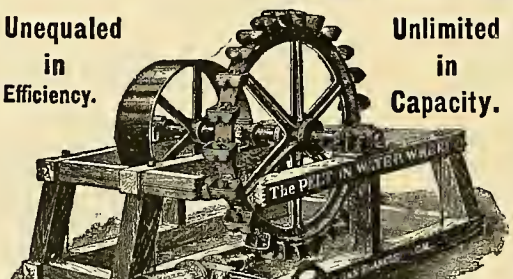

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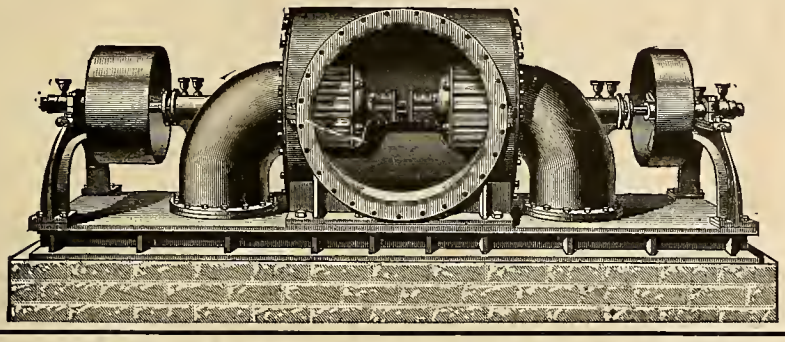

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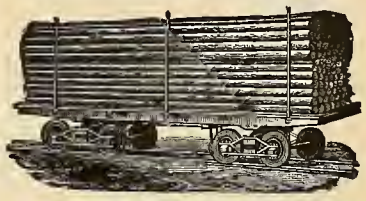

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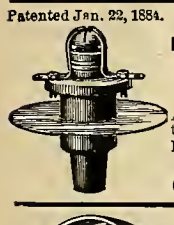

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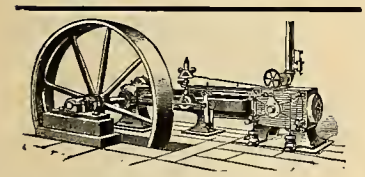

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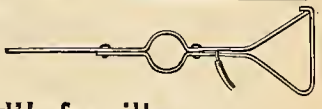

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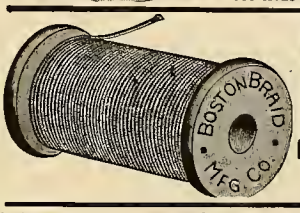

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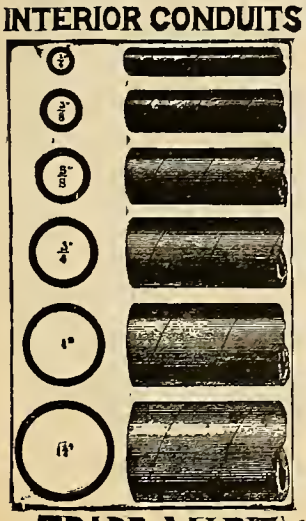

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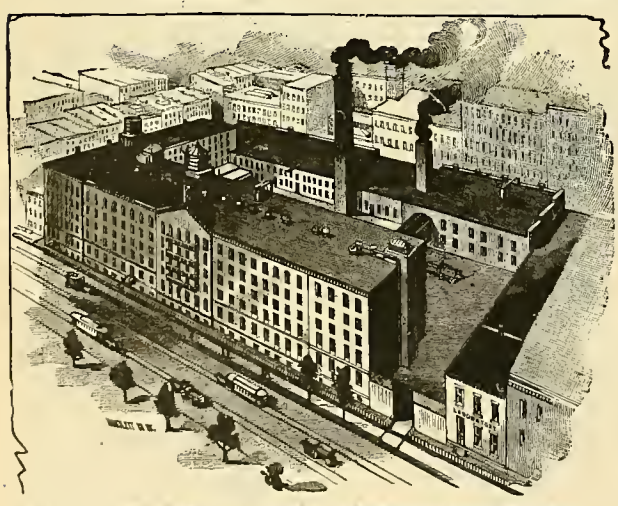

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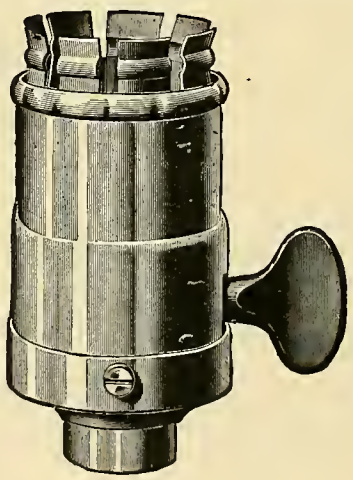

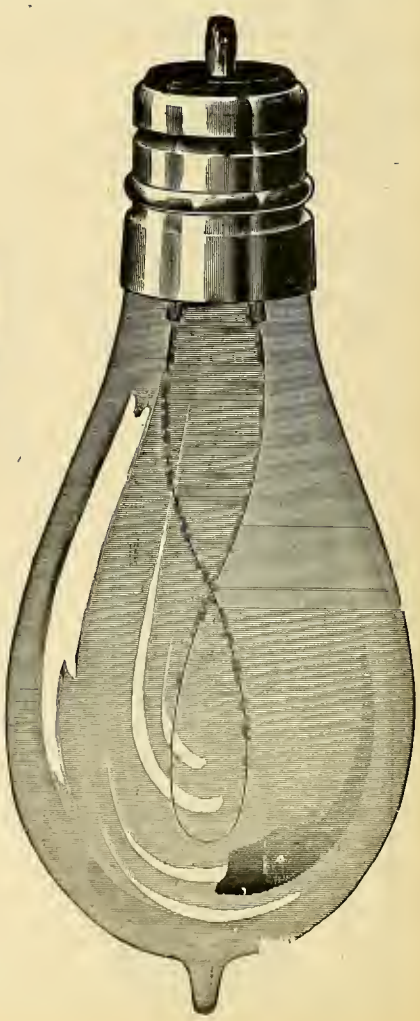

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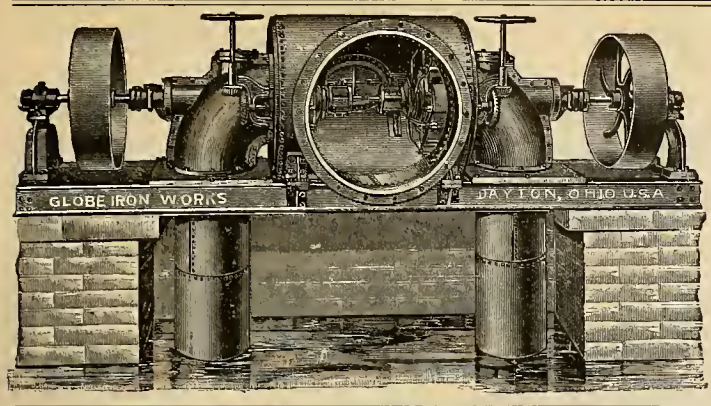

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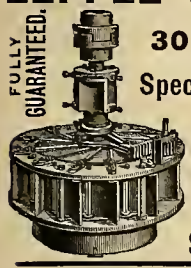

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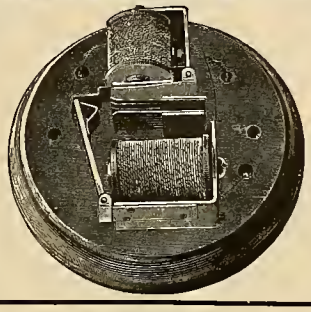

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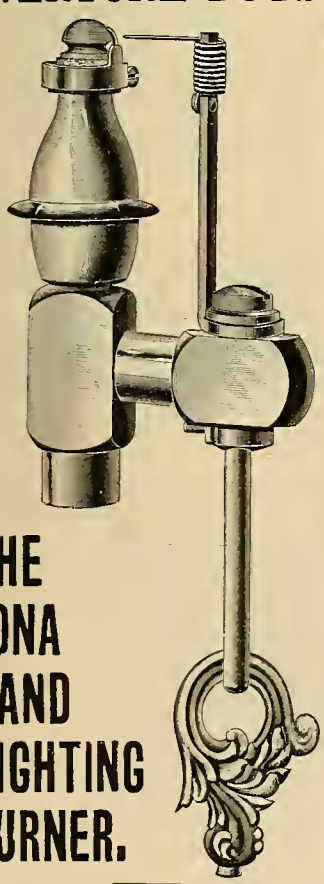

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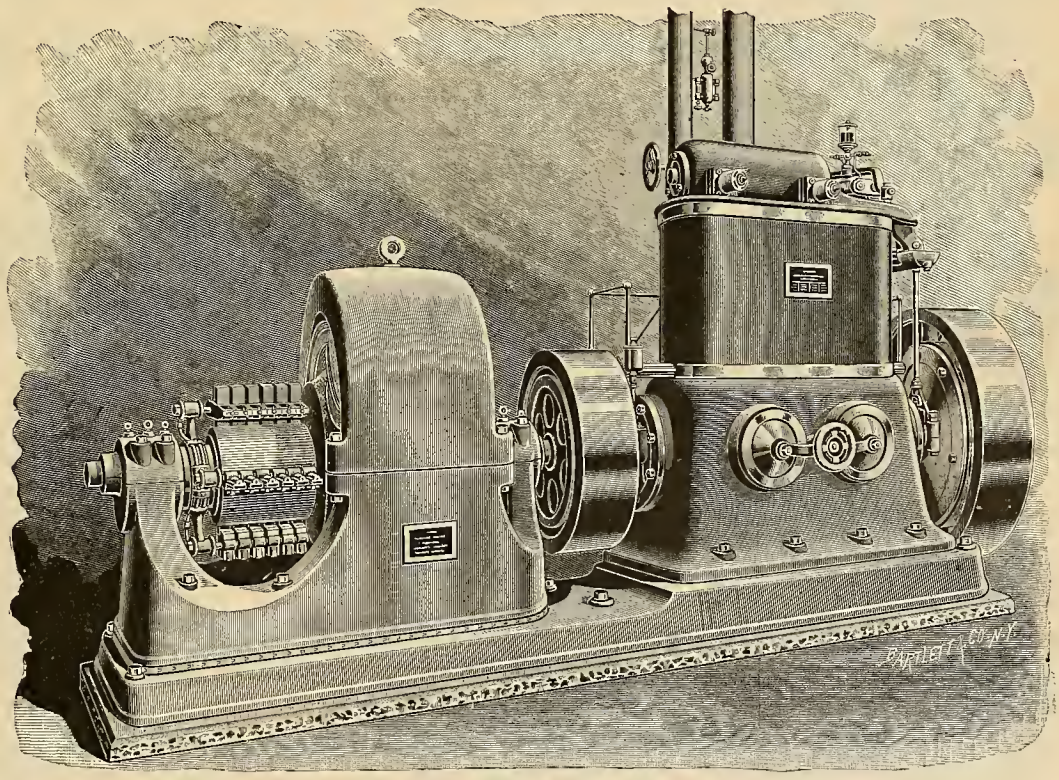

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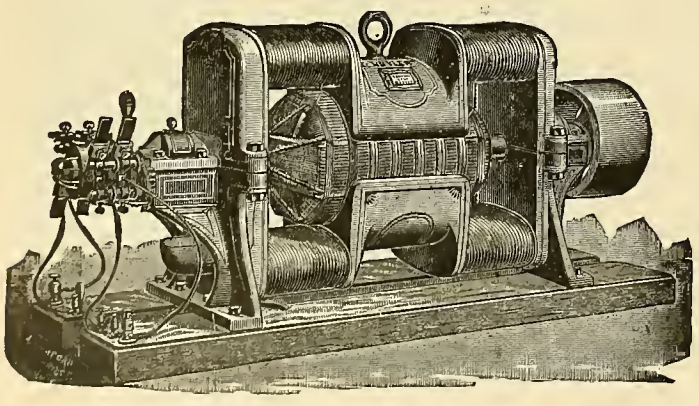

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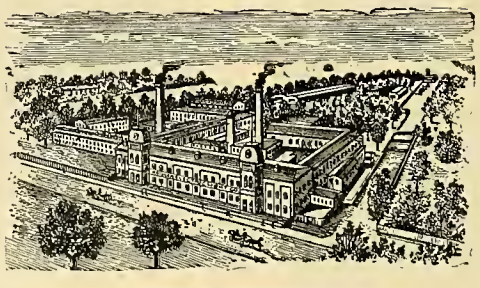

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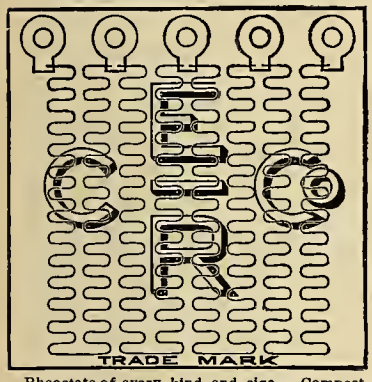

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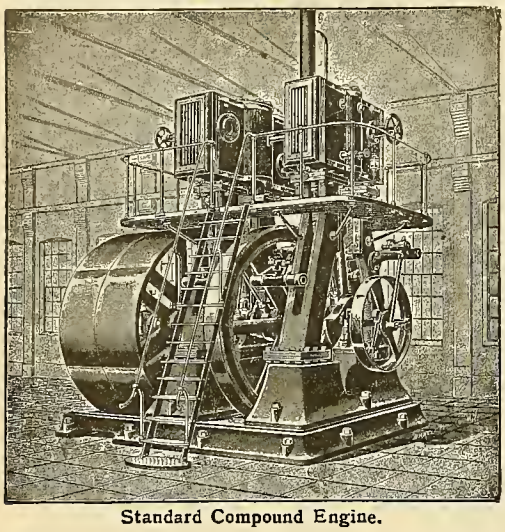

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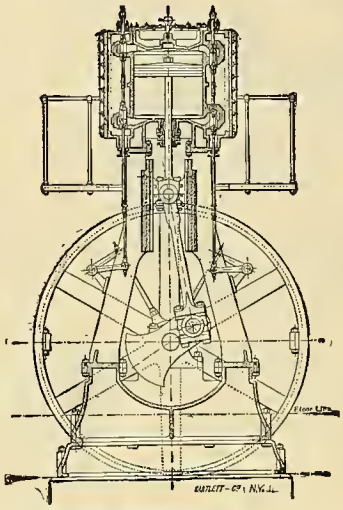

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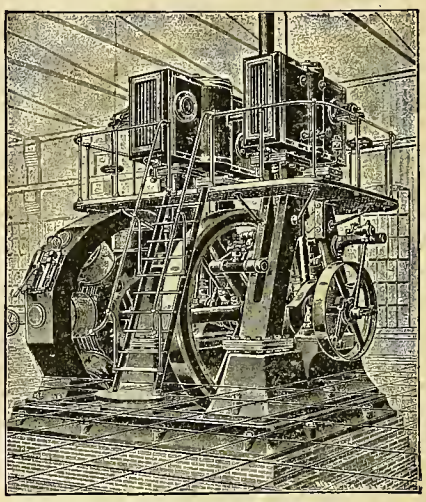

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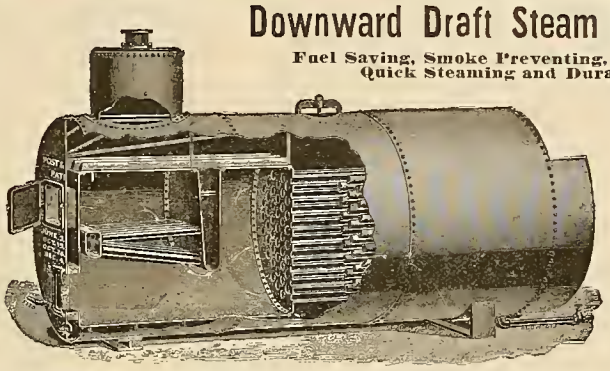

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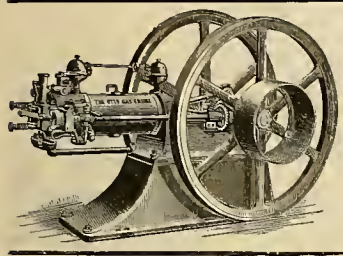

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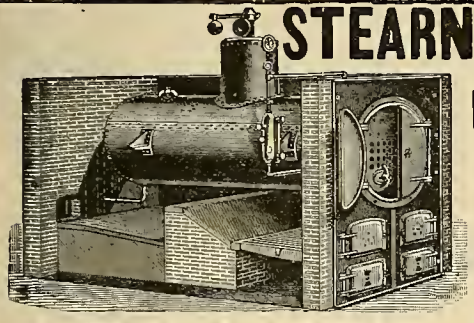

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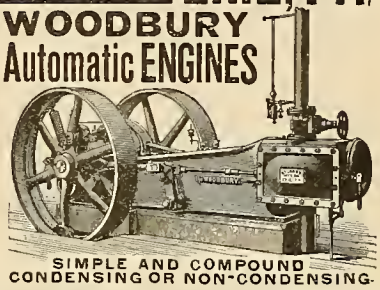

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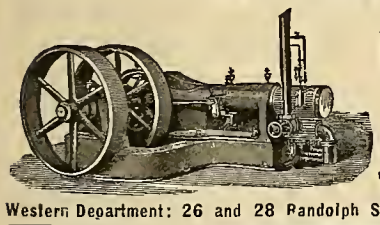

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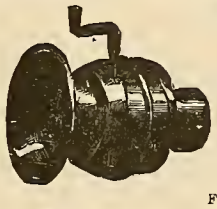

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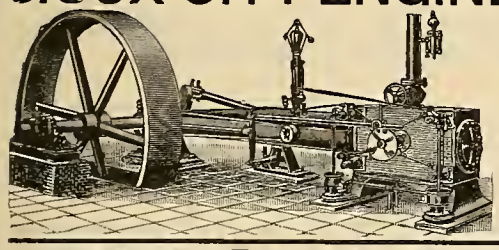

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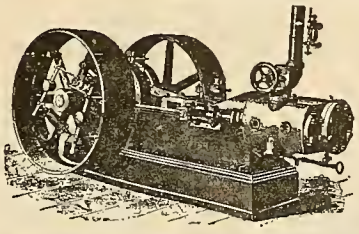

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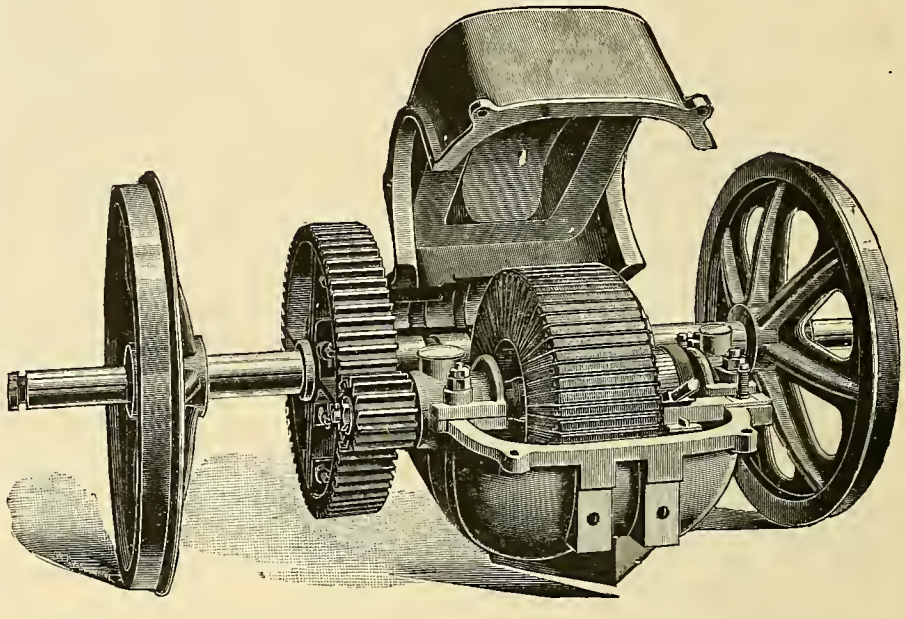

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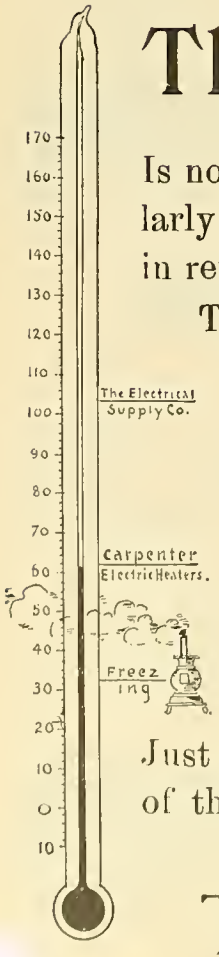

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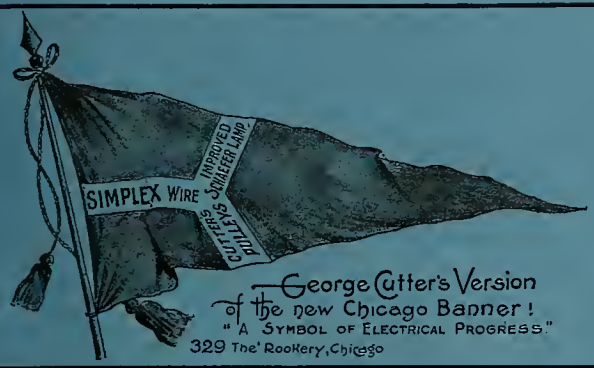

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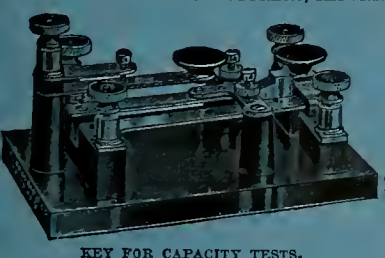

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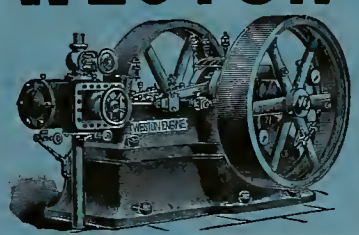

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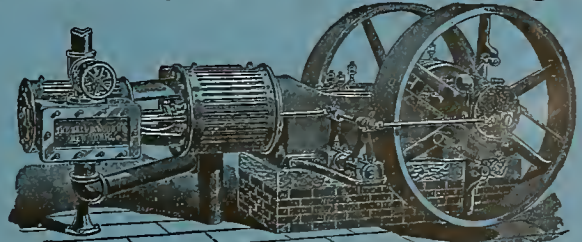

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Spokane, Wash.

INDEX AND CLASSIFICATION OF ADVERTISEMENTS.

ALPHABETICAL LIST.

American Battery Co..... ix
American Desk & Seating Co.. xvii
American Electrical Mfg. Co.. lx
American Engine Co..... xii
Andrews & Co., A. H.... ... ——
Babcock & Wilcox Co., The.... i
Baggot, E xlv
Baker & Co..... xii
Ball Engine Co..... xxi
Ball & Wood Co., The i
Beacon Vacuum Pump & Elec. Co.i
Becker Mfg. Co., John..... xiii
Beggs, J. E., Mch. & Supply Co xiv
Bernstein Electric Co..... xii
Blanchard, Albert..... ——
Boston Braid Mfg. Co..... xiv
Bowers Bros..... xix
Bridgeport Mach. Tool Wks.. ——
Brookfield, Wm..... xii
Brush Electric Co xix
Bryan, W. H.. xv
Bryant Electric Co..... xil
Buckeye Electric Co., The..... lx
Carpenter Enamel Rheostat Co. xix
Central Electric Co..... ... v
Chicago Rawhide Mfg. Co.... ——
Columbia Inc. Lamp Co..... ——
Columbia Mfg. & Supply Co.. xiii
Crescent Ins. Wire & Cable Co. xiii
Crocker-Wheeler Electric Co.. xiii
Cushing, F. W..... vii
Cutter, Geo..... i
Cutter Electrical & Mfg. Co...——
Dayton Globe Iron Works Co..xvii
Densmore Typewriter Co..... xii
Detroit Electrical Works.... xxvi
Diamond Electric Mfg. Co.... xii
d'Infreville, G..... xiv
Dixon Crucible Co., Jos..... xv
Dudley & Co., W. W..... xix
Duplex Electric Co., Ltd.....——
Eastern Electric Cable Co..... xiii
Eastman Kodak Co..... xiv
Edwards, W.S. Mfg. Co..... xvii
Electric Appliance Co xii
Electric Cons. & Supply Co... vi
Electric Engr'g & Supply Co.. iv
Electrical Mfg. Co., The..... vi
Electric Secret Service Co.... xxi
Electrician Pub. Co xvii, xviii, xxi
Electrical Construction Co., The. xiii
Electrical Eng. & Supply Co. The.—
Electrical Supply Co., The... xxiv
Elektron Mfg. Co..... xv
Empire China Works..... xvii
Enterprise Electric Co..... xix
Falls Rivet & Machine Co..... ix
Ferracute Machine Co..... xiv
Ford-Washburn Storelectro Co.. iv
For Sale Advertisements.
....xii, xiii, xiv
General Electric Co.... ii, xviii, xxii
Great Western Elec. Supply Co——
Greeley & Co., The E. S.....1
Gregory, Chas E..... xiii
Hart & Hegeman Mfg. Co..... xiv
Heisler Electric Co..... ——
Hill Clutch Works..... xxi
Hine Eliminator Co.... .. ...——
Holmes, Booth & Haydens.... x
Hood & Co., Wm..... vi
Hughes Bros. Mfg Co..... xvii
Ide & Son, A. L xiii
Illinois Electric Lamp Co..... x
India Rubber & G. P. Ins. Co. xxv
Institute of Technology..... xvil
Interior Conduit & Insulation Co viii
International Okonite Co..... i
Jewell Belting Co..... 1
Johns Mfg. Co., H. W.....xviii
Kartavert Mfg. Co..... xlx
Klipstein, A..... xiii
Knapp Electrical Works..... xxiii
Lake, J H. & D., Co .....——
Lake Erie Engineering Works. xx
Lane & Bodley Co.....——
La Roche Electric Works..... xv
Leclanche Battery Co., The .. x
Lefmann, Julius xv
Leffel, & Co., Jas..... xvii
Link Belt Machinery Co..... xiii
Loud, H. M. & Sons Lumber Co. xiv
Mather Electric Co iv
Midland Electrical Wks..... xii
Moore, Alfred F..... i
Morse & Co., A. M..... .. xiv
Mosher Electric Co..... ——
Munsell & Co., Eugene..... xii
National Carbon Co.... x
National Electric Mfg. Co.... ——
National India Rubber Co.... ——
New York Insulated Wire Co. xix
N. Y. Safety Steam Power Co xiv
New York & Ohio Co..... 1
Otto Gas Engine Works..... ——
Osborne Steam Engineering Co. xiii
Ostrander & Co., W. R..... xxi
Page Belting Co..... iv
Partrick & Carter Co..... ——
Pearson & Co., W. B..... xx
Pelton Water Wheel Co..... x
Penn. Electric Engineering Co x
Perkins Elec. Switch Mfg. Co.——
Phoenix Glass Co..... xxi
Porter-Leavitt Elec. Motor Co. xiii
Queen & Co..... xiii
Racine Hardware Mfg. Co.... ——
Railway Equipment Co.....vi, lx
Redding Electric Co..... xvii
Rice Electric Specialty Co..... x
Roebling's Sons Co., J. A ....——
Rose Elec. Light Supply Co.... xii
Samson Cordage Works. xii
Sawyer-Man Electric Co..... xvi
Schuyler Electric Co..... viii
Sechrist, Albert..... xvii
Shawmut Fuse Wire Co..... x
Shultz Belting Co..... iv
Siebert, G..... ——
Siemens & Halske Electric Co. ix
Sioux City Elec. Supply Co...——
Sioux City Engine Works.... xxi
Smith, A. T..... .....——
Smith, Thos. G. Jr.....——
Sperry Elec. Mining Mach. Co. xix
Standard Electric Co..... xxvi
Standard Paint Co x
Stanley Electric Mfg. Co..... v
Stearns Mfg. Co..... xxi
Steuben Lamp Works..... xiii
Sterling, W. C..... xv
Stilwell & Bierce Mfg. Co. xlv, xv
Sturm, Ernst..... xv
Sunbeam Incand. Lamp Co.. xxv
Taylor Engine Co..... ——
Taylor, Goodhue & Ames.. viii
Union Hardware Co..... xii
Utica Elec. Mfg. & Supply Co. x
Van Nuis C. S..... i
Vulcanized Fibre Co..... xv
Waddell-Entz Company..... xii
Wannopee Pottery Co.....xviii
Washburn & Moen Mfg. Co.. lv
Western Electric Co.....xiv
Westinghouse, Church, Kerr & Co..... xx
Westinghouse Elec. and Mfg Co..... xi, xvi
Weston Engine Co..... i
Woodhouse & Rawson, Ltd....xvii
Worthington, Henry R..... xii
Wrigley, Thos..... viii

CLASSIFIED LIST.

Annunciators.
Central Electric Co.
Detroit Electrical Works.
Electrical Supply Co., The.
Knapp Electrical Works.
Ostrander & Co., W. R.
Partrick & Carter Co.

Arc Lamps.
Beggs, J. E., Mchy. & Supply Co.
Duplex Electric Co., Ltd.
Electric Cons. & Supply Co.
General Electric Co.
Knapp Electrical Works.
Mosher Electric Co.
Rose Electric Light Supply Co.
Schuyler Electric Co.
Siemens & Halske Electric Co.
Standard Electric Co.
Westinghouse Electric & Mfg. Co.
Western Electric Co.

Arc Light Cord.
Knapp Electrical Works.
Samson Cordage Works.

Batteries.
American Battery Co.
Detroit Electrical Works.
Electrical Supply Co., The.
Ford Washburn Storelectro Co.
Greeley & Co., The E. S.
Knapp Electrical Works.
Leclanche Battery Co., The.
Partrick & Carter Co.
Western Electric Co.

Battery Jars.
American Battery Co.
Central Electric Co.
Detroit Electrical Works.
Electrical Supply Co., The.
Knapp Electrical Works.
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Bells, Electric.
Central Electric Co.
Detroit Electrical Works.
Electrical Supply Co., The.
Greeley & Co., The E. S.
Knapp Electrical Works.
Ostrander & Co., W. R.
Partrick & Carter Co.
Taylor, Goodhue & Ames.
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Bells, Magneto.
Central Electric Co.
Detroit Electrical Works.
Greeley & Co., The E. S.
Knapp Electrical Works.
Partrick & Carter Co.
Western Electric Co.

Belting.
Chicago Rawhide Mfg. Co.
Jewell Belting Co.
Link Belt Machinery Co.

Boilers.
Babcock & Wilcox Co., The.
Blanchard, Albert.
Lane & Bodley Co., The.
N. Y. Safety Steam Power Co.
Stearns Mfg. Co.
Weston Engine Co.

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Central Electric Co.
Detroit Electrical Works.
Electric Appliance Co.
Electrical Supply Co., The.
Greeley & Co., The E. S.
Knapp Electrical Works.
Partrick & Carter Co.

Cables.
(See Insulated Wires.)

Cables, Electric. (See Insulated Wires), **Copper, Sheet and Bar.**
Moore, Alfred F.
Roebling's Sons Co., J. A.
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Smith, Thos. G. Jr.
Western Electric Co.

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American Engine Co.
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Bryan, W. H.
Brush Electric Co.
Detroit Electrical Works.
Diamond Electric Mfg. Co.
Ford-Washburn Storelectro Co.
General Electric Co.
Great Western Electric Supply Co.
Heisler Electric Co.
Lake Erie Engineering Works.
Lane & Bodley Co., The.
La Roche Electric Works.
Lefmann, Julius.
Mather Electric Co.
Morse & Co., A. M.
N. Y. Safety Steam Power Co.
Osborne Steam Engineering Co.
Pearson & Co., W. B.
Racine Hardware Mfg. Co.
Siemens & Halske Electric Co.
Sioux City Engine Works.
Smith, Thos. G. Jr.
Standard Electric Co.
Waddell-Entz Company.
Westinghouse Electric & Mfg. Co.
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Washburn & Moen Mfg. Co.
Weston Engine Co.

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Crescent Ins. Wire & Cable Co.
Cutter, Geo.
Detroit Electrical Works.
Electrical Supply Co., The.
Enterprise Electric Co.
Holmes, Booth & Haydens.
International Okonite Co., The.
Knapp Electrical Works.
Moore, Alfred F.
National India Rubber Co.
Roebling's Son's Co., J. A.
Sperry Elec. Mining Machine Co.
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Washburn & Moen Mfg. Co.
Western Electric Co.

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Central Electric Co.
Detroit Electrical Works.
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Hughes Bros. Mfg. Co.
Knapp Electrical Works.
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Mather Electric Co.
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Schuyler Electric Co.
Siemens & Halske Electric Co.
Standard Electric Co.
Waddell-Entz Company.
Western Electric Co.
Westinghouse Electric & Mfg. Co

Electric Lava Gas Tips.
Smith, A. T.

Electric Railways.
Detroit Electrical Works.
General Electric Co.
Siemens & Halske Electric Co.
Westinghouse Electric & Mfg. Co

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Osborne Steam Engineering Co.

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Greeley & Co., The E. S.
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Central Electric Co.
Cutter, Geo.
Cutter Electrical & Mfg. Co.
Detroit Electrical Works.
d'Infreville, G.
Electric Appliance Co.
Electric Cons. & Supply Co.
Electric Eng. & Supply Co.
Electrical Eng. & Supply Co., The.
Electrical Manufacturing Co., The.
Electrical Supply Co., The.
Enterprise Electric Co.
General Electric Co.
Great Western Electric Supply Co.
Greeley & Co., The E. S.
Hart & Hegeman Mfg. Co.
Hood & Co., Wm.
Klipstein, A.
Knapp Electrical Works
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Redding Electric Co.
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Brookfield, Wm.
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Electric Engineering & Supply Co.
Electrical Supply Co., The.
Empire China Works.
Enterprise Electric Co.
General Electric Co.
Hart & Hegeman Mfg. Co.
Interior Conduit & Insulation Co
International Okonite Co., The
Johns Mfg. Co., H. W.
Kartavert Mfg. Co.
Knapp Electrical Works.
Lefmann, Julius.
Moore, Alfred F.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co
Standard Paint Co.
Taylor, Goodhue & Ames.
Utica Elec. Mfg. & Supply Co.
Vulcanized Fibre Co.
Wannopee Pottery Co.

Insulated Wires and Cables. Magnet Wire.
American Electrical Mfg. Co.
Central Electric Co.
Crescent Ins. Wire & Cable Co.
Cushing, F. W.
Cutter, Geo.
Detroit Electrical Works.
Eastern Electric Cable Co.
Electric Appliance Co.
Electrical Supply Co., The.
Enterprise Electric Co.
General Electric Co.
Great Western Electric Supply Co.
Holmes, Booth & Haydens.
International Okonite Co., The.
India Rubber & G. P. Ins. Co.
Knapp Electrical Works
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Roebling's Sons Co., J. A.
Shawmut Fuse Wire Co.
Sperry Elec. Mining Machine Co.
Waddell-Entz Company.
Washburn & Moen Mfg. Co.
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American Electrical Mfg. Co.
Beacon Vacuum Pump & Elec. Co.
Bernstein Electric Co.
Bockeye Electric Co.
Central Electric Co.
Columbia Inc. Lamp Co.
Cutter Electrical & Mfg. Co.
Electric Appliance Co.
Electrical Eng. & Supply Co., The.
Electrical Manufacturing Co., The.
Electrical Supply Co., The.
General Electric Co.
Hood & Co., Wm.
Illinois Electric Lamp Co.
Knapp Electrical Works.
New York and Ohio Co.
Penn. Electric Engineering Co,
Redding Electric Co.
Sawyer-Man Electric Co.
Steuben Lamp Works.
Sunbeam Incandescent Lamp Co.
Taylor, Goodhue & Ames.

Lathes.
Bridgeport Machine Tool Works.

Lightning Arresters.
Knapp Electrical Works.
Van Nuis, C. S.

Magnet Wire.
(See Insulated Wires.)

Mechanical Machinery.
Ferracute Machine Co.
Bridgeport Machine Tool Works.

Medical Batteries.
Detroit Electrical Works.
Partrick & Carter Co.

Mica.
Bowers Bros.
Johns Mfg. Co., H. W.
Munsell & Co., Eugene.

Milling Machinery.
Becker Mfg. Co., John.

Mine Signals, Electric.
Detroit Electrical Works.

Mining Apparatus, Electric
General Electric Co.
Sperry Elec. Mining Machine Co.
Westinghouse Electric & Mfg. Co.

Model Making.
Columbia Mfg. & Supply Co.
Midland Electrical Wks.

Motors.
Brush Electric Co.
Crocker-Wheeler Electric Co.
Detroit Electrical Works.
Electrical Eng. & Supply Co., The.
Ford-Washburn Storelectro Co.
General Electric Co.
Great Western Electric Supply Co.
Knapp Electrical Works.
La Roche Electric Works.
Mather Electric Co.
Porter Leavitt Electric Motor Co.
Siemens & Halske Electric Co.
Waddell-Entz Company.
Westinghouse Electric & Mfg. Co.

Name Plates.
Becker Mfg. Co., John.

Office Furniture.
American Desk & Seating Co.
Andrews & Co., A. H.

Pins and Brackets.
Central Electric Co.
Electrical Supply Co., The.
Hughes Bros. Mfg. Co.
Lefmann, Julius.
Loud, H. M. & Sons Lumber Co
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Siebert, G.

Poles.
Electrical Supply Co., The.
Lefmann, Julius.
Loud, H. M. & Sons' Lumber Co
Railway Equipment Co.

Porcelain.
Empire China Works.
Wannopee Pottery Co.

Publishers, Electrical
Electrician Publishing Co.

Push Buttons.
Detroit Electrical Works.
Central Electric Co.
Electrical Supply Co., The.
Knapp Electrical Works.
Union Hardware Co.
Western Electric Co.

Railways, Electric.
(See electric railways.)

Regulating Sockets.
Ries Electric Specialty Co.

Rheostats.
Carpenter Enamel Rheostat Co.

Separators, Steam.
Hine Eliminator Co.

Silk Braid.
Boston Braid Mfg. Co.

Speaking Tubes.
Central Electric Co.
Electrical Supply Co., The
Knapp Electrical Works
Ostrander & Co., W. R.
Western Electric Co.

Speed Indicators.
Queen & Co.

Steam Pumps.
Worthington, Henry R.

Supplies, Electric Railway.
Detroit Electrical Works.
Electric Appliance Co.
Lefmann, Julius.
Railway Equipment Co.

Tapes, Insulating.
Central Electric Co.
Cushing, F. W.
Crescent Ins. Wire & Cable Co.
Electrical Supply Co., The.
India Rubber & G. P. Ins. Co
International Okonite Co., The.
Knapp Electrical Works.
New York Insulated Wire Co.
Standard Paint Co.
Washburn & Moen Mfg. Co.

Telegraph Apparatus.
Central Electric Co.
Electric Secret Service Co.
Electrical Supply Co., The.
Greeley & Co., The E. S.
Knapp Electrical Works.
Western Electric Co.

Telephones, Electric.
Detroit Electrical Works.
Western Electric Co.

Test Instruments.
Central Electric Co.
Electrical Supply Co., The.
Greeley & Co., The E. S.
Knapp Electrical Works.
Queen & Company.
Western Electric Co.

Transformers.
Diamond Electric Mfg. Co.
National Electric Manufacturing
Stanley Electric Mfg. Co.
Westinghouse Electric & Mfg Co.

Trolley Cord.
Samson Cordage Works.

Trucks, Electric Car.
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Westinghouse Electric & Mfg. Co.

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Dayton Globe Iron Works Co.
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Typewriters.
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Wire, Rare.
Central Electric Co.
Crescent Ins. Wire & Cable Co.
Electrical Supply Co.
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—ESTABLISHED 1831.—

WASHBURN & MOEN MANUFACTURING COMPANY.

MAKERS OF IRON, STEEL AND COPPER, and Manufacturers of IRON, STEEL AND COPPER WIRE for all Purposes

Oldest and Largest Manufacturers of Electrical Wires in the World.

Bare and Insulated Copper Wire

FOR ELECTRICAL PURPOSES.

Galvanized Iron and Steel Telegraph Wire.

Magnet Wire. Annunciator Wire.

Feed Wire.

LEAD ENCASED WIRES.

HARD DRAWN COPPER TROLLEY WIRE.

Rubber, Weather-Proof and Underwriter's Wire.

ABSOLUTELY

FIRE and WATER-PROOF WIRE,

Superio to

Anything Heretofore Made.

WORKS { WORCESTER, MASS. WAUKEGAN, ILL.

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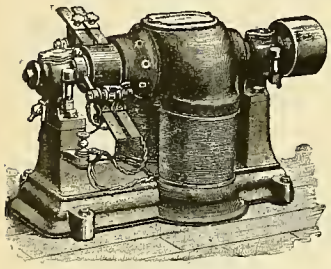
THE FORD-WASHBURN STORELECTRO CO.,



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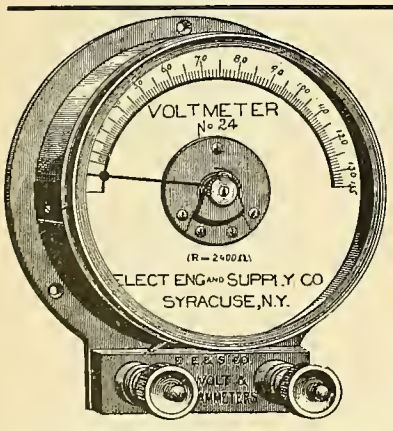
Storage Batteries,

DYNAMOS AND MOTORS.

SUCCESS GUARANTEED.

CLEVELAND, - OHIO.



E. E. & S. Volt and Ammeter.

These instruments excel in

Durability,
Accuracy,
Economy of Power,
Dead-Beatness and
Good Finish.

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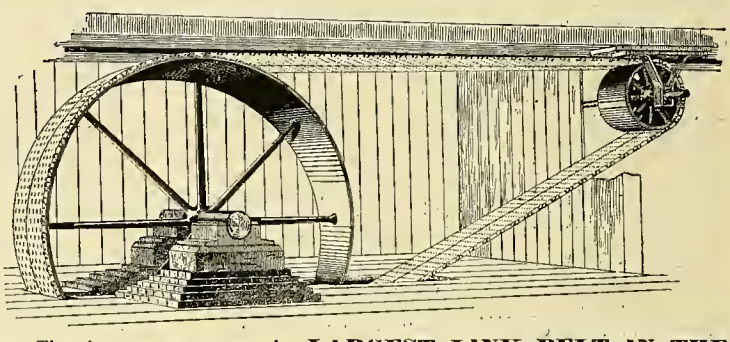
New York Office, 126 Liberty St. SEND FOR CATALOGUE.



The above cut represents the **LARGEST LINK BELT IN THE WORLD** in actual operation in the engine room of a large plant at Rapid City, Sonth Dakota. It is an **ACME** link, 181 feet long, 28 inches wide, and contains over 185,000 pieces, weighing, when ready for shipment, 1,656 pounds.

THE **ACME** IS MADE ONLY BY

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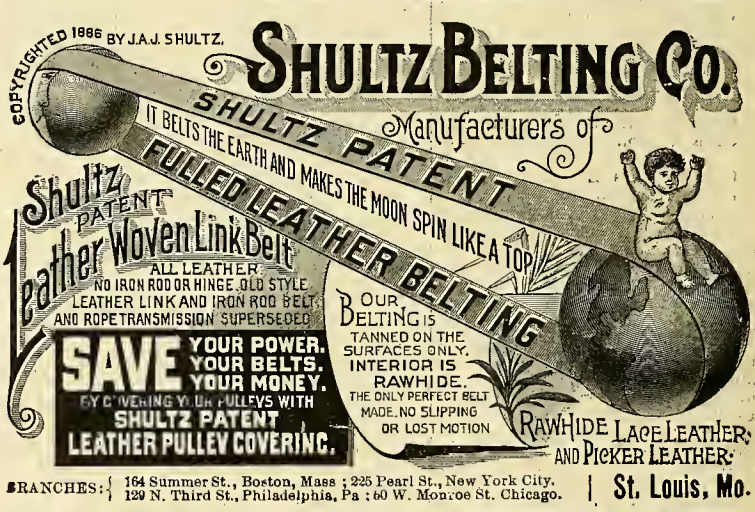
FACTORY: CONCORD, N. H.
Write us for prices and descriptive circular.

Branches: { New York, Chicago, Boston, San Francisco.



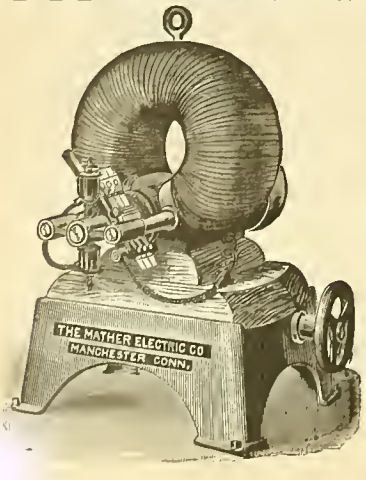
BRANCHES: { 164 Summer St., Boston, Mass; 225 Pearl St., New York City. 129 N. Third St., Philadelphia, Pa; 60 W. Monroe St. Chicago.

St. Louis, Mo.

THE MATHER ELECTRIC COMPANY,

Factory: Manchester, Conn.,

MANUFACTURERS OF



DYNAMOS, MOTORS and GENERATORS, CENTRAL STATION and STEAMSHIP LIGHTING.

The Mather System of Power Transmission and the Mather System of Electric Lighting are Unsurpassed.

INDEPENDENCE! PROMPTNESS! RELIABILITY!

Western Office, 161 and 163 Randolph St., Chicago.

The Redding Electric Company of Boston has recently brought out an improved socket for incandescent lamps, also a porcelain rosette, which can be put up without the use of a screw driver, the outside cap being adjustable by a half turn. The name of the rosette is the "Iona," and the

CENTRAL ELECTRIC COMPANY,

116 and 118 Franklin St., Chicago,

have been appointed Western Agents, and have gotten in a big stock of these, and can fill all orders promptly at low prices.

The use of this rosette will save the construction man time and money.

Central Electric Company,

116 and 118 Franklin Street, Chicago.

HEADQUARTERS FOR GENERAL ELECTRICAL SUPPLIES.

DON'T BUY

The transformers you will need this Fall until you have had our prices and fully considered our claims on your patronage.

The Continued Prosperity

Of Lighting Companies is threatened by attempts to completely control this business on the part of one or two great corporations

Protect Yourselves

By supporting every legitimate manufacturing enterprise which can furnish you with good apparatus and which has the courage to be independent.

Our Transformer is the Best.

STANLEY ELECTRIC MFG. CO.,

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Corner Randolph Street and Michigan Avenue, Chicago, Ill.

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The Pioneer Electric Heating Company.

RAILWAY EQUIPMENT CO.,

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Ahearn Electric Heater,

The Only Fully Demonstrated Successful Electric Heater for

HEATING ELECTRIC CARS and RESIDENCES.

Private Houses, Offices and Bakeries

COMPLETELY FITTED FOR HEATING AND COOKING.

WRITE FOR PARTICULARS.

BRILLIANT! BRILLIANT! BRILLIANT!

HIGH GRADE INCANDESCENT LAMPS.

THE ELECTRICAL MFG. COMPANY, OCONTO, WIS.

Lamps for all Systems. **Any Voltage or Candle Power.**

DIRECT CURRENT LAMPS.
ALTERNATING CURRENT LAMPS.
RAILWAY CIRCUIT LAMPS.

FILAMENTS WITH OR WITHOUT HOOKS.
MINIMUM CURRENT CONSUMPTION, with
MAXIMUM CANDLE POWER AND LIFE.

Before purchasing elsewhere send in a trial order for Brilliants.
Lamps furnished to consumers in quantities at factory prices.

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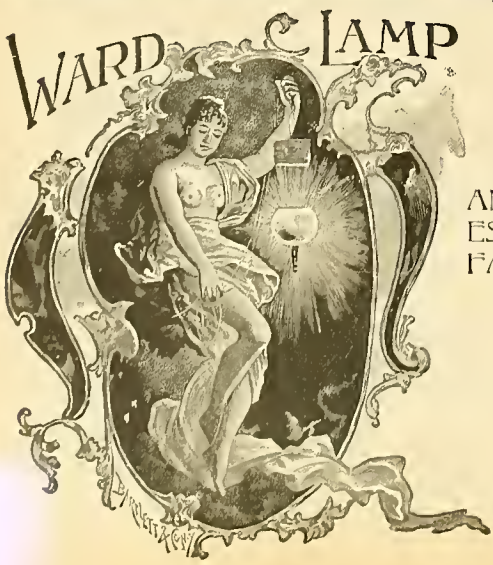
MILWAUKEE:—E. C. Mullen, Manager.
THOMASVILLE, GA.:—J. B. E. Love, Manager.

MANUFACTURERS ORGANIZED 1881. INCORPORATED 1883.



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FOR INCANDESCENT AND STREET RAILWAY CIRCUITS.

AN ESTABLISHED FACT: THE ONLY ARC LAMP THAT WORKS SATISFACTORILY ON AN INCANDESCENT CIRCUIT.

SPECIAL APPLICATIONS:
PHOTO-ENGRAVING, THEATRICAL, AND SEARCH LAMPS.

Search Light No. 13.

THE ELECTRIC CONSTRUCTION & SUPPLY CO.

UNITY BUILDING, CHICAGO. TELEPHONE BUILDING, NEW YORK.

12,672,000 Feet.

The largest order ever given in this country for high grade insulated wire. The New York Central Railroad has just ordered

300 Miles of 8 Conductor

Kerite Insulated Cable for their block signal system between Albany and Buffalo.

THIS MEANS SOMETHING.

THE BEST INSULATION
IS

THE OLDEST RUBBER COVERED WIRE ON THE MARKET
IS

The Old Reliable.

THE MOST ACID-PROOF INSULATION
IS

THE INSULATION THAT HAS STOOD THE LONGEST LIFE TEST
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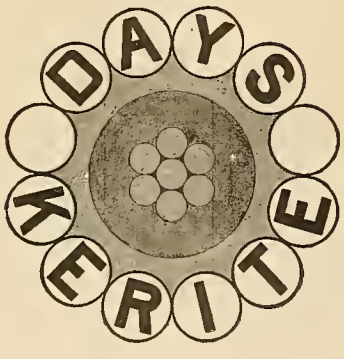

W. R. BRIXEY, General Manager and Eastern Agent,
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Burton Electric Car Heater.

FIRST IN THE FIELD AND STILL IN THE LEAD.

Now In Use On Over One Hundred Roads.

Indorsed in unmeasured terms by Managers of Electric Roads and Former Selling Agents.

The only Electric Heater which has successfully stood the test of time and passed the experimental stage.

Officers of Electric Roads are requested to see that when their orders read "Burton Heaters" no other make is substituted.

FOR PRICES AND FULL INFORMATION ADDRESS,

TAYLOR, GOODHUE & AMES,

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General Selling Agents,
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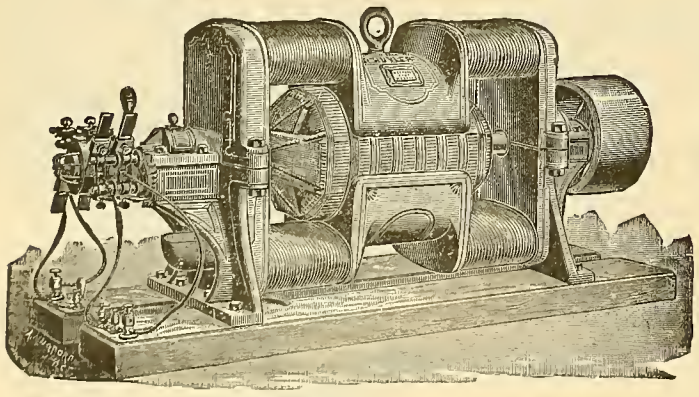
THE SCHUYLER

—SYSTEM OF—

ARC LIGHTING

CONTAINS THE FOLLOWING IMPORTANT FEATURES:



Instantaneous and Automatic Regulation.

Self-Lubricating Boxes.

Ventilated Armature, proof against a burn-out.

A Pure White Steady Light.

THE SCHUYLER ELECTRIC CO.,

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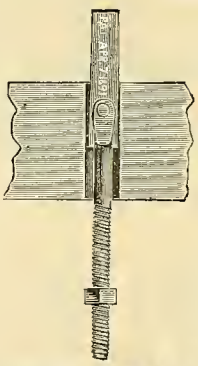


TOGGLE BOLTS.

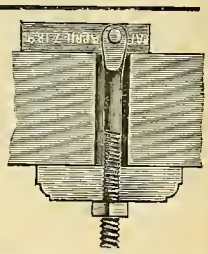
For Holding in Place

TELEPHONE and ELECTRIC LIGHT

FIXTURES

ON HOLLOW TILE AND WALLS.

Metallic Ceilings, Gas Pipes, Electroliers, etc.



The undersigned desires to notify the trade that he is the sole owner of the patents for Toggle Bolts, used for the purposes named above, or for any similar use. No rights to manufacture have been given out under these patents, and any one making or using these bolts will be held liable for infringement. Any one furnishing information that will lead to the detection of any person fraudulently using this invention will be rewarded. All Toggle Bolts are stamped with date of patent. The trade supplied at liberal discounts. Address

THOS. WRIGLEY, Inventor and Sole Owner, 85 and 87 Fifth Ave., CHICAGO.

BINDERS —FOR THE— WESTERN ELECTRICIAN, ONE DOLLAR.

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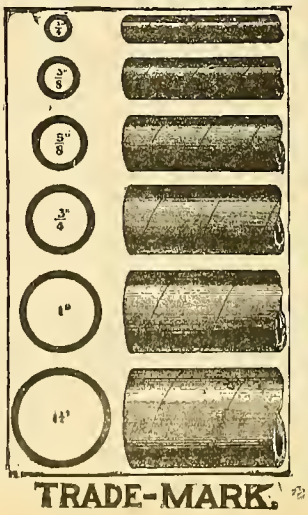

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The Solution of the Problem of Safe Guarding

ELECTRIC CONDUCTORS

Wherever and for whatsoever purpose employed, is to be found in the

CONDUIT SYSTEM.

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CONDUITS

MANUFACTURED BY

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Southern Electrical Mfg. & Supply Co., 110 Baronne St., New Orleans, La.
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Electrical Machinery.

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MANUFACTURERS OF

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STORAGE BATTERY.

DRY BATTERIES, BATTERY SUPPLIES, ETC.

The Best Traction Battery in the World.

Storage Batteries for Street Cars, Electric Lighting, Electric Launches, Electric Fans, Phonographic and Surgical Use, Etc., Etc.

Electromotive Force High; Life Long.

This Battery is made by the Planté process, no oxides being used, either mechanically or applied in the form of paste, paint or cement.

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RAILWAY EQUIPMENT CO.,

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Electric Railway Supplies

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Prompt Shipments.

CATALOGUES AND ESTIMATES FURNISHED.

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W. R. MASON, Gen'l Mgr. CHICAGO.

For Long Life, High Efficiency, Full Candle Power and Freedom from Discoloring.

American

INCANDESCENT LAMPS

ARE PRONOUNCED BY ALL WHO HAVE TRIED THEM TO BE THE BEST.

OUR SPECIAL RAILWAY LAMPS ARE UNEQUALED.

SEND FOR SAMPLES AND PRICES.

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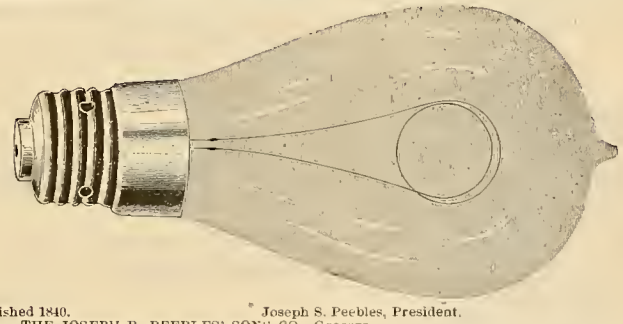
2011 TO 2017 PINE STREET, ST. LOUIS, MO.



Established 1840. Joseph S. Peebles, President.

THE JOSEPH R. PEEBLES' SONS CO., Grocers, 69-73 West Fourth Street, CINCINNATI, August 16, 1892.

BUCKEYE ELECTRIC CO.:

DEAR SIRS:—It affords us great pleasure to add our recommend for the **BUCKEYE** Electric Lamp. In our large store, where we use hundreds of them, we have made a test of all the leading lamps that are made in this country, and we have no hesitancy in stating that after the most severe test that we could give the lamps (considering quality and price), the **BUCKEYE** Lamp is the **BEST** Lamp we have thus far been able to test. Yours respectfully,

P. S.—Please note this is **not** a **"Disinterested Test."**

THE JOSEPH R. PEEBLES' SONS CO., Joseph S. Peebles, President

THE BUCKEYE ELECTRIC CO., CLEVELAND.

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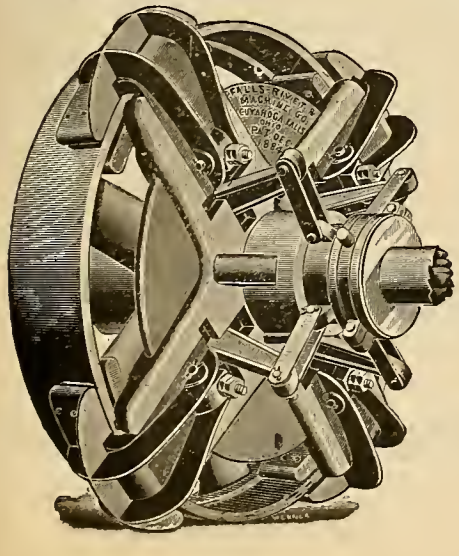

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CUYAHOGA FALLS, OHIO.

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Friction Clutches,

SHAFTING, ETC.

Special attention given to the Complete Equipment of Electric Plants.

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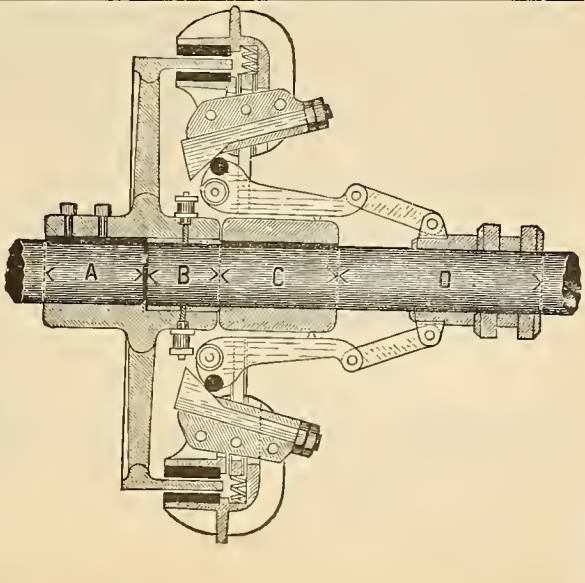

THE RIES REGULATING SOCKET

FOR ALTERNATING CURRENT INCANDESCENT LAMPS, IS BEING UNIVERSALLY ADOPTED.

THE RIES ELECTRIC SPECIALTY CO., Sole Patentees and Manufacturers, BALTIMORE, MD.

THE PENNSYLVANIA LAMP.

ACKNOWLEDGED TO HAVE THE HIGHEST MERIT IN ALL THE RECENT COMPETITIVE TESTS.

INCANDESCENT LAMPS, 8 TO 300 CANDLE POWER. ALL VOLTAGES AND BASES ALWAYS IN STOCK.

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Insulating Compounds, Tape and Armature Varnish.

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NOVELTY ELECTRIC CO., Philadelphia,
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And Supply Houses Everywhere.

Utica Electrical Mfg. & Supply Co.,

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"HERCULES" SWITCHES for Arc and Power Circuits.
"UTICA" QUICK BREAK—ABSOLUTE LOCK—KNIFE SWITCHES for any voltage and amperes.
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CARBON BRUSH HOLDERS for Generators, Motors and Dynamos.
CARBON HOLDERS, CIRCUIT JUMPERS and CONNECTORS.
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HIGHEST GRADE
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SEND FOR CATALOGUE
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Factories: Waterbury, Conn. - - 25 Park Place, New York.

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Bare and Insulated Wire.

Underwriters' Copper Electric Light Line Wire, Copper Magnet Wire, Flexible Silk, Cotton and Worsted Cords for Incandescent Lighting. Round and Flat Copper Bars for Station Work. Insulated Iron Pressure Wire.

TRADE MARK "K.K."

PATENT "K. K." LINE WIRE

For Electric Light, Electric Railways, Motors, Telegraph and Telephone Use.

Agents for the Washington Carbon Company. Carbons for Arc Lighting.

THE GREAT WESTERN ELECTRIC SUPPLY COMPANY, CHICAGO, - - SELLING AGENTS.

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THE STANDARD OPEN CIRCUIT BATTERIES OF THE WORLD.
And the best made anywhere.
SEND FOR CIRCULAR & PRICES.

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111 to 117 East 131st St., N. Y.

ELECTRIC LIGHT AND BATTERY CARBONS.

THE NATIONAL CARBON CO.

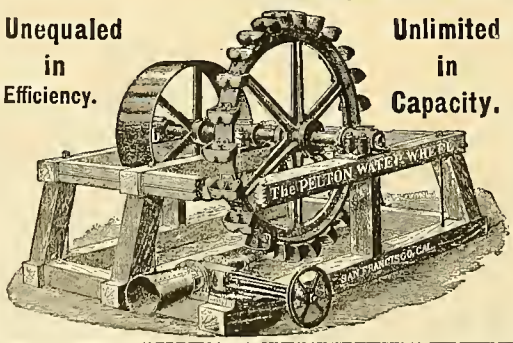
CLEVELAND, OHIO.

MOTOR BRUSHES.

THE PELTON WATER WHEEL

Gives the Highest Efficiency of any Wheel in the World. Over 2,000 in use.

Unequaled in Efficiency.



Unlimited in Capacity.

Affords the most simple and reliable power for all mining and manufacturing machinery. Adapted to heads running from 20 up to 2,000 or more feet. From 20 to 30 per cent. better results guaranteed than can be produced from any other Wheel in the country.

ELECTRIC TRANSMISSION.

The advantages the Pelton Wheel affords in the way of a uniform and reliable power, close regulation and the facility of adaptation to varying conditions of speed and pressure, have brought it into special prominence and extensive use for this class of work. All applications should state amount and head of water power required, and for what purpose, with approximate length of pipe line. SEND FOR CATALOGUE.

THE PELTON WATER WHEEL CO.,
121-123 Main St., San Francisco, Cal., U. S. A.
143 LIBERTY STREET, - - NEW YORK.

☞ It having come to our notice that our patent rights are being infringed upon, intending purchasers are hereby warned that all such infringements will be duly prosecuted.

PELTON WATER MOTORS. Varying from the fraction of 1 to 15 and 20 horse power, unequaled for all light running machinery. Warranted to develop a given amount of power with one-half the water required by any other. ☞ Send for Motor Circular. Address as above. Deliveries made from San Francisco or New York, as may afford the most favorable freight rates

The ILLINOIS ELECTRIC LAMP CO.,

Lamps for any System, Voltage or Candle Power.

MAKERS OF THE CELEBRATED

"ILLINOIS JEWEL" INCANDESCENT LAMP.

SPECIALTIES:

Illinois Alternating Lamp.

Send for Trial Order.

SPECIALTIES:

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Send for Trial Order.

171 and 173 South Canal Street, CHICAGO, ILL.

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ELECTRIC AND MANUFACTURING CO.,

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LAMPS.

EFFICIENT.
LONG LIFE.
NO DECREASE IN CANDLE POWER.

SOCKETS.

SIMPLE.
ORNAMENTAL.
RELIABLE.
CHEAP.

Our new lamps not only do not infringe the Edison patent, but they are fully covered by patents of our own.

By means of an important discovery the burner is rendered stable, its efficiency increased, its life prolonged, and its normal candle power maintained.

The prices for our new incandescent lamps and sockets will be a surprise and satisfaction to all users.

OUR PRICE LIST WILL BE FURNISHED IN NOVEMBER.

Our reason for not now announcing prices is due solely to the fact that we desire to fix them with reference to the economies which are being effected in their manufacture in very large quantities by the use of special machinery.

The efforts of the agents of the General Electric company to induce our customers to exchange generating apparatus of our make for Thomson-Houston generating apparatus is fully explained by the fact that

THE THOMSON-HOUSTON COMPANY PAYS US,

through the Consolidated Electric Light Company, five cents for every incandescent lamp it makes, for the right to sell such lamps for use in connection with generating apparatus of its own manufacture only.

While we do not sell our new lamp for use in connection with Thomson-Houston generating apparatus, the present users of the same may avail themselves of our new lamp by substituting our generating apparatus, the quality and efficiency of which will fully warrant the cost.

NOTE.—We are in receipt of numerous letters from all parts of the country congratulating us upon the perfection of a new and better lamp, and we are abundantly assured that the tactics employed to secure exorbitant prices for apparatus as illustrated in connection with the World's Fair lighting, by threatening not to supply lamps unless all apparatus was purchased from "The Trust," will not prove effective. We are also assured that the competition resulting from our independent course is widely appreciated.

Do not hamper your business by long time contracts to purchase lamps and machinery exclusively of any one concern.

We shall be prepared to supply these lamps in large quantities, beginning December 1st.

STANDARD SCREW GLASS INSULATORS

MANUFACTURED BY

WM. BROOKFIELD,

BUSHWICK GLASS WORKS. 83 FULTON STREET, NEW YORK.

RECENT FESTIVITIES

Have broken in somewhat on the regular routine of business. We have shown all our visiting friends our

UNEQUALED FACILITIES

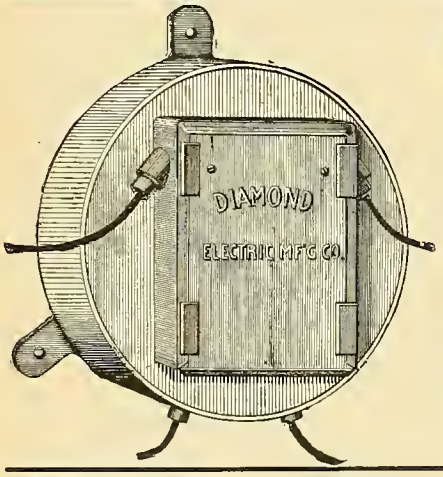
For taking care of their business, and are again busy taking orders for

ELKHART CONVERTERS,
PACKARD LAMPS,
RATCHET TRACK DRILLS

and General Supplies.
Are you "wid" us or "agin" us!

ELECTRIC APPLIANCE COMPANY,

242 MADISON STREET, CHICAGO.



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GOOD REGULATION
AND
HIGH AVERAGE EFFIENCICY.

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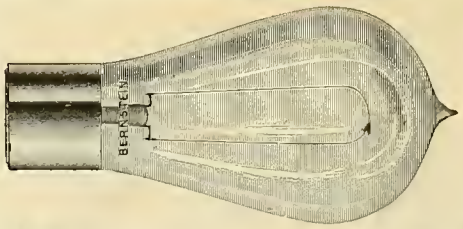

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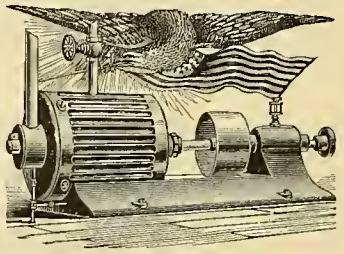

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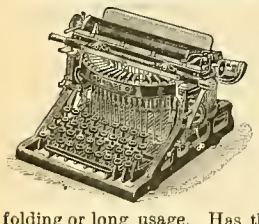

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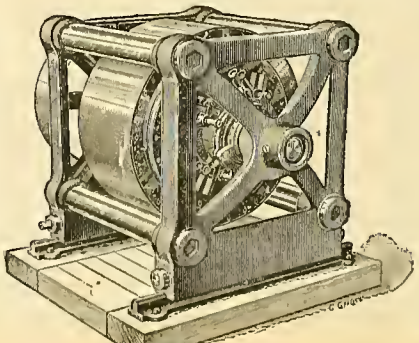

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Western Electrician.

EVERY SATURDAY.

Vol. XI. CHICAGO, NOVEMBER 5, 1892. No. 19

Electricity at the World's Fair.

Owing to the multiform applications of electricity shown at the World's Fair the visitor interested in the general development of the art will be confronted by electrical devices in all parts of the grounds. Thus, in addition to the general display in the electricity building proper, which promises to be bewildering in extent and brilliancy, there will be the great service plant in machinery hall, electrical elevators in various buildings, electric fountains in front of the administration building, electrically propelled boats skimming over the lagoons, trains pulled by electric motors on the elevated railway and a large display of electric railway apparatus in the transportation building. The electrical railway now occupies a prominent place in the development of American cities, and the exhibits of cars, motors and trucks in the last named building is sure to be varied and extensive, including the latest inventions in this line. All who are interested in electric traction will therefore find it necessary to spend much time in the transportation building and its annex. This building is located west and north of the mines building, and forms one of the central group of large buildings. It is longer than the electricity building but not so wide. In architecture the structure is, compared with the other large World's Fair buildings, noticeably plain, with the conspicuous exception of the "golden gate," which forms the principal entrance to the building. This beautiful portal, which is represented in the picture presented on this page, is located on the eastern front of the building, about midway between the northern and southern ends. As will be seen the doors are recessed in a series of elaborately sculptured arches, with profuse ornamentation. The bas reliefs represent various methods adopted for the carriage of men and goods, from the earliest times to the present day. At present the entrance is done in staff, but it will be gilded before the opening of the fair, and will then merit its title. The "gate" is advantageously located and will excite the wonder and admiration of all visitors.

ELECTRICITY AT THE WORLD'S FAIR.

The Western Union Telegraph company will make a large exhibit at the World's Fair. The display will include the first Morse instrument as well as examples of the most modern quadruplex instruments now in use by the company. This company will also show the interesting collection of relics of cable telegraphy belonging to the late Cyrus W. Field. The exhibit will be in the gallery of the electricity building. Aside from it the Western Union will have six or seven stations on the grounds for commercial telegraph service. The wires will be strung in the underground conduits.

It is likely that the office of the department of electricity will be removed from the Rand McNally building to the electricity building at Jackson Park within a week or so, and that hereafter Chief Barrett and Secretary Hornsby will do much of their work on the grounds.

A new building has been erected south of machinery hall, on the grounds, especially for the use of the mechanical and electrical sections of the department of works. The structure is 50 by 200 feet and one story high. The space will be about equally divided between the two departments, and private offices will be provided for Frederick Sargent, mechanical and electrical engineer, and R. H. Pierce, assistant electrical engineer. The change is made in order to secure more room for other departments in the service building, which is overcrowded.

A number of wiremen have been temporarily laid off by the New York Insulated Wire company, which is doing the construction work for the Westinghouse company, as nearly all the work for which plans are now in hand has been accomplished. One of the first buildings laid out for incandescent wiring was the woman's, but the work had to be stopped, owing to the inability of the ladies in charge to come to a definite decision regarding the number and arrangements of the lights wanted. Work on this building has been hanging fire for several months on this account. The incandescent wiring of the administration building is practically completed. This building will have 4,800 lamps and a feature will be the lighting of the great dome. The corona at the top, the vertical ribs and the colonnade corner at the base will all be outlined in incandescent lamps, making a beautiful effect at night.

A striking feature of the Westinghouse incandescent plant in machinery hall will be the two great marble switchboards, preliminary sketches for which are now being made. These boards will be quite ornamental and will be arranged in two galleries, winding iron stairways giving access from the floor. The upper gallery will contain the circuit switch-board, which will be about 100 feet long and 11 feet high, the top being about 35 feet from the floor. Below and in front of this will be the dynamo switch-board, which will be about 50 long and 11 feet high. The white marble, polished copper, handsome instruments and ornamental surroundings will combine to make a fine impression.

About 1,000 main line cut-outs, of a special type designed by Superintendent Keller, will be used in the Westinghouse incandescent installation. There will be one for every converter box, with a copper fuse designed to carry a normal load of 120 amperes. The strip is 1¼ inches wide, mounted on a porcelain base 7½ inches long and 3 inches wide.

The *Daily Financial News* of Pittsburg says: "The Westinghouse Electric & Manufacturing company will soon be in shape to turn out 10,000 of its new lamps per day, owing to new machinery and a largely increased force of workmen. At this rate it will require less than two weeks to make the number required for the World's Fair."

In its summary of the rules just adopted by the national commission the *Chicago Herald* says:

For the six months of the exposition a charge of $8 is made for furnishing power for each sixteen candle power electric lamp. No charge less than $20 will be made for furnishing electric power for exhibits. The rate per horse power for electricity varies from $20 for one-fourth horse power to $60 for three horse power or more. The charge for connecting with the main line varies from $10 to $15 per horse power, according to the amount used. For arc lamps for the six months $60 each will be charged. The charge per horse power for steam power is $40 and for compressed air $60.

One of the most interesting historical exhibits in the electricity building at the World's Fair will be a Morse scrap-book, belonging to S. F. B. Morse of Chicago, a grandson of the great inventor of the same name. This unique volume belonged to the elder S. F. B. Morse, and was kept up by him until the time of his death. In addition to many newspaper clippings relating to the notable events of Professor Morse's life, the book contains original letters of much interest and value, as well as portraits, programmes of anniversary celebrations, photographs of decorations, etc., the whole forming a collection of Morsania that could not be duplicated.

Wisconsin Electric Club Banquet.

The third annual banquet of the Wisconsin Electric club was held at Pabst Hotel, Milwaukee, October 27th, and was attended by seventy-five members and invited guests. The president of the club, W. S. Johnson, acted as toastmaster. After a few appropriate remarks President Johnson introduced the speakers of the evening. C. N. Harrison responded to the toast "Quantitative Relations," and H. G. Underwood spoke about "Electricity in the Sweet By-and-By." Mr. Underwood believed there was no end to the possibilities of electricity, and that the mission of electricity was to improve what already existed. "The Polytechnic Society of Wisconsin, our Colaborer in the Field of Science," was assigned to R. Birkholtz, who referred to the pleasant relations which existed between the two societies, and then explained the objects of the Polytechnic society. Don J. Whittemore entertained the guests with a pleasant talk in response to the toast, "With Electricity All Things are Possible, Perhaps!" and Prof. Speirs, of the People's Institute, gave a brief outline of the plans of the institute regarding the study of electricity. Other numbers were songs by J. B. May, a cornet solo by O. Kessler, a story by H. B. Aldrich and piano solos by Prof. Frank Colby. The organization is in a flourishing condition. It has a membership of fifty-five, and several applications for membership are pending. Its library contains forty valuable books of a scientific nature. The principal electrical journals, English as well as American, are on file in the club's rooms. A special committee is arranging for a course of lectures of a popular and experimental nature.

The Danville, Va, Street Car company will at once commence the work of extending its electric railroad.

Victory for the Electric Railway at San Francisco.

The Metropolitan Railway company, operating the second electric railway constructed in San Francisco, has commenced running cars over its new line. The route is from Eddy and Market, and from Mason and Market out Eddy to Hyde, to O'Farrell, to Scott, to Fall, to Baker, to Page, thence to Stanyon street, entrance to Golden Gate Park. A branch road, which is soon to be continued from the power house to the Olympic Club grounds and the Pacific ocean, leaves the Page street line at Clayton street and runs to Waller, to Cole, thence on Carl street to Front avenue, where the power house is located.

The Metropolitan company's power house, a view of which is herewith presented, is situated on Carl street, between First and Second avenues. This is well up upon a hillside that overlooks Golden Gate park, the ocean and a large portion of the city. It is at the terminus of the line as thus far constructed, but when the road as projected is completed to the Pacific Ocean House, the power-house will be about the center of the system. At present the steam plant consists of two tubular boilers, made by the Risdon Iron Works of San Francisco, and one 400 horse power compound non-condensing Corliss engine, also built by the same company. Rope transmission is used to the countershafting, whence leather belting runs back to three 90 kilowatt Thomson-Houston multipolar railway generators. The engine room will accommodate three such equipments, while the boiler capacity may be correspondingly increased. The entire station is large, light and airy, and every detail, both in mechanical and electrical construction is of the best. Twenty foot three truck cars, open at one end, are used, each of which is provided with two single reduction Thomson-Houston waterproof 25 horse power motors, and the maximum grade is 13.58 per cent. The road was equipped by the San Francisco office of the General Electric company, Dr. Thomas Addison, manager.

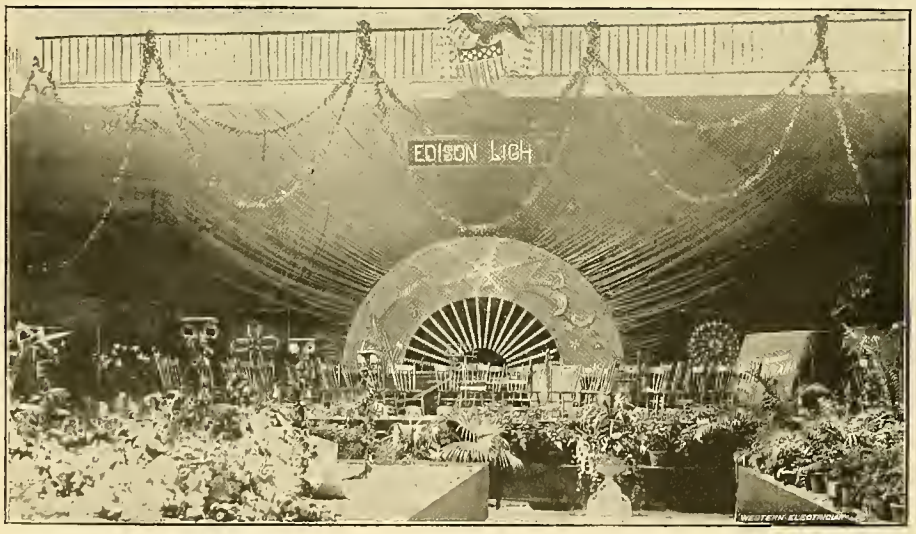
Thanksgivings galore prevail at the offices of the company over the fact that despite the howls and influence of the street railway cableites and the anti-trolleyites, the Metropolitan company downed the order of the Board of Supervisors prohibiting trolley circuits east of Van Ness avenue and has, within the space of about forty-eight hours, completed its overhead electric construction from its old terminus at O'Farrell street and Van Ness avenue, down O'Farrell to Hyde, down Hyde to Eddy, thence east to the junction of Eddy, Powell and Market streets. It has also finished the overhead construction of a branch line turning from Eddy into Mason street, thus giving it a second Market street terminus at the junction of Mason, Turk and Market streets. On September 23d the Superior Court dissolved an injunction against the company secured by the city. Taking advantage of this discision in its favor, the company determined to act at once, before the city authorities and others who were fighting overhead construction could have an opportunity of throwing another obstacle in the way. Every man that could be used to advantage was engaged; work was prosecuted night and day, the looked-for legal obstacle did not materialize; and now the railway officials breathe easy in the knowledge that they have dealt what is believed to be a death blow to anti-trolley humbuggism in the Pacific Coast metropolis. Considering the fact that the same Board of Supervisors which adopted the anti-trolley law passed a special resolution exempting the San Francisco & San Mateo Railroad company from its provisions, and now that an injunction granted under the law has been dissolved and that the city authorities made no further effort to combat the erection of trolley circuits within the prescribed limits, it would appear that the trolley is victorious, and that it will now find its way out Kearney and Montgomery streets and elsewhere, unhampered.

It seems that electric railway companies in San Francisco, to secure valuable terminal privileges, must do so by some sort of strategy, or at least by some extraordinary exertion, but in fighting the injunction just dismissed the Metropolitan company had a different proposition to contend with than had the San Francisco & San Mateo Railway company

VICTORY FOR THE ELECTRIC RAILWAY AT SAN FRANCISCO.

when it rushed the work of erecting its poles and circuits up along Harrison and Brannan streets and down Stewart to Market street, by day and night between court hours. At that time the San Mateo company had no franchise, but the enactment of one was under consideration, and the company, fearing adverse action, wanted to have its road built complete before such adverse action could be taken. As is well known, the company succeeded, and shortly afterward the franchise was granted. When the Metropolitan company, however, undertook to build and operate the road, it had a franchise granting it power to operate an electric road over the entire route now occupied, allowing five cent fares from the down-town terminus to the ocean. Subsequently the anti-trolley order so often referred to was adopted and under it Mayor Sanderson refused to permit the placing of poles or the erection of circuits east of Van Ness. Those who know the mayor best have fullest confidence in his integrity and it is now believed that his opposition to overhead circuits was due not to external influence but to honest belief. He is not a man to abandon a position once taken without ample reason therefor, and the conclusion is reached that the mayor is now a convert to electric railways.

As if to attest their hearty indorsement of the course which the events recited had taken, the elements favored San Francisco with a most unusual electrical display. Lightning is almost unknown in San Francisco, and so unusual was the spectacle that from the commencement of a gorgeous sunset until nearly ten o'clock, when the lightning ceased, the greater portion of the city was out of doors. It was only heat lightning, but it brilliancy was noteworthy even to those who are more familiar with the "forked flash."



ELECTRICAL DISPLAY AT THE BUFFALO EXPOSITION.

American Electrical Machinery for China.

For several months Toy Wing Sang, an enterprising Chinaman, has been interested in the incorporation of a company of Chinese and American capitalists, for the purpose of building electric railroads and lighting Canton and other cities of the Chinese empire by electricity, says the *San Francisco Chronicle*. He has now about succeeded in his efforts, and $14,000,000, raised by American and Chinese moneyed men, will be invested in the enterprise. Sang is now in San Francisco, but will soon leave for China, to attend to the shipping of a portion of the machinery which has been ordered. He said recently that he had experienced heavy obstacles in interesting American capitalists in the stupendous enterprise, but a far greater obstacle was the opposition with which he met from the lower classes of his countrymen, caused by their animosity against anything savoring of progress. Considerable opposition was also met with in obtaining permission from the Chinese government to build the plant, "for," as he explained, "you would be surprised at the number of intelligent residents of Canton who are opposed to the stringing of wires and the building of a power house. I can only attribute this opposition to the hatred entertained by our people toward foreigners, and it was feared that the presence of the latter during the process of construction might prove to be obnoxious and exasperating to the people of Canton. The uneducated people have derided the idea, and have positively refused to be convinced that there is such a thing as electricity, and that it can run cars and produce light. However, all obstacles have been overcome, and before many months Canton will have electric lights, electric cars, and perhaps a telephone system."

Sang says the Edison company and several large eastern firms have been contracted with to supply the motors and wire. Five hundred thousand dollars has already been spent for machinery, and perhaps as much more will be invested as soon as the electric light is in full operation. A franchise for an electric railroad will be obtained, if possible.

American Institute of Electrical Engineers.

At the monthly meeting of the council of the American Institute of Electrical Engineers at New York, October 25th, the following named associate members were elected: Bion J. Arnold, consulting engineer, General Electric company, Chicago, Ill.; D Herbert Jeffery, secretary and treasurer, Crocker-Wheeler Electric company, New York; Julius Meyer, consulting engineer, North American company, New York. F. S. Pearson, chief engineer, West End Street Railway company, Boston, Mass.; George Jarvis Spencer, electrician, Yale & Towne Manufacturing company, Stamford, Conn.; Walter H. Tapley, electrician in government printing office, Washington, D. C.; Gurdon C. Van Buren, electrician, Albany, N. Y.; Geo. S. Wallace, telegraph office manager, Chesapeake & Ohio Railway company, Clifton Forge, Va.; Norman R. Weaver, superintendent of repair department, General Electric company, Chicago, Ill.; Clayton W. Pike, Philadelphia, Pa.; Jas. D. Bishop, New York; E. T. Barberie, New York; Richard O. Heinrich, Newark, N. J.; Frank B. Rae, Detroit, Mich.

Electrical Display at the Buffalo Exposition.

The accompanying illustration gives an excellent idea of the fine display made at the recent Buffalo Exposition by the Edison Lamp Works of Harrison, N. J. Many beautiful designs made of incandescent lamps were shown, including several electric signs, a national shield and a number of tasteful geometrical and symbolic figures. The lamps were of several sizes and many colors, and the effects obtained elicited general praise. Some of the designs were reproductions of those that excited so much attention at the recent Actors' Fund Fair in New York, but others were original or else old designs greatly improved. The display was arranged on the platform in Music Hall, back of the space reserved for the musicians, and proved a drawing card for the Exposition management. In all about 7,000 lamps were employed.

Telephoning in Roumania.

The telephone is rapidly conquering the remoter parts of the old world. One of the latest connections is that made between Galatz and Braila, two commercial cities of Roumania, on the lower Danube. A merchant of Braila wanted to buy some barley, and went to the telephone office to speak to his agent at Galatz, where the produce exchange was held at the time. "Have you written to your friend to be at the telephone at this hour?" asked the officer in charge of the telephone station. "Then you have telegraphed, I guess?" persisted the officer. "I should not come to the telephone, if I wanted to telegraph," said the merchant irritably. "Then I can not let you use the telephone," retorted the officer. "The instructions are," continued he, "that people who want to talk to each other through the telephone must agree upon the time before hand by letter, or by telegraph or by other means of communication." "But I did not know until now that I wanted to buy barley," explained the merchant. "Then I can not allow you to use the telephone," said the officer quietly, and the merchant had to give up the idea of buying barley that day.

Practical Notes on Electrolytic Copper Refining.

By Lieut. F. B. Badt.

Since the publication of my paper read before the American Institute of Electrical Engineers many inquiries have come to me concerning the effect which impurities contained in the anodes will have on the purity of copper deposited on the cathodes.

An electrolytic copper refinery which has been in operation for over four years has been trying to subject black copper anodes containing antimony, arsenic and lead to the electrolytic process, without success. This establishment sent anodes and cathodes to the New England Electrolytic Copper company, whose works are at Pawtucket, R. I., under the management of H. R. Caulfield.

Mr. Caulfield tried the method used for comparatively pure black copper anodes at his refinery, and the accompanying cuts represent the results obtained during the first twenty-four hours of experimenting.

Instead of getting a pure, solid deposit of copper, the copper was deposited in a spongy mass resembling sea weeds, and absolutely unfit for the market. The deposit showed considerable impurities beside.

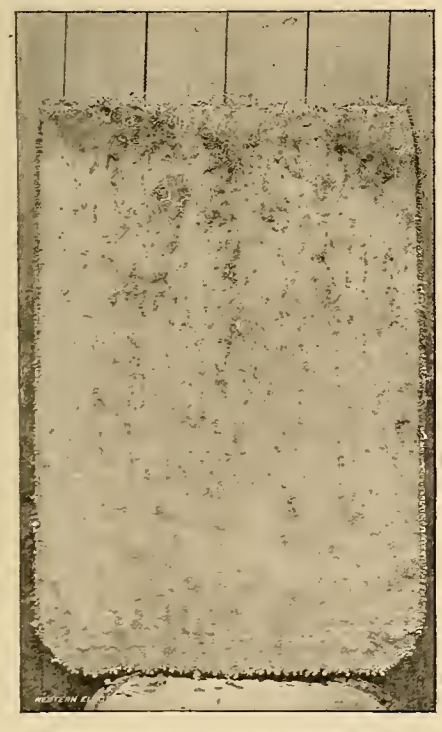
After a thorough chemical analysis, and after applying the proper remedies, an entirely pure deposit is now obtained from this copper in spite of its impurities.

This illustrates the necessity of employing the proper method in each case, and shows how large sums of money may be saved by employing competent electrolytic refiners instead of squandering money wholesale on hap-hazard experiments.

I do not doubt but that anybody interested in the electrolytic refining of copper will look at the reproduction of these photographs with interest.

Important Legal Victory for Electric Railways.

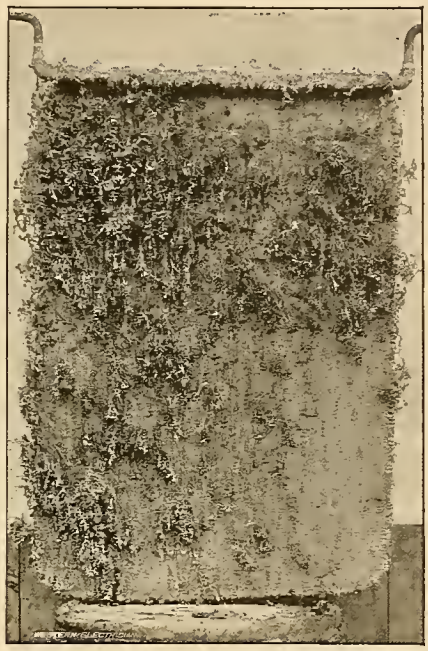
A long, hard fought and important case determining the relative rights of telephone and electric railroad companies in highways was decided by the New York Court of Appeals a few days ago. The case was that of the Hudson River Telephone company against the Watervliet Turnpike & Railroad company. The telephone company complained of injuries due to the adoption by the turnpike company of the single trolley system of electric propulsion. Judge Maynard delivered the opinion of the court. An



PRACTICAL NOTES ON ELECTROLYTIC COPPER REFINING.

abstract of that portion of the opinion of greatest interest to the electrical fraternity follows:

There was no question of prior equities involved; it was a question of strict legal right which was to be decided. The telephone company was not using the streets for one of the purposes to which they had been dedicated as public highways, while the turnpike company was using them in such a manner as to expedite public travel. The loss resulting from the adoption of a mode of locomotion authorized by law, which was carefully and skillfully employed, and which did not destroy or impair the usefulness of a street as a public way, could not alone justify recovery in the absence of a statute providing therefore. The telephone company had no easement in the public street. It was there by virtue of a legislative grant, revocable at the pleasure of the power that created it, and it was a part of its contract with the state that the maintenance of its lines of communication should not prevent the adoption



PRACTICAL NOTES ON ELECTROLYTIC COPPER REFINING.

by the public of any safe and expeditious mode of transit, such as the turnpike company's system was shown to be. It was not deprived of any property right, but was simply compelled to yield the subservience which it was bound to render under the charter which gave it existence. These considerations disposed of one of the grounds upon which the telephone company claimed to be entitled to relief.

It was found that the turnpike company's use of electricity in the propelling of its cars rendered the operation of the telephone company's telephones at all times difficult and sometimes impracticable, and this disturbance could not be avoided by the turnpike company without a complete change of the system adopted by it, and the use of more expensive and dangerous motors. To require such change to be made would be to grant to the telephone company by decree of the court that which the Legislature had expressly withheld.

But the telephone company was exposed to another danger which also deserved consideration. Its system of communication was partially established in the public streets. Its telephones were located upon the premises of its subscribers, and it had a central exchange which was upon private property. To render their respective plants available, both parties must have a return electric current, and both use the earth for that purpose. The telephone company grounded its wires upon private property, and in many cases connected them with the gas and waste pipes, and in that way established and completed its required circuit. The turnpike company allowed the electric current used for the movement of its cars to escape directly from the rails into the ground, and the most serious loss which the elephone company sustained resulted in its spreading upon the telephone company's grounded wires. This the turnpike company claimed it had a perfect right to do. The court, however, was not prepared to say that a person even in the prosecution of a lawful business upon its own land could gather there by artificial means a natural element like electricity, and discharge it in such a volume that, owing to the conductive properties of the earth, it would be conveyed upon the lots of his neighbor with such force as to interfere with the rightful enjoyment of the use of his property, and not be liable for the damages resulting therefrom. Still, it was not required in this case to decide that point. The use which the telephone company was making of its grounded wires was a part of its system of telegraphic communication through public streets, and was subject to the condition that it should not incommodate the use of the streets by the public. It was an indivisible franchise, and was in its entirety subservient to the lawful uses which might be made of those thoroughfares for public travel. The telephone company, by the manner in which it elected to use its franchise, accorded to the public the unrestricted right of passage, and it could not question the form in which such right should be enjoyed so long as it was of lawful origin, and was utilized with care and skill. The turnpike company's mode of conveyance of passengers was of that character, and the telephone company could no more justly complain of its loss from that source than it could if by the jarring of loaded vehicles up and down the street its delicate and sensitive instruments were impaired or destroyed.

For these reasons the previous decision of the General Term of the Supreme Court in favor of the telephone company was set aside, and the turnpike company was given its costs of suit.

Electric Traction by Storage Batteries.[1]

It may be safely stated that with few exceptions almost all types of accumulators, up to the present, have been constructed on the principle of a number of plates; the reason for this preferred mode of construction is obvious, as large surface must be provided in order to store up the electrical energy in a given space, and, on the other hand, it is also necessary to produce an accumulator with the lowest possible internal resistance. The principle of plates seems to answer well the two purposes absolutely necessary in a practical accumulator. But it has been proved, from long experience, that when such accumulators are put to work, altough the introduction of a large number of plates secures a means for large storage capacity, the evil of its own destruction is at the same time introduced in the same proportion; for instance, it is absolutely necessary for the equal electrical distribution in a cell, that the distances between the plates should be alike all through the entire construction, and this has been found an utter impossibility in spite of the best forms of separators used in the building up of the accumulators. Supposing such an accumulator were perfect in its mechanical construction, when first put to work, how long does it last? A few charges and discharges alter the whole of the conditions and destroy the uniformity of its internal construction with the fatal result of destroying the electrical distribution between the plates. The natural consequence follows: those plates or parts which come under closer proximity do greater work than those further apart, the current while under charge disintegrates those parts more rapidly, and the same evil is repeated while undergoing the discharge; in fact, while some portions still contain a good charge others are completely discharged, and when this inequality of action sets in, self-destruction goes on very rapidly day by day. To cope with such a difficulty appears perfectly hopeless in spite of the best supervision. It is like an internal cancer, which, when once the malady has declared itself, can only be treated by a surgical operation, and the sooner the better; it seems indeed that

PRACTICAL NOTES ON ELECTROLYTIC COPPER REFINING.

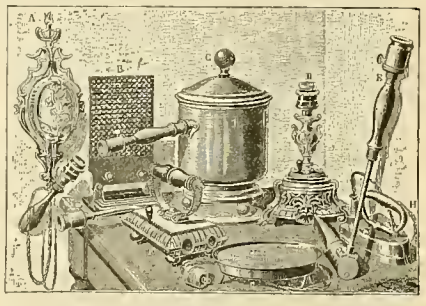
plate accumulators from their very birth carry with them the germ of self-destruction. This should only be the result of the natural law, like in everything else, but in an accumulator there is something more than self-destruction under ordinary circumstances, as the rapid disintegration which soon takes place in an accumulator bears no proportion to the amount of work performed; there must therefore be a radical fault in the principle of construction which has not yet been understood; or is it a parasite that exists in the very principle common to all plate accumulators, which cannot be cured? From practical experience and close observation it seems that this difficulty, which has so much

1. From the London *Electrical Review*.

prevented the universal application of accumulators, so indispensible for street traction, and in other fields no less important, is not an insurmountable obstacle, but in order to achieve the desired end the evils which are brought to play must be cut down to a minimum; each plate that constitutes a portion of a storage battery, notwithstanding that it plays its part for storing capacity, brings also its contribution towards distortion, resulting in rapid disintegration. It is therefore evident that if the number of plates be increased this evil is multiplied in proportion. If an accumulator could be constructed without plates there would be an absence of all those innate faults above mentioned, therefore the fewer the plates the less cause for destruction. From past results it has been proved that it would be useless to attempt further running electric cars for commercial purposes, unless an efficient accumulator, capable of taking up high charges, and at the same time capable of discharging at any required rate, is worked out, and that such an accumulator, when put to actual work, would require no more attention during the first year than any other portion of the system, beyond cleaning of connectors and refilling of cells from time to time; if after the first year renewal be necessary, such renewal should not exceed 15 per cent of the original cost. It is evident that from past and recent events in this country, electric traction by storage batteries has made no progress, but rather the contrary, and it seems to point to the fact that the sole reason for the failure lies in the present type of accumulators as being too costly an element as far as the maintenance and renewal is concerned. It may be safely stated that 50 per cent. of the total expenditure is absorbed in the accumulator department, although it has been stated over and over again that large electrical firms would undertake the maintenance of accumulators at 1d. per car mile. If such were a fact, there would not be a single car drawn by horses in this country, without mentioning any other country where electric traction by storage batteries has come to a standstill after exhaustive trials everywhere on account of the same old story, viz., the too costly maintenance of accumulators. How little feasible is the 1d. per mile theory in the light of a remark passed a short time ago by a gentleman in this country, largely interested in electric traction, in reference to accumulators, viz.: "We patch them up during the night and the following day the patches come off." It seems beyond discussion that from all points the present types of storage batteries are totally unsuited for practical work, especially for tram car propulsion, where so much strain is required to be sustained with impunity in order to compare favorably with the present cost of horse haulage.

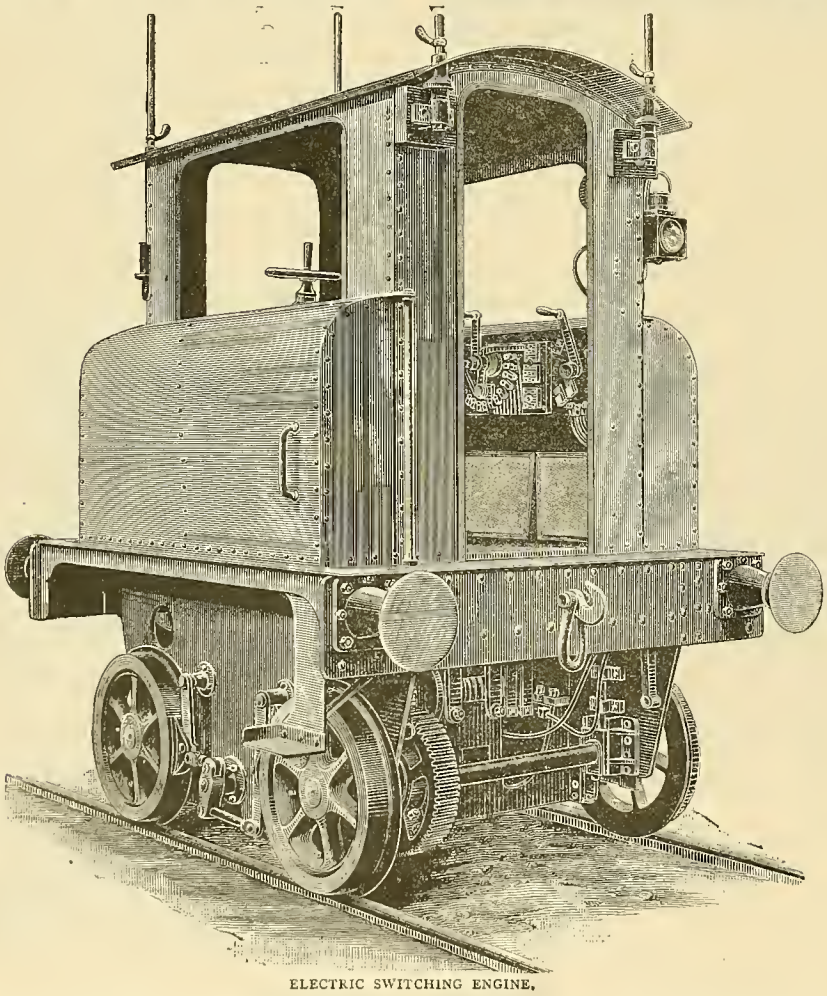
Electric Heating.

Electric heat at the present time is expensive as compared with that of the coal stove, and the application of electricity on a large scale for this purpose is not to be expected in the immediate future. Certain applications, however, have proved so desirable and convenient that the matter of cost is not taken into consideration. In certain exceptional cases the use of an electric heater may not prove uneconomical, and this claim is made for the electric car heater



ELECTRIC HEATING.

Actual tests have proved, it is stated, that it costs no more than the dirty, gas-producing car stove, while the advantages attendant upon its use are manifest. In the accompanying cut *La Nature* has grouped apparatus designed to illustrate the principles of electric heating. It is noticeable that the most prominent application—electric car heating—is not represented. The first device to which reference is made is the familiar form of electric cigar lighters, shown at *A* and *D*. This device would scarcely be classed among electric heating apparatus in this country, although, strictly speaking, it belongs there. The heater for curling irons, shown at *F*, has been found to be extremely useful in actresses' dressing rooms. The other devices are of familiar forms. *B* is a radiator; *C*, a heater designed for boiling water; *G*, a frying pan; *E*, a soldering iron; *H*, a sad iron. *La Nature* speaks somewhat at length of the laundry in which electric irons are used, and which was first illustrated and described in the WESTERN ELECTRICIAN. This application, it considers, will prove economical, as well as convenient. The same paper refers to the electric cooking feats performed at the Crystal Palace exhibition, which first brought electric heating before the public on the other side of the Atlantic. It says that the cook-electrician was marvelously successful in preparing palatable dishes.



ELECTRIC SWITCHING ENGINE.

Electric Switching Engine.

The electric switch engine shown in the illustration is similar in design to the electric locomotives used on the City and South London railway. It was built by the manufacturers of the latter apparatus, Mather & Platt, of Manchester, for use in a large iron plant in Sweden. It is designed to draw a load of 70 tons at a maximum speed of four and a half miles per hour. The motor is of the double armature type made under the patents of Drs. J. and E. Hopkinson, and owing to the slow speeds at which the axles have to run the armatures are connected to them by means of spur gearing in the ratio of 10 to 1. The armatures are of the Gramme ring type and are connected in series, and provision is made for cutting out either armature if required. There are two main switches, one for stopping and starting or for cutting off the current altogether, the other for reversing and for entirely breaking the connection between the locomotive and the main conductor. The resistances are placed under the curved side of the cab, neatly cased in and fitted with ventilators, the switches and ammeter being carried on one main board fixed above the resistances. The locomotive, as will be seen from the illustration, is designed for use in connection with an overhead system. The trolley poles are attached to the upright pipe pillars on the frame. The illustration is reproduced from *Engineering* of London.

Telephone and Telegraph Service in New York City.

Just before the recent Columbian exercises in New York the *Sun* published some interesting information for strangers visiting the metropolis, pointing out places of interest to sight-seers and describing the great institutions of which Gotham is justly proud. Concerning the telephone and telegraph, the *Sun* said:

New York's system of telephone communication is conducted so unobtrusively, and maintained with so little friction, that it is almost the last thing which a visitor to the metropolis would think of investigating. Most people coming to New York for the first time are astonished at the signs displayed in all the elevated railroad cars, stating that five hundred thousand passengers are carried daily by the elevated roads. If the volume of the telephone business of New York were calculated in the same way, it would be found that sixty million people use the telephone in New York city every year. This vast business is in the hands of the Metropolitan Telephone & Telegraph company, with headquarters at No. 18 Cortlandt street, where, in a substantial fire-proof building, there is a switch-board that cost nearly four hundred thousand dollars. This switch-board is the largest and best equipped in the world. It has accommodations for six thousand circuits or twelve thousand wires, and is used for the down-town district almost exclusively.

In addition to the Cortlandt street office there are similar buildings and switch-boards at Spring and Thirty-eighth streets. There are also important central offices at Eighteenth street, Seventy-sixth street, Columbus avenue and Harlem. At Broad street there has been erected another model fire-proof telephone building, which is being provided with a large switch-board to take care of the increasing volume of business down town. All of the subscribers' lines centering at these offices are conducted underground almost exclusively, and a comprehensive system of underground trunk line connects the various central offices together. Hereafter anything like a serious break-down, due to storms or blizzards, which have heretofore interrupted communication in large cities, cannot occur in New York.

The equipment of subscribers' stations is of the highest class known to the telephone art; and it is possible to talk with entire satisfaction from metallic circuit subscribers' stations to any point reached by the long-distance wires, including Chicago and all intermediate points in the West, Baltimore and Washington at the South, and Boston and Portland in the East.

The present highly creditable condition of the New York telephone service has not been accomplished without an immense outlay of money and years of labor by a large technical staff which has been concentrated upon the work for a long time. To properly appreciate the magnitude of what has been done, it should be understood that the telephone system of New York, like that of all other large cities, both in this country and abroad, was constructed on the grounded circuit plan; that is, but one wire was employed to connect with each subscriber, the earth being used as a return, as in the case of the telegraph, which was the model followed by the early telephonists. Ten years of hard experience, however, demonstrated that satisfactory telephone business could not be accomplished over one wire; and notwithstanding the fact that the Metropolitan company had already in existence a plant of switch-boards and underground wires which cost well up into the millions, it all had to be abandoned to make way for the new class of service; so that not a foot of wire or section of switch-board which was in use six years ago is now in service at New York, all the cables being withdrawn from the ducts and the switch-boards dismantled and

The Western Union Telegraph company was made defendant in a suit in the Superior Court at Terre Haute, Ind., recently, in which Nelson H. Wyatt claimed $1,000 damages. On August 30th he was sent a telegram from Worthington, Ind., informing him of the death of his father in-law, which telegram was never delivered, causing him great sorrow of mind, mental worry and distress.

sold for old junk. Such a technical revolution as this has no parallel in any other industry. As a result, New York leads in the character of its telephone service, as well as in so many other things. A fair idea of the multitude of details and practical difficulties of operation entering into the metropolitan telephone system can be had by an inspection of the plant at Cortlandt street, to which all subscribers, as well as visitors to New York, are admitted upon application at the general manager's office in the building.

The Metropolitan Telephone & Telegraph company has about 900 employes, 400 of whom are girls (who operate the switch-boards at the various offices). This company was the first to comply with the Underground Law, and as a result there are nearly 500 cables underground, containing nearly 40,000 miles of wire. In addition to the underground system, there are a large number of cables connecting with Brooklyn and other Long Island points, by the Brooklyn bridge. Under the North river and Harlem river there is a complete system of submarine cables connecting the city with the North and West.

Altogether the problem of telephoning in New York has been solved in a manner whose success is reflected in the satisfaction expressed by a great majority of the subscribers of the company.

The United States possesses in the Western Union Telegraph company the most complete and extensive telegraph system in the world. The greater part of the continent is covered by this system as with a vast metallic net. Every city, town, and almost every village is in telegraphic communication with the metropolis.

The Western Union Telegraph company operates the two trans-Atlantic cables of the American Telegraph & Cable company between Penzance, England, and Canso, Nova Scotia, connecting at the latter point with two cables that run to Coney Island, there connecting with an underground system of wires across Long Island, aerial cables over the Brooklyn bridge, and subterranean wires under the streets in New York city to the company's principal cable office at 16 Broad street. From the cable landing at Penzance independent wires run to the company's office in London. The cables in New York are connected directly with the New York Stock Exchange and the other principal exchanges, so that messages concerning dealings in the different stocks and produce markets are flashed backward and forward between New York and London in an almost imperceptible period of time. The brokers in those two cities, as well as at Paris, Antwerp, Amsterdam, Hamburg, and other leading cities in Europe who have business connections with New York are virtually brought into communication with each other through the business hours, allowing for the difference of time between the two hemispheres, and deal with each other almost in the same way as if they were face to face on the floors of their respective exchanges. The Atlantic cable service of the Western Union Telegraph company is made the more comprehensive by that company's arrangement with the Anglo-American Telegraph company, which owns three cables between Newfoundland and Ireland, thence by direct wire to London and several of the larger cities in Great Britain, one of these cables extending directly to Emden in Germany, where exclusive connection is made with the telegraph lines of the German government; also one cable from Duxbury, Mass., via St. Pierre, Miquelon, to Brest, France, where a direct wire connects it with Paris; also by its connection with the Direct United States Cable Company, which owns a cable from Rye Beach, N. H., via Halifax, Nova Scotia, to Ireland, thence by direct wires to London. The Western Union Telegraph company also operates the only cable s between Florida and Havana, which belong to the International Ocean Telegraph company. They connect there with the entire system of cables which extend to all the West India Islands, Venezuela, and the northeastern coast of South America. It also has the only connection at Galveston, Tex., with the cables of the Mexican Telegraph company and the Central and South American Telegraph company, which extend, via Mexico, to Peru and Chili, and via a land line over the Andes Mountains to Buenos Ayres, Argentine Republic. It is therefore possible to send a message by the Western Union Telegraph company's lines from the remotest telegraph office in the country to any part of the world, and be sure of the promptest transmission, because of the numerous routes which the company controls.

Brown & Boveri's Slow Speed Dynamos.

Four slow speed dynamos now in course of construction at the works of Brown & Boveri, Baden, Switzerland, for the central lighting station at Rouen, in France, are shown in the accompanying illustration, Fig. 1. A view

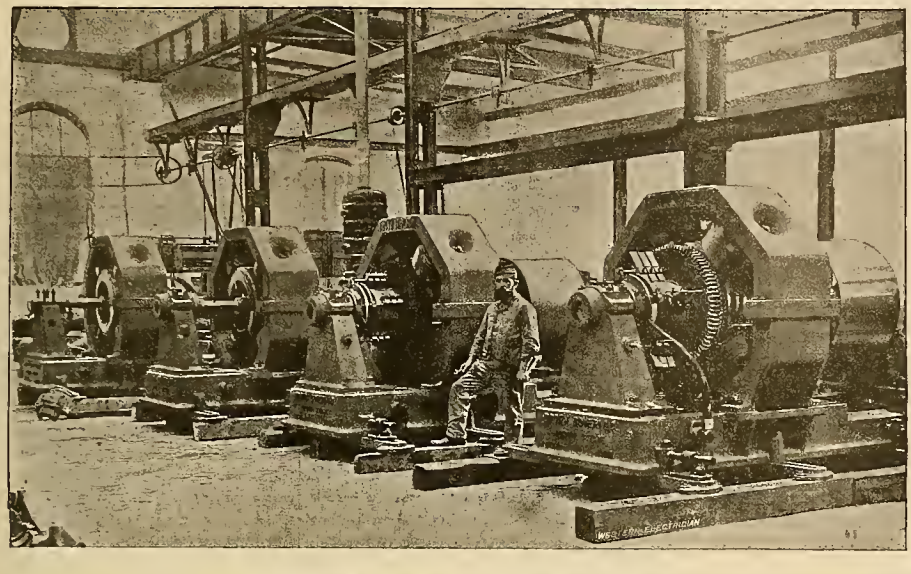


FIG. 1. BROWN & BOVERI'S SLOW SPEED DYNAMOS.

of one of the armatures is given in Fig. 2. Each machine gives normally 1,200 amperes, at 120 volts, with 320 revolutions, but is capable of giving 1,500 amperes at 180

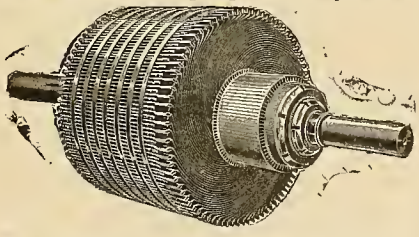


FIG. 2. BROWN & BOVERI'S SLOW SPEED DYNAMOS.

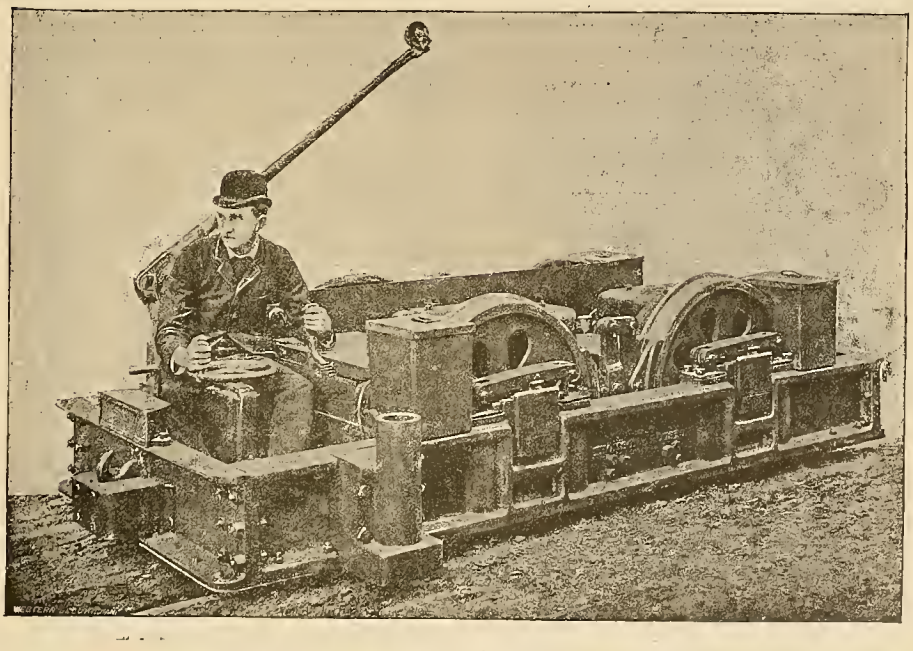
volts. These dynamos are thus really 270,000 watt machines when running at 320 revolutions. The armatures are drum wound, the conductors being connected in parallel. Mr. Brown asserts that trouble does not arise from parallel winding if the bearings are well designed and are kept in good order, and he therefore adheres to this type of winding, as it gives more commutator sections, and thus avoids sparking, which is otherwise apt to give trouble in such machines.

The armature sections are cross-connected by curved plates like those employed in making the connections proper, so that two brushes can be used. The iron cores of the armatures are 31½ inches diameter and 18 inches long, and are smooth. There are, however, eight driving teeth. Eight slots are milled out of the surface of the armature, and slips of vulcanized fiber are driven in tightly. The armature is wound with round cables. The field magnets are of cast steel. The pole pieces are also of steel, and the machine is so designed that the "pole shoes"—as the Germans call them—are turned out of rings of steel, each ring being cut up into four shoes. The back of each shoe is then turned to allow the field coil to project well forward, thus making a very compact arrangement. The field coils are also round, a matter of considerable importance in ease of manufacture. There are three bearings, with self-acting lubricating arrangements. These machines weigh 10 tons each, and contain about 1,800 pounds of copper. The cuts are reproduced from *Industries* of London.

New Mining Locomotive.

A new electric mining locomotive has been brought out by the General Electric company, and a picture of it is herewith presented. It will be known to the trade as the T. M. M. type, and consists principally of two standard railway motors, mounted upon a heavy iron truck frame The truck frame is built of cast iron side frames, bolted to heavy steel channel beams, which are securely fastened together by a wrought iron angle plate. The axle bearing boxes are small and solid in construction, easy of access for oiling and replacing the brass linings. The frame of the locomotive is hung from the axle boxes by means of steel springs, so that there is little pounding upon the track. By this method of construction it is possible to take the motors, together with the wheels and axles, entirely out of the frame. The motors used are of the standard railway type, either the W. P. 30 or W. P. 50, as required. For gauges narrower than three feet special four pole motors have been designed, which will run on gauges as narrow as eighteen inches. The controlling mechanism used is the standard series parallel controller. The brake is a powerful form of steel screw and lever. No adjustment is necessary for the wear of the brakes used, as the steel screw takes up the lost motion until the shoes are worn out. The trolley is of the single arm insulated type, and may be moved from one side to the other of the machines, as occasion may require. As the motors are self-protected, no cover for the locomotive is considered necessary, but one can easily be supplied. The cover increases the total height of the machine four inches. Sand boxes are provided for both front and rear wheels. All of the controling levers are placed on the platform of the machine, within easy reach of the operator.

The oldest horse car line in Germany, that between Berlin and Charlottenburg, is to be converted into an electric line. The traffic returns have recently somewhat fallen off, and it is hoped that the change will bring some improvement in this respect. As the terminus of the line is not far distant from Spandau it is not improbable that it will be extended to the latter place. Spandau is growing in importance, several of the government factories, including the small arms factory, being situated there.



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CORRESPONDENCE relating to electricity, or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

PAGE.

Electricity at the World's Fair. Illustrated 233
Wisconsin Electric Club 233
Victory for the Electric Railway at San Francisco. Illustrated. 234
American Electrical Machinery for China 234
American Institute of Electrical Engineers 234
Electrical Display at the Buffalo Exposition. Illustrated 234
Telephoning at Roumania 234
Practical Notes on Electrolytic Copper Refining. By Lieut. F. B. Badt. Illustrated 235
Important Legal Victory for Electric Railways 235
Electric Traction by Storage Batteries 235, 236
Electric Heating. Illustrated 236
Electric Switching Engine. Illustrated 236
Telephone and Telegraph Service in New York City 236, 237
Brown & Boveri's Slow Speed Dynamos. Illustrated 237
New Mining Locomotive. Illustrated 237
Editorial 238
A New Rheostat. By Charles E. Carpenter. Illustrated. Discussion. (American Institute of Electrical Engineers) 239
Interesting Power Transmission Plant 240
Carhart-Clark Standard Cells. Illustrated 240

DEPARTMENTS.

Correspondence 240, 241, 242
New Incorporations 243
Electric Lighting 243
Electric Railways 243
Telegraph 243
Telephone 243
Miscellaneous 243, 244
Trade News 244
Business 244
Electrical Patents 244

SINCE the World's Fair was first projected many mistakes have been made in the conduct of the enterprise, as was, perhaps, inevitable; but, as greater progress was made, these errors of judgment have generally been rectified by the men in charge, who have, as all will cheerfully admit, only the best interests of the exposition at heart. It is this fact and the further conviction that the details of an undertaking in which the people of this country have so strong and peculiar an interest as the World's Fair will never be settled until rightly settled that make it seem almost certain that the national commission will take steps as soon as possible to retrieve itself from the grave error into which it has fallen by adopting the rule providing that the gates of the exposition shall be closed at seven o'clock in the evening on all ordinary days.

That there be no misunderstanding in the matter, however, the WESTERN ELECTRICIAN, representing, as it believes, the unanimous sentiment of the electrical interests at the World's Fair, desires to record an emphatic protest against this absurd determination. One reason why this rule should not be allowed to stand has already been set forth with much force by the daily press, which points out that with the exhibition closed on Sunday and in the evening the Chicago workingmen will have almost no opportunity to witness the fair. This injustice is so evident that it may be passed with the remark that if the rule were adopted with the idea of bringing about the opening of the fair on Sunday, as has been hinted, the commissioners have chosen a method to achieve their purpose that is far from being either honorable or courageous. Let the Sunday question be fairly settled on its merits; the fair should be open in the evening whether the gates are closed on Sunday or not.

But it is the disastrous effect of the rule on the electrical display with which this journal is chiefly concerned. If this new regulation be allowed to stand, it will interfere very seriously with the electrical features of the exposition — just the extent, indeed, which separates a brilliant success from a commonplace performance. The electrical men, who are now so enthusiastically supporting the fair and contributing their skill, time and money, will lose heart and have little more than a perfunctory connection with an enterprise in which such a conspicuous disregard of their claims is shown. They have been led to believe that the fair was to be open evenings, and it is unfair and unjust to deprive them, at this late day, of the benefit the exposition would be to them as an object lesson to all the nations of the earth of the latest advances in electric lighting.

Why has the Exposition company entered into contracts for electric lighting appliances involving the expenditure of between a million and a million and a half of dollars if the grounds are not to be open to the public in the evening? Why have expensive electric fountains been contracted for if they are only to spout on a few "gala nights"? Why were the companies who figured on the electric boat and electric railway concessions not told that they need expect no receipts after 7 P. M., except in a few instances? These are a few of the questions that must be met before those interested in electrical industries can be made to believe that they have been fairly dealt with.

The prospects have been that the electricity building would be fairly aglow with light, exhibitors vying with one another in producing illumination; but with the gates shut at seven there will be no incentive for this display, and one of the most attractive features of the fair will be lost. There seems to be no valid reason why the entertaining features of the exposition, at least, like the electricity building, the fountains, casino and the attractions of Midway Plaisance should not be on exhibition in the evening. The attraction would be sufficient to bring in more money than the lighting and attendance would cost. This was demonstrated at Paris, where a syndicate of outsiders lighted portions of the exposition of 1889 for a percentage of the gate receipts and made a small fortune. If the commissioners fear the financial aspect of the question, resort can again be had to this resource.

The electrical industries are alive to the importance of this question and will not rest content until the injustice is righted. Even now a movement is on foot to convince the commission that it has dealt a blow not only to the electrical interests of the United States, but, unwittingly, to the World's Columbian Exposition as well. That this is the case there can be no doubt, and all possible influence must be brought to bear on the commissioners to enable them to see the folly and wrong of their amazing seven o'clock rule.

CHARLES E. CARPENTER'S paper on "A New Rheostat," which was read at the last general meeting of the American Institute of Electrical Engineers in Chicago, is presented in this issue. The rapidly increasing interest that is being manifested in electric heating devices, and the claims of merit advanced by manufacturers, lend additional importance to the utterances of one of the pioneers in this branch of the art. Mr. Carpenter explains the construction of his rheostat and heating devices. Essentially they consist of metal plates carrying a zig-zagged resistance which is attached to the plate by a covering or layer of enamel. The plates are provided, too, with ribs or blades for extending their radiating surface. In manufacturing resistance plates of low resistance and great current capacity, several wires in parallel are employed, each one having a capacity of from, say, 25 to 200 amperes or more. For instance, a 50 kilowatt 500 volt motor starting resistance is made up of a number of these low resistance plates connected in series; each plate has four wires in parallel, and each plate forms a step or division of the rheostat. It is interesting to note that the plates for this size of motor would be eighteen inches long and three inches wide and weigh about four pounds; twelve or fourteen of each would be used for this size of machine.

VICTORIES for the electric railway are recorded daily and from all parts of the country, but seldom have the advocates of the trolley gained so notable a conquest as that recorded in this issue, namely, the introduction of the overhead trolley system in the "prohibited" district of San Francisco east of Van Ness street. The Metropolitan Railway company has succeeded in defeating the prejudices and malicious opposition of citizens and interested railway men who favored other methods of propulsion. The cable had powerful advocates, it was well established and had possession of the principal streets, but the persistence displayed by advocates of the trolley prevailed, and to-day the electric cars are in successful operation on the streets of San Francisco. There can be no doubt that extensions will follow, if reliable, efficient service is appreciated on the coast. Already many of the men who honestly opposed the introduction of the trolley are now favorably disposed toward it and have withdrawn all opposition. Among these may be mentioned Mayor Sanderson who at one time refused to entertain the proposition to construct an electric road, but who, it is now claimed, has become a convert to electric railways. The people of San Francisco are to be congratulated upon this change in the mind of the mayor, and it is to be hoped that other city officials on the coast will follow Mayor Sanderson's example.

WITH a knowledge of all the fuss that the daily newspapers have been making over the alleged dangers of the overhead electric railway system, to say nothing of what has been published about electric light wires, the announcement in the daily papers of Chicago that nine persons have been asphyxiated in Hyde Park through carelessness on the part of one gas company, and that all of these fatalities have occurred within nine days, shows that electricity is not the only agent that must be handled with care. In fact, statistics can be furnished which prove conclusively that as between gas and electricity the latter is far the safer means of illumination. Were it not for the fact that electrical applications are novelties, accidents occurring through the use of electrical apparatus would not attract such general attention. It is the exaggeration of details in describing these accidents, which, comparatively speaking, amount to little or nothing, that does so much damage to the electrical manufacturing interests.

It is needless to say that had the Hyde Park fatalities been the results of electric shocks and the victims been two instead of nine, the daily papers would have developed the unfortunate accidents into a first-class sensation with startling headlines and a profusion of exclamation points. As it was the papers told the story without an effort to create a sensation.

The fact remains, though, that the gas jet is in reality far more dangerous than the electric lamp. The majority of people forget a most important fact that should be taken into consideration in making a comparison of the relative merits of gas and electricity. It should be remembered that electricity cannot escape like gas and suffocate the sleeper in his bed. An accident or trouble in an electric plant may cause the extinguishment of the lights, but when the current is switched into the circuit again the consumers who failed to turn their lamp keys are not in danger of their lives. This point should not be overlooked by those who are forever misapplying the word "deadly."

It is true the electric light is dangerous, and so is the electric car, but so also is the cable and so is gas. But sensible men are beginning to realize that any powerful agent is dangerous, and that electricity is safer by far than some others that the people are more accustomed to.

Then again the trolley system compares most favorably with cable cars, especially when one considers that during a recent political demonstration at Pittsburg two uncontrollable cable cars plowed their way through a torch light procession.

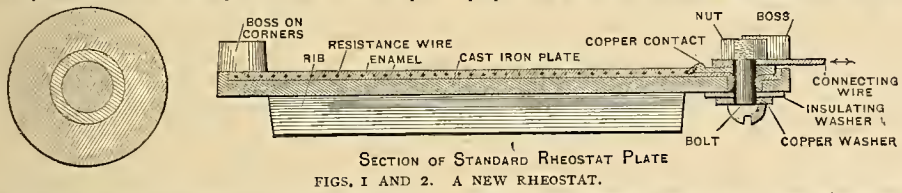
A New Rheostat.[1]

By Charles E. Carpenter.

It is a well known fact that an insulated wire suspended in the air will carry a given amount of current at a lower temperature than the same wire without this covering of insulation under the same conditions. This is obviously due to the fact that while the cross-section of both conductors is the same, the one which is insulated has a much larger radiating surface than the bare wire, and therefore dissipates the heat conducted through the insulation more rapidly. Suppose, for convenience of illustration, we conceive a conductor to be first covered with some insulating substance, and then enclosed within a metallic tube so that its insulated surface shall fit perfectly within and against the inside surface of the tube, as shown in section in Fig. 1. We thus have a comparatively small conductor with a largely increased radiating surface, and the insulation between the two metallic bodies does not materially obstruct the flux of heat from the conductor to the outside metallic shell.

One of the early experiments of the writer in electric heating—in fact, his first successful apparatus—consisted of two iron plates, between which was interposed an iron resistance wire of the "reflex" or "zig zag" type insulated from both plates by means of thin sheets of mica or asbestos paper, with screws passing through one plate and engaging the other. By this means the plates could be pressed into close relation to the resistance wire. By connecting this apparatus to a constant potential system, the current at first would be comparatively large, but would gradually decrease as the temperature of the plates increased, until a point was reached where the heat was dissipated as fast as generated. By tightening or loosening the screws, the current could then be either increased or decreased. This increase of the current by increasing the mechanical pressure is due to a reduction of temperature effected by the more intimate heat conducting relations between the resistance and plate, facilitating the flux of heat. The better the conduction for heat is made, the less will be the difference of temperature between the wire and the radiating surface plate, and it follows that the larger the surface of the radiating plates, which are closely impressed upon the conductor, the larger will be the current carrying capacity of the latter.

These experiments are cited as an illustration leading to a thorough appreciation of the extent to which the current capacity of a resistance wire may be carried, as it is upon this principle, but with modifications of construction, that the new and improved rheostat herein described is based,—that is, a resistance wire of small cross-section is used, but a large radiating capacity is secured by placing the wire in such relations to a metal plate as to practically increase its radiating surface to a very great extent.



Section of Standard Rheostat Plate

FIGS. 1 AND 2. A NEW RHEOSTAT.

The results of the experiments described above suggested a modified form of construction, one in which the resistance would be entirely covered by a medium which would protect the wire from oxidation and yet act as a good insulator of electricity and a good conductor of heat, and which would permanently attach the wire to, but insulate it from, a radiating plate. A special enamel was finally found by the writer to be suitable for this purpose. A section of this construction is shown in Fig. 2.

The injurious effect of linear expansion of the resistance wire, due to heat, is avoided in this method by the "reflexed" or "zig zag" form in which the wire is bent, as shown in Fig. 3, and it has been demonstrated by experience that this linear expansion is thereby so distributed as not to injure or crack off the enamel in practice.

On this principle, since we are able to greatly reduce the cross-section of the conductor, it follows that its length is also proportionately shortened for any required resistance, and no consideration of mechanical strength of the wire enters into this construction, since it is so perfectly confined and supported on all sides.

Practice has demonstrated that 20 watts of electrical energy may be dissipated continuously to each square inch of resistance surface, without injury to the apparatus. However, on account of the excessive temperature of the plate used in close proximity to the other materials, it is not practicable to dissipate over 8 or 10 watts to the square inch in continuous service.

By placing one surface of the plate in contact with water, so that its heat is dissipated in this manner, we are able to continuously dissipate about 25 watts to the square inch. From this it will be seen that by means of water we are able to increase the capacity of a certain plate to about three times that of the same plate dissipating its heat directly into the atmosphere, or we may decrease the size of the plate to one-third for the same capacity where water is used.

In many applications, especially in railway work, apparatus is often subjected to a load far beyond its rated capacity. Rheostat plates for such service are made with narrow ribs, between which the resistance wire and enamel are placed. It is found that by means of these ribs, the safe carrying capacity of a wire is greatly increased, while the ribs serve also to protect the insulation and wires from mechanical injury.

In adapting this construction to meet practical requirements in its several applications, it is necessary to alter only in detail the general construction and distribution before explained, and shown in Fig. 3, which shows the usual plan of distributing the wires in a simple rheostat plate. Connection to the resistance wire is made by means of a sheet copper contact strip, one portion of which is folded back upon itself, and after inserting a portion of the wire this sheet copper is crushed about it. The joint so formed can not oxidize, since it is completely sealed by the enamel fused about it.

To divide the resistance so formed into steps, it is only necessary to place contacts for connection to the resistance wire at convenient points where the loops approach the edge of the plate, as at *a*, and so on, in Fig. 3. This particular way of locating the connecting points on one side of the plate is especially convenient in using these plates with small motors, where only few steps or divisions of the resistance are required. A modification of this arrangement is to have the connecting points alternate from one side of the plate to the other, as at *b*, *a*, etc., Fig. 3. A distribution best adapted for stage or field-controlling rheostat, or one in which a great number of steps are required, is secured by arranging the resistance in a similar manner around the entire outer portion of a disk, with contact connections near the circumference. Another arrangement is required in a plate of low resistance and high ampere capacity. In this case, several coils are placed in parallel and connected to a common contact piece.

The plates, with their coils and contacts distributed as above described, are well suited for use in connection with rheostat switches. They are provided with ribs or blades for extending their radiating surface, and lugs at the corners for convenience in attaching them to the back of the switch. Each contact of the resistance plate is connected by a very short wire or strip to the corresponding contact piece on the rheostat switch.

A very simple and complete rheostat is made by placing the switch contacts and lever, properly insulated, directly upon the radiating plate, on the surface opposite the resistance face. With this arrangement, as shown in Fig. 4, a rheostat is obtained which is no larger than the switch parts alone of existing rheostats.

To make a single plate large enough to dissipate the energy wasted in the rheostat in starting a large motor, would make it necessary to have a surface so large as to be objectionable. To avoid this difficulty, a number of plates of, say, 10 inches square, are placed in parallel with each other, but separated by sufficient space to admit of proper ventilation, and connection made from the switch contacts to the contacts upon the various plates as required. With this arrangement, a rheostat of very large watt capacity may be placed within a small cubic space.

This form of rheostat, by reason of its compactness, is well adapted for use with arc lamps on constant potential circuits. In this application, the resistance plate may be attached directly to the outside of the casing, leaving just sufficient space between the casing and plate for ventilation. Where the casing is cylindrical, the plate may be disk-shaped and placed on top of the cylindrical casing, with holes in the plate for the hooks and chimney to pass through. A valuable feature of this rheostat in this application is that it will endure exposure to the weather while in use. As an example of this, the writer knows of a case where one of these plates has now been in use on a pair of lamps for over seven months, where the plate is in a horizontal position, with the enameled side up and water dripping upon it continually.

In some places the heating effects of rheostats should be avoided. For example, in stage controllers 5 to 10 kilowatts continuously converted into heat is extremely objectionable in warm weather. This may be avoided by conveying the heat away through the agency of running water. To accomplish this the resistance plate may be hollow, with inlet and outlet pipes connected directly to a source of water supply. By this means and with proper circulation the plates will always be comparatively cold, and no sensible amount of heat will be given off to the surrounding atmosphere, while the size of the apparatus is so reduced as to occupy no considerable amount of space.

It is evident that numerous modifications of this general design may easily be made to adapt the apparatus to the requirements of practice.

The following facts are true regarding this form of rheostat:

First—It is fireproof, as no combustible material enters into its construction, and it can never be submitted in normal use to a temperature so high as that to which it is subjected in the process of manufacture.

Second—It is durable, since the resistance wires cannot deteriorate from oxidation, electrolysis, etc.

Third—It is compact, as it requires less than 5 per cent. of the cubic space required by the ordinary coiled wire rheostat of the same capacity.

Fourth—It is simple, the three necessary elements, resistance wire, insulation and radiating surface plate, being fused into one integral mass.

Fifth—It is cheap, for a certain resistance and carrying capacity can be obtained by the use of a wire whose cross-section and and length will both be but one-tenth of that required for a wire used in the air. That is, the total weight of wire, and hence the cost of the same, will be but one per cent. of that usually required.

Sixth—It is unaffected by heat, cold, acids, alkalies, oils and other chemicals, and for this reason is especially adapted for use in mines, breweries, marine vessels, etc., where chemical action rapidly destroys ordinary insulators. It is even practicable to operate these plates submerged in flowing water, in case it is desirable to carry off the heat in this way.

Another and important application of this method of converting electric energy into heat in a compact form is for the operation of various heating devices.

The requirements of a commercially successful electric heating device are:

First—The concentration upon the working surface of the apparatus, of practically all of the heat produced in the resistance, thus preventing as far as possible the dissipation of heat by radiation or conduction to other bodies or parts than those it is required to heat.

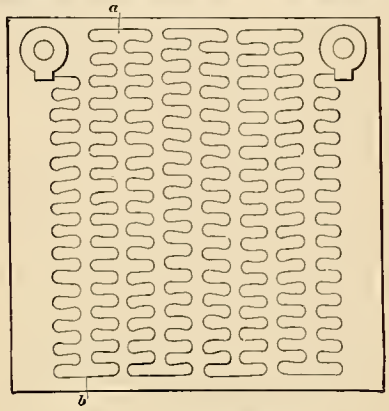


FIG. 3. A NEW RHEOSTAT.

Second—The ability to rapidly supply a large amount of heat energy from the resistance to the working surface, through a medium having a high conductivity for heat, thus keeping the working surface at the proper temperature even when a large amount of heat is rapidly drawn from it.

Third—The protection of the resistance wire from deterioration by chemical and electrical action, so that its life shall be indefinitely prolonged.

All the above requirements are fulfilled in this device.

Discussion.

E. A. Sperry: I would like to know if the rheostat has been designed for heavy currents, and if so what is the heaviest that has been used?

Mr. Carpenter: We are manufacturing resistance plates of low resistance and high ampere capacity. In these low resistance plates several wires are in parallel or multiple, and have a capacity depending upon the kind and size of the wire, from 20 to 200 amperes or more. A 50 kilowatt 500 volt motor starter is made up of a number of these low resistance plates connected in series. Each plate has four wires in parallel, and each plate forms a step or division of the rheostat. The plates for this size of motor are 18 inches long and 3 inches wide, and weigh about 4 pounds. Twelve or 14 of each are used for this size of machine. These series plates have the coils or wires enameled between ribs for increasing the adhesion of the enamel to the plate. It has been found by experience that 50 per cent. more current may be passed through a wire when placed between the ribs in this manner, without breaking the enamel, than where the wire is simply enameled on a plain surface. It is also a fact that these plates used in this way will endure splashing of water about them without breaking the enamel, when the temperature is as high as will be reached in normal use.

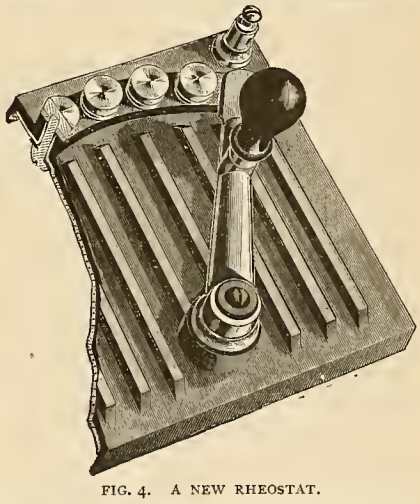


FIG. 4. A NEW RHEOSTAT.

The strike of the Chicago wiremen is still on. The strikers have scored a triumph over the Western Electric company. This company had the contract for the electrical work in the new Schiller building, and forty-two of its men were among those to strike. This so interfered with the work that the company has had to give up the contract, which was relet to the Cornish Electric company. This company will fill the place of the forty-two strikers with union men.

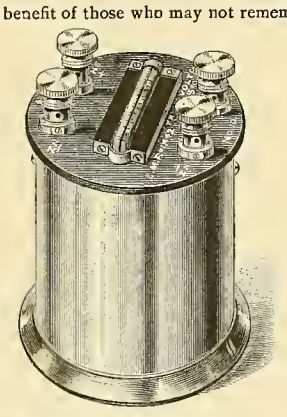
1. Read at the general meeting of the American Institute of ectrical Engineers, Chicago, Ill., June 7, 1892.

Interesting Power Transmission Plant.

The San Antonio Electric Light & Power company turned on the electric lights in San Antonio canyon Sunday night, says the Los Angeles, Cal., *Express* of October 19th, and everything was found to be in perfect shape for furnishing Pomona and vicinity with light and power. The wires have been run all over the city, and the power house is nearly completed. The power plant is located in the San Antonio canyon, where there is a minimum flow of 1,300 cubic feet of water per minute, with a head of about 400 feet. The water is brought to the power station through 1,900 feet of 30 inch and 600 feet of 24 inch double riveted sheet iron pipe, which involves a loss of head by friction of 12 feet. The laying of the pipe line necessitated a rock tunnel 1,300 feet in length, as well as several heavy open cuts. The power station is provided with four double-nozzle Pelton wheels, 34 inches in diameter, coupled directly to the armature shafts of as many Westinghouse alternating current generators of 200 horse power each. The wheels run at 600 revolutions per minute. Two exciters are provided, which are also run by Pelton wheels coupled to the shafts in the same manner, 20 horse power each. The current thus generated is carried on two No. 7 bare copper wires seven miles down the canyon to a point where they diverge, one running to Pomona, 15 miles, and the other to to San Bernardino, 28 miles. By means of transformers the potential is raised at generating station to 10,000 volts, and the current carried at this pressure to sub-stations located just outside the cities named, where, by means of step-down transformers, it is reduced to about 1,000 volts, and then distributed for both light and power purposes. The motors used for power purposes are of the Westinghouse synchronous type. The sub-stations are provided with regulators, by means of which the attendants can regulate the voltage of the distributing circuit independently of the generating plant. This installation is attracting much attention, as it is by far the highest tension distributing system ever attempted in this country on so extensive a scale for commercial purposes.

Carhart-Clark Standard Cells.

The accompanying illustration shows a new form of the Carhart-Clark cell with thermometer permanently attached. This type is well known to scientists both here and abroad, but for the benefit of those who may not remember all of



CARHART-CLARK STANDARD CELLS.

its special features, the following brief description is given:

The Carhart-Clark standard cell is the result of several years' study by H. S. Garhart, professor of physics and electrical engineering at the University of Michigan. Recognizing the fact that the ordinary forms of standard cells had but small endurance, and could not stand the jars and strains of transportation without permanently destroying both accuracy and constancy, Prof. Carhart, about five years ago, started out on the basis of Lord Rayleigh's experiments in standard cells, with a view to making a cell having no local action, perfectly sealed, giving a uniform and constant electromotive force for all time, and which should not be injured by transportation.

After over two years' study and trial, Prof. Carhart, in the early part of 1889, concluded that he had solved the problem. The Clark cell, as is well known, is composed of zinc and mercury as electrodes, and mercurous sulphate and zinc sulphate as salts. Great difficulty has always been found in securing the ingredients in a pure state, the smallest amount of foreign matter being sufficient to destroy the reliability of the cell. Another great trouble has been that in transportation the mercury would be so shaken through the other salts as to cause often a short circuit. The first of these difficulties Prof. Carhart overcomes by making his own chemicals, the second by the use of a special device, so that any short circuit in transportation is practically impossible.

One of the chief points of the Carhart-Clark cell is its very low temperature coefficient. By a method discovered only after long and laborious investigation, the temperature coefficient has been reduced from .08 per cent. per degree Centigrade to about .03, or from .00077 to .00039, thus making for all practical purposes the temperature change inappreciable. Each cell has, inside of its mounting, an extra graphite resistance of about 10,000 ohms, so that no particular injury will result, should it be accidentally short circuited for a short time. The cells proper are prepared by Prof. Carhart at his laboratory in the University of Michigan, and are furnished with his personal certificate of accuracy, which also states the exact electromotive force at 15 degrees Centigrade, and the temperature coefficient of the cell. Queen & Co., Philadelphia, handle these cells.

CORRESPONDENCE.

New York Notes.

NEW YORK, October 29.—The Western Union Telegraph company went on record last week as a corporation, stocked at $100,000,000. At a special meeting on Tuesday the stockholders voted upon the proposition to increase the capital stock of the company from $86,000,000 to $100,000,000. John T. Terry presided in the absence of Dr. Norvin Green. There were 651,312 shares voted in favor of the increase and only 100 shares against it. The opposition came from Col. J. C. Reiff, who appears at every stockholders' meeting to vote his 100 shares in opposition to the policy of the controlling element in the corporation. Col. Reiff introduced a resolution providing that the old directors be requested not to distribute any of the new stock in dividends. Nobody voted for this but Col. Reiff. Russell Sage said, during the proceedings, that he would favor the distribution of some of the new stock—$8,620,000—as a 10 per cent. dividend to the present stockholders and the retaining of the rest—$5,180,000—to be used for the extension of the company's lines. Next Tuesday the directors will decide how the new stock shall be distributed.

New York, like Chicago, is experiencing a wiremen's strike. Trouble has been brewing for some time, and on Friday the union electric wiremen, numbering about 700, quit work. The difficulty began a few weeks ago, when about twenty of the most prominent electrical contracting firms, finding that the union could not supply all the men required, formed themselves into the Electrical Contractors' association, and put up a notice in their workshops to the effect that on and after October 15th they would make no discrimination between union and non-union men The association is affiliated with the United Building Trades, formed after the last housesmiths' strike to protect employers against capricious strikes. The men didn't like the notice, but trade was brisk, and the contractors carried out their programme. Several small strikes were begun, and it was on Friday, at a special meeting of the union, that the general strike was ordered against the contractors' association. According to the contractors about 250 men are on strike, and according to the men 500 are out. The work involved now is principally electrical appliances in buildings. No city lights will be affected by the strike.

On Wednesday the *Electrical Engineer* of this city gave a house warming which was largely attended by engineers, journalists and business men, who were glad to offer their congratulations upon the prosperity of the paper and the comfort and convenience with which it is housed. Last April this journal moved into its present quarters in the *Mail and Express* building, 203 Broadway, New York, where its offices now occupy the entire eighth story of the Fulton street wing, covering a floor space of 2,060 square feet. Messrs. Phelps, Colvin, Martin and Wetzler on this occasion had an opportunity to show what adepts they were in dispensing hospitality, and it is needless to say they proved themselves equal to the pleasurable task. An elaborate luncheon was served.

Here is a chance for a real estate man. The Wolverton-Glow Electric Light company of 1671 Third avenue, New York, announces that it will locate its entire plant, which includes all its general manufacturing shops and store houses, in the city, town or village which offers the greatest inducement in gifts of land and money, together with water privileges, shipping facilities, etc. Twenty acres of land will be required. This company intends to expend not less than $300,000 and employ about 200 hands the first year.

W. F. O.

St. Louis, Mo.

ST. LOUIS, October 29.—A number of important improvements have just been completed on the cross-town line of the Lindell electric railway on Vandeventer avenue. A loop has been put in at the northern terminus at the fair grounds. At the southern end the company has purchased a right of way, and has extended the line to the junction of Chouteau avenue with the Missouri Pacific railway, where transfers are given to the Lindell company's Chouteau avenue line. A handsome stone depot has been built at this point, and all local trains on the Missouri Pacific and the Frisco roads stop here. This is a great convenience to visitors to the city coming from the West who desire to reach the northern, central or western districts of this city or the fair grounds without going down town.

The Carondelet Electric Light & Power company is making a number of improvements and additions to its plant. A new engine and two new dynamos and a day circuit for light and power will be operated.

Great interest continues to be manifested in the proposed alterations of the Merchants' bridge, to permit its use as a public highway for foot passengers and vehicles, as well as to operate an electric railway over it. The Merchants' bridge is located about two miles north of Eads bridge, and connects North St. Louis with Madison, Ill. The bridge is now used solely for steam railway traffic, and the alterations proposed are quite expensive, as new approaches will be necessary on both sides. Present indications are, however, that the work will be undertaken at no distant day.

The projectors of the Chicago & St. Louis electric railway were presented at a mass meeting held at Fairbury, Ill., on the 14th inst. Addresses were made by Dr. Wellington Adams, general manager; T. C. Hughes, chief engineer, and others. The plans of the company were explained in detail. Efforts are being made to induce the company to locate one of its power stations at Fairbury, and the company has agreed to do this, providing twenty-five miles of right of way be granted, together with a suitable site for the plant and certain coal rights. A committee of prominent business men was appointed to further the interest of the city in the matter.

In the St. Louis letter published in the WESTERN ELECTRICIAN for September 17th it was stated that the city council of Edwardsville, Ill., had awarded a contract and franchise for public and private electric lighting to the N. O. Nelson Manufacturing company of St. Louis. It seems that the city and the Nelson company were unable to agree on terms, and the contract was awarded to the next best bidder, Wm. Wurdack of St. Louis, president of the Inter-State Complete Electric Construction company. Mr. Wurdack has signed a contract with the city and furnished bond, and is making preparations to begin work immediately. The capacity of his plant will be 50 arc lights and 1,500 incandescents to start with.

The street car companies of St. Louis have recently filed with the city register their report of business done for the third quarter of the year 1892. These figures are interesting, as they show the result of the large crowds of visitors. The various reports have been summarized as follows:

Name of Company.	Number of Trips.	Number of Passengers.
Baden and St. Louis, horse	5,136	44,684
Bellefontaine, electric	58,070	915,659
Cass avenue and fair grounds, including Northern Central and Union, horse	147,412	1,865,553
Citizens' cable	110,238	2,564,266
Jefferson avenue, horse	46,532	539,426
Lindell, electric	163,380	3,276,754
Missouri, cable and electric	267,970	3,735,678
Mound City, electric	96,126	1,144,195
People's, cable	58,880	1,275,289
St. Louis, cable	207,964	3,282,423
St. Louis and Suburban, electric	31,972	1,923,227
Southern, electric	73,600	1,379,330
Union Depot, electric	146,858	2,745,711
Total	1,414,168	24,692,195

The St. Louis & Bellefontaine Street Railway company, the most recent to change to electricity, reports an increase of over 100 per cent. in business. The mileage of road has been increased from 8 to 13. The company's plant is working very satisfactorily.

The city of Fayette, Mo., has issued bonds, and now has $12,000 in the treasury as a fund for the purchase and installation of an electric lighting plant. A meeting of the council was held on the 18th inst. to receive propositions.

Among recent incorporations in St. Louis is the Etzell Hill Railway company. It has been capitalized at $120,000, with the following named gentlemen as incorporators: J. H. Terry, J. H. Murphy, S. S. Scott, R. F. Spencer, F. B. Fox, A. T. Terry and Mr. Holman.

A telegram from Little Rock, Ark., reports the incorporation of the Consumers' Light & Power company at that point with a capital stock of $200,000, of which $75,000 is paid. The incorporators are B. E. Sunny, B. J. Arnold and G. Martin of Chicago, Geo. R. Brown and H. G. Allis of Little Rock.

Some months ago the WESTERN ELECTRICIAN gave some interesting facts regarding the mail service on the county extension of the St. Louis and Suburban electric

railway. So satisfactory has the service proved that it has been extended to the city itself as a part of the carrier system. Three trips a day are made over the entire line. The car is a regular U. S. mail car, 16 feet long, equipped with every convenience. It is operated by two mail clerks, beside the motor man and conductor. The cars run on schedule time and deliveries are made at three sub-stations along the road, where carriers are in waiting. Should the scheme meet with the success anticipated, it will be extended to other lines.

After a session of several weeks the officials of the Order of Railway Telegraphers have reached a satisfactory understanding with the management of the Missouri Pacific railway. The operators were granted a number of important but reasonable concessions, there being an increase in wages of $45,000 per annum. The minimum rate was adjusted to $50 per month on the main line and $45 on the branches.

The electrical fraternity of St. Louis is greatly interested in the Edison Illuminating company of St. Louis, which filed articles of incorporation last week, with a capital stock of $5,000, all paid. The incorporators are: John J. Taussing, 10 shares; August Gehner, 10 shares; Fred W. Beebinger, 10 shares; Breck Jones, 10 shares, and Peter J. Doerr, 10 shares. These gentlemen are well known local capitalists, interested in many enterprises of magnitude. On being interviewed, however, they expressed themselves as not being prepared as yet to make any statement whatever regarding their plans.

The autumnal festivities and the St. Louis exposition closed together in a blaze of glory on the evening of the 22d instant, and the beautiful electrical effects and gas fixtures are now being dismantled. The season was a most successful one, resulting in great benefit to the city. The illuminations next year will be on even a grander scale, and efforts are being made to insure a large attendance from among the visitors to Chicago during the World's Fair. President Kennard authorizes the statement that the illumination then will be absolutely unparalleled, and that electricity will be the paramount agent in securing the effect.

Articles of incorporation have been filed for the Suburban Electric Light & Power company, with a capital stock of $10,000. The incorporators are: Walter Krausnick, 50 shares; Stanley W. Simons, 149 shares, and Gus George, one share. This company will operate in the suburban towns of Webster Groves, Old Orchard, and Tuxedo Park. current for incandescent lights being supplied by the Municipal Electric Light & Power company, whose mains are being extended to the city limits of St. Louis, at which point the Suburban company's circuits begin. Some 2,500 lights are now being installed. The company has offices both in St. Louis and Webster Groves.

A. J. O'Reilly, superintendent of city lighting, has issued in pamphlet form his report for the last fiscal year. The relative cost for lighting the city by gas and electricity is well shown by the following figures, the electric lighting having begun in April, 1890:

Year ending April, 1888	$300,407 68
Year ending April, 1889	318,598.76
Year ending April, 1890	318,043.61
Year ending April, 1891	211,130.44
Year ending April, 1892	218,526.22

The following table is also interesting, as indicating the amount of electrical construction in St. Louis for the year:

Name of company.	No. of poles set.	Miles of wire strung.
Municipal Electric Lighting & Power Co.	331	150 5 8
Missouri Electric Light & Power Co.	146	49 1-8
Laclede Gas Light Co.	99	35 5-8
Carondelet Electric Light & Power Co.	141	7
St. Louis Electric Light & Power Co.	0	8 5-8
Union Depot Railroad Co.	59	0
Mound City Railway Co.	0	0
Southern Railway Co.	0	0
St. Louis & Suburban Railway Co.	535	48 1-2
Lindell Railway Co.	0	0
Benton, Bellefontaine Railway Co.	703	31 5-8
Missouri Railway Co.	29	0

W. H. B.

Milwaukee, Wis.

MILWAUKEE, October 29.—Judge Austin of the Superior Court has dissolved the injunction secured by the Milwaukee Street Railway Company against Adam Mosher, contractor, restraining the latter from interfering in any way with the operation of the company's cars. In his opinion the judge referred to the section of the city charter which gives the city control of the streets. He held that the Board of Public Works, being the executive body of the city, had direct possession of the streets, and that the defendants, in their capacity of contractors for the work of improving Third street, were the direct agents and representatives of the city. They were bound to finish their work within a certain time or suffer the penalty. They had as much right to the possession of the street as either the Board of Public Works or the Common Council. If necessary, they could close the street so far as public travel was concerned. The electric railway company's franchises, the court held, were subordinate in every particular to the rights of the municipality. If the street were closed, the company would have no greater grievance than any one who wished to drive his team on the thoroughfare. The court refused to continue the injunction pending an appeal to the Supreme Court. There is only one other decision bearing on the question in issue, it is said, and that was rendered in Maryland about five years ago.

Judge Austin's decision did not prevent the Villard syndicate from continuing the fight against the contractors. The contractors, it is said, thought of stopping the cars, but they were served with an order which the Villard attorneys had secured from the Supreme Court, continuing the preliminary injunction and directing the contractors to show cause why the preliminary injunction should not be made permanent. The order does not prevent the contractors from going on with their work so long as they do not interfere with the company's cars.

The point is one that has been in dispute between city contractors and street railway people for many years. The latter, while claiming the contractors had no right to prevent the running of their cars, have generally aided the contractors, either by giving them a little money or doing a little of the work. In the case of Third street it appears that one John Rœbring, a sub-contractor, went to Henry C. Payne, the representative of the Villard syndicate, and got him to consent to do the grading. After about half the grading had been done the principal contractors told Mr. Payne that if he would do the paving nothing more would be required of him. Mr. Payne accordingly stopped the work of grading and set his men to work on the paving. Then the sub-contractors objected because Mr. Payne had not finished the grading, and the trouble commenced. Mr. Payne said he was willing to do either the grading or the paving, but would not do both.

A compromise was finally effected. The contractors said that they would be satisfied if the company would run its cars on one track north of Walnut street, and the company at once put in switches and began using one track only.

On the second trial of her case against the Milwaukee Street Railway company Mary Hardy secured a verdict for $7,000. She was injured while riding on an electric car, and even on the second trial had to recline on a lounge in the court room while giving her testimony. On the first trial she got a verdict for $5,000. The company appealed to the Supreme Court and secured a new trial. The plaintiff was also willing that there should be a new trial, and the outcome of it justified her policy.

Anton Schmidt has sued the Milwaukee Street Railway company to recover $5,000 damages alleged to have been sustained as a result of an electric car running into his buggy.

A resolution to light the mayor's office by electricity is pending in the common council.

A movement is on foot to put in electrical swinging apparatus at Pleasant street and Kinnickinnic avenue bridges.

The statesmen who preside over the destinies of the new village of Whitefish Bay have been wrestling with an application for an electric railway franchise made by the North Lawndale Electric Railway company. They held an all-night session a few days ago. The company's application was finally denied, because it did not state when the road would be completed. The villagers want the road completed within a year, and demand that a 5 cent fare be established, and that 5 per cent. of the earnings be paid into the village treasury. A new proposition will be submitted by the company.

Henry C. Payne, president of the Wisconsin Telephone company, was present at the Chicago end on the occasion of the opening of the long distance telephone line between the World's Fair City and New York. General Manager John D. McLeod of the Wisconsin company took a number of Milwaukee newspaper men to Chicago on the same occasion. The Cream City journalistic guests were M. E. McIntosh of the *Evening Wisconsin*, W. C. Colbron of the *Journal*, Robert H. Odell of the *Sentinel*, Edgar W. Coleman of the *Herold*, P. V. Deuster of the *Seebote* and George H. Yenowine of *Yenowine's News*. They left Milwaukee at 10:30 o'clock in the forenoon, and returned at midnight. The opening of the line really gives Milwaukee and other Wisconsin cities as great advantages as Chicago enjoys. There has been for some time a long distance line between Chicago and Milwaukee, and metallic circuits have been extended to Appleton on the north and Waukesha and intermediate points on the west, as well as to Racine and Kenosha on the south. A day or two before the New York long distance line was formally opened it was used by two Milwaukee men. Manager McLeod had a little chat with Angus Hibbard, who was at his residence in Morristown, N. J., and so did Charles Ray, the banker, who is Mr. Hibbard's father-in-law.

Vice-president Payne and Manager Lynn, of the Milwaukee Street Railway company, attended the meeting of the American Street Railway association, at Cleveland, and secured the next convention for Milwaukee. They say that they had expected to have to make quite a fight in order to capture the prize, but, much to their surprise, they won without meeting with any material opposition. The exposition building will be secured if possible. Everything in the street car line, from the most elaborate car to the smallest piece of mechanism, will be exhibited.

It is now practically settled that the formal transfer of the West Side railway, popularly called the Becker line, to the Villard syndicate, will not take place until the first of next April.

In a few days the cars running on the West Side north and south trunk lines will be divided between Third street and West Water street. All of them run on Third street at present.

The Wauwatosa electric cars now run from Walnut street via West Water street, Grand avenue and Wisconsin street, to the Northwestern railway depot on the lake front.

The new power house on the South Side will give the Villard system three large generating plants. The Becker power house on Wells street is sufficient for the lines in that part of the city.

The Goodrich line steamer Virginia gave an exhibition of her powerful search light a few evenings since. She steamed out into the bay and threw the light on the shore, making the most minute objects visible, and then turned the light on a boat a mile out on the lake. Many people on shore watched the performance.

Mr. Payne states that a large bridge and viaduct will be built across the Menominee valley for the extension of the Clybourn street electric line to the Soldiers' Home and Calvary cemetery. It will be constructed of iron and stone, and will be one of the largest structures in the West. A right of way, it is understood, has been secured some distance west of the cemetery. The line will run along the northern boundary of the Soldiers' Home grounds. Work on the line, it is expected, will be begun in the spring.

The E. P. Allis company will make more of a specialty than ever of electrical machinery when the new addition to its plant is completed. A 50 ton and a 20 ton electric traveling crane will constitute a part of the equipment of the new machine shop. The outlay will be in the neighborhood of $250,000. The Allis plant on Clinton street now covers fifteen acres, and the company has an embryo plant on a 20 acre tract on South Bay street.

The Milwaukee Electric Railway company's road was built several years ago, and has never been in first-class shape. There is no return wire. Last Sunday, as the Light Horse Squadron was returning from Chicago, where it took part in the Columbian exercises, the horses of the foremost troopers received at the corner of Broadway and Oneida street what was believed to be a shock from the rails, and fell and threw their riders, who had a narrow escape from being seriously injured. Mayor Somers promptly requested the board of public work to secure the services of an electrical expert and have the road thoroughly examined. The board has requested electrician Kleinsteuber, of the fire department, to make a complete inspection of the road. The old Thomson-Houston system is used on the road.

Edwin Reynolds, of Reynolds-Corliss engine fame, denies a report that he intends to resign his position with the Allis company and locate in the east. He is a large stockholder of the Allis establishment.

The North Lawndale, Whitefish Bay & Milwaukee Railway company, which has asked the village board of Whitefish Bay for a franchise, proposes to build an electric road from the end of the Third street line to Whitefish Bay. The company's first proposition was not granted by the board, but the projectors say they will carry out the plan of building the line. The route, however, may be changed.

The Milwaukee & Wauwatosa Motor Railway company has increased its capital stock from $200,000 to $300,000. The company held its annual meeting a few days ago and re-elected the old officers. Through the winter the line will continue to be operated by steam, but next season it may be equipped with electricity. The company is willing to extend its line to North Greenfield, if the people of that

suburb will build the track. The projectors of the new suburb at Homewood are anxious to have the motor company build its line out to that point, and have offered to bear the expense and take the amount out in stock. The company declined the offer, preferring a bonus.

Charles F. Pfister has commenced a suit against the Milwaukee Electric Railway company to recover judgment on his note for $125,000. Mr. Pfister's claim has been pronounced valid by the Supreme Court. Should the note go to judgment, a receiver of the road will probably be appointed and the property sold at public auction. It is possible that Hinckley will redeem the note. He has a claim of $100,000 against the company, which claim, however, still remains to be established. Pfister continues to be in possession of the road.

In the Superior Court a verdict in favor of the plaintiff has been returned in the case of Henry O. Parks against the West Side Railway company, and damages fixed at $1,350. The plaintiff had demanded $20,000. His residence is next to the Wells street power house, and his claim was that its value had been injured by the steam and noise and smoke.

Announcement is made by Henry C. Payne of the Villard syndicate's intention to build a large branch power house on the South Side. The site will be on Kinnickinnic avenue, to the east and in the rear of the car house and other buildings. The company has purchased at that place four acres, with a water frontage, and the plant will be an immense one when everything is finished. The new power house will be similar to the one on River street. Car and repair shops are now being built at the plant. The present buildings form an L, and the car and repair shops will be so built as to form a square. The new power house, in addition to furnishing power for the South Side electric lines, will supply that part of the city with arc and incandescent lighting.

It is reported that the Villard people, instead of waiting until next spring, will come into possession of the West Side railway system before snow flies. Mr. Payne admits that the company might exercise its privilege in that respect and give the thirty days' notice necessary at almost any time. Much depends, he states, upon the state of the money market. The Villard people are already at work rebuilding the West Side company's Wisconsin street tracks. New cars of the latest pattern, sufficient to equip the West Side system, have been received, and are being fitted with motors. The Grand avenue and Wells street tracks will soon be overhauled.

The people of Racine are walking just now. The old horse and mule system has been abandoned, and work on the electric system is in progress. The power house is nearly built, most of the track is laid and the wiring done. Electric cars will be running in about a month.

There is some talk of an electric railway system connecting Waukesha with the adjoining lake resorts. Philadelphia capitalists, it is said, have been looking into the matter.

The Kenosha electric railway, for which a franchise was granted last spring, is likely to be built soon. Mr. Munson, the holder of the franchise, declares that it is his intention to begin work at once. The ties and other material have already been purchased.

At Madison last Monday an electric railway wire crossed a telephone wire and caused a fire in the cupola of the telephone exchange. The telephone system was completely knocked out for several days. C.

Northwestern Notations.

MINNEAPOLIS, October 29.—The St. Paul street railway muddle is now more complicated than ever. The prospect of an amicable compromise has been dispelled by a fresh declaration of war from the aldermen. At a recent boisterous session a measure was proposed calling for the construction of two new lines, one a horse car line to Como Park. It is claimed that the failure to build one of the lines means the forfeiture of the old horse car franchise and failure to build the other forfeiture of the electric franchise. Mr. Lowry and Mr. Goodrich both being out of town, no official utterance from the company is forthcoming. The situation is getting serious.

Good headway is being made in St. Paul on the work of burying the electric wires, and a few months more will see the important work completed. The telephone company has four miles of wires down. The National Subway company has three. The Edison Electric Light & Power company is placing its wires underground in the business center as fast as possible. The council has not yet passed finally on the petition from the Western Union Telegraph company and the Economy Steam Heat & Power company for permission to put in conduits.

A company has been organized with a capital stock of $20,000 to provide electric lights for the Midway district, between Minneapolis and St. Paul. There are half a dozen suburban residence centers in this district which always have been miserably lighted. The new company is to be known as the Midway Electric Light company, and the officers are: Anson S. Brooks, president; C. G. Hager, Jr., vice-president; C. A. Magnussen, secretary, and D. E. Platter, treasurer.

The Northwestern Telephone company has sent a thrill of joy through business men of St. Paul, Minneapolis and neighboring towns by announcing that it will improve its extra-urban service by substituting copper wires for the old iron ones, and putting in a complete metallic circuit. The company has about 700 miles of wire in the state outside the city exchanges. Of these 200 miles have already been changed and the rest will be as fast as possible.

The Northwest General Electric company has purchased a centrally located lot at Winona, Minn., whereon it will erect at once a light, heat and power plant. Work is to be pushed to completion by January 1st if possible. The boilers will be of 500 horse power, and the plant will be equal to all probable demands for years. The building will be 60 by 140 feet and will cost $20,000.

No headway has yet been made toward changing the street car system at Mankato, Minn., to electric power. Since the council granted a 30 years franchise it has been discovered that the charter prohibits granting a franchise for more than 20 years.

The Duluth street railway company has its poles and tracks down on Eighteenth avenue West, which means the abandonment of the heavy grade on Superior street from the Point of the Rocks to Eighteenth avenue East.

Lakefield, Minn., is to have electric light supplied by the mill company. A similar arrangement at Heron Lake is being talked of.

A Washington avenue clothing house in Minneapolis has evolved a novelty in the way of a sign. It is 45 feet long and three wide, completely bordered by 180 incandescent electric lights. The effect is striking and brilliant. It costs $1.80 an hour to illuminate the sign.

All the St. Paul cars are being repaired and repainted in the shops at Minneapolis. They are being painted yellow to correspond with the Minneapolis cars, and to distinguish them an "A" is placed before the number.

The first installment of the new 34 foot vestibuled motor car bodies for the inter-urban are expected next week. They are said to be the finest thing out in the car line.

Poles for an electric light system are being set at Mitchell, S. D.

The power house engine for the Brainerd street railway system has arrived and good progress is being made all along the line. The contract has been let for the bridge to East Brainerd.

Under the new schedule at Superior there has been a reduction of six minutes in the running time on each division of the street railway, and a further reduction is promised. H. C. C.

New England News.

BOSTON, MASS., October 29.—The electric search light on Mt. Washington will, it is reported, be transferred to Mt. Wilson, Cal., this winter. Mr. Rogers, who put it in place, will superintend its removal.

The ladies' dining room of the Hôtel Reynolds, Boston, has just been fitted up with electric lights which complete the furnishing of the room. It is now considered one of the handsomest dining rooms in this country. The electric fixtures are all in gilt, and cost alone $1,800. The electrical equipment consists of sixteen 5 light brackets and six columns of eight lights each. Henry T. Edwards, newly appointed New England agent of the General Fixture company of New York, furnished the fixtures.

The New England Electric club has elected A. C. Shaw secretary in place of L. M. Hays, resigned. The club has organized an orchestra under the leadership of O. E Mitchell, a club member, and it expects to have some very enjoyable entertainments this winter. The club is only six months old, but already numbers 275 members.

The assignee of the Eastern Electrical Supply company makes a statement showing assets nominally of $28,956, and liabilities of $21,706. The creditors have taken no action.

There is a war on in this city between the gas and electric light companies. J. Edward Addicks, president of the Bay State & Boston Gas Light company, claims that the Suburban Electric Light & Power company is hopelessly insolvent, and he asks the Insolvency Court to adjudge it so. The Suburban people say that they are able to pay all their debts and that the petitioner, being interested in rival concerns, is trying to get rid of a competitor. Mr. Addicks says the electric light company owes him $7,786.60 for money advanced and can not pay the debt. Accordingly he brought a writ in the Superior Court and attached the property of the defendant. No action was taken to dissolve the attachment before the return day of the writ in the suit and so he now petitions that the company be declared insolvent. On the other hand the Suburban denies that it owes him anything and alleges that the attachment was a trespass upon its rights and that the petition should be dismissed. Mr. Addicks shows an itemized bill of money loaned to pay wages and buy the plant and machinery to do its work. At the hearing of the case W. A. Paine of the Suburban company testified that his company was given the contract for lighting the city of Boston for five years. The board of aldermen refused to grant permits for erecting poles and laying wires. The company was figuring on a profit of 10 cents a light each night and now claims the city is liable to it in $300,000 for breach of contract. Mr. Paine thought this was the way he was taking to get possession of the concern. In another suit a temporary injunction was granted restraining Addicks from interfering with the business of the Suburban and removing its plant from the power house as he threatened to do in order to satisfy a claim.

It is said that the General Electric company is soon to send an electrician to Spain and another to Germany to attend to its business in those countries. There are now 371 roads in operation using the General Electric systems —196 having Thomson-Houston and the rest Edison motors. The number of motor cars in use by these roads is 6,663, of which 4,337 are Thomson-Houston and the rest Edison. On August 1st there were 57 roads under contract with this company for a total of 1,411 cars. The Lynn & Boston, before its purchase by the Philadelphia syndicate had contracted for 180 Thomson-Houston motor cars.

The two rival Boston signal systems were the cause of a row in the Holyoke board of aldermen. The contract was awarded to the Municipal company by a sub-committee, and then there was a fight over the necessary appropriation. An injunction was taken out restraining the company from erecting poles. The case will be aired at the next term of the Superior Court.

The syndicate which has bought the North Shore street railways from Boston to Salem has been incorporated under the title of North Shore Traction company with a capital of $6,000,000. It has moved its main offices to Lynn.

The West End road, through President Whitney, has been entertaining a distinguished Londoner, in the person of J. Whitaker Ellis, ex-lord mayor, who was accompanied by his wife and private secretary. His visit to Boston was for the purpose of making an examination of electrical systems in use on the great street railways in and about the city. He was accompanied by Hon. Erastus Wyman of New York. Under the guidance of Chief Engineer Pearson the party was taken through the central power station. After this a special car was taken and during the afternoon a visit was made to all the different cities which are reached by the electric system.

Westinghouse electric is being bulled hard on the local stock market. It is reported that the company did a gross business for the second quarter of this year of $1,300,000 against $600,000 for the same portion of the previous year. The electric stocks are watched narrowly in the Boston markets. The general opinion here is that negotiations are going on between Westinghouse and General Electric which will result not in a consolidation but in an agreement relating to the incandescent lamp. It is thought that the agreement will be reciprocal and allow the General Electric to use the new Westinghouse lamp, which can be manufactured at less cost than the old, providing all litigation against Westinghouse is withdrawn.

The report of President Clark, of the New York, New Haven & Hartford railroad, shows that the Worcester *Gazette* was not far wrong when it said the road was going to use electricity. President Clark says: "If electricity as a motive power becomes commercially practicable, the two inside tracks of the four now under construction between New York and New Haven, with their improved grades and alignments and absolute freedom from grade crossings, will prove especially adapted to its use."

The New England Telephone & Telegraph company has been granted permission to bury all its wires in the town of Brookline.

The plant of the Buckport, Me., electric light company has been sold for $16,000 to Charles H. Rice.

The Tourist Light & Power company of New Hampshire has closed a contract with an electric company of Portland, Me., for an electric plant of 6,000 lights capacity, with arrangements to increase this to 10,000.

Rockville, Conn., has voted to put in a $25,000 electric light plant. J. C. E.

PERSONAL.

C. B. Fairchild, editor of the *Street Railway Journal*, New York, is in Chicago.

J. B. McDonald, president of the American Battery company, Chicago, left for New York on Monday to be absent from the city for the remainder of the week.

C. K. Mead, secretary and general manager of the Des Moines Water Power company, Des Moines, Ia., passed through Chicago on Monday, returning from Springfield, O.

H. G. Madden of New York, for some time general agent for a number of electrical companies, has been appointed purchasing agent for the C. & C. Electric company, New York.

H. M. Sloan, late superintendent of the St. Paul street railway system, remained in Chicago several days after the Cleveland convention. Mr. Sloan has recently resigned his position with the St. Paul company.

J. M. Fisher, until recently general manager of the Mosher Electric Manufacturing company, has removed his family to Ann Arbor, Mich., and expects personally to superintend, for the winter, a large cattle ranch in Mexico.

President Elias E. Ries, of the Ries Electric Specialty company, of Baltimore, was a visitor last week at the New York office of the WESTERN ELECTRICIAN. Mr. Ries will soon start on an extended trip through the west, visiting Chicago and other western cities.

NEW INCORPORATIONS.

Eureka Light & Power company, Eureka, Kans., capital stock, $30,000; manufacturing electric light and power.

Pittsfield Electric company, Naperville, Ill ; capital stock, $20,000; to furnish light and power; Scott & Royce, Naperville, Ill.

Atchison Electric Motor & Street Railway company, Atchison, Kan ; capital stock, $500,000; to construct an electric railway on the streets of Atchison, Kan.

Marengo Light & Power company, Chicago, Ill ; capital stock, $25,000; to furnish light and power in Marengo, Ill., and vicinity; A. C. Reed, 225 West 12th street, Chicago, Ill.

Valley Passenger Railway company, Scranton, Pa.; capital stock, $200,000; constructing and operating an electric railway in Lackawanna county, Pa.; J. P. Burns, Scranton, Pa.

Magnolia Light, Heat & Power company, Warrensburg, Me., capital stock, $20,000; to generate and furnish electricity and gas for light, heat and power; J. D. Eads, Warrensburg, Me.

Miami Valley Railway company, Piqua, Ohio; capital stock, $10,000; building and operating a line of electric railway between Piqua and Troy, Miama county; L. M. Flesh, Piqua, Ohio.

Edison Illuminating company, St. Louis, Mo.; capital stock, $5,000; to manufacture, vend and distribute incandescent and arc lights and electricity for power and heat; John R. Butler, St. Louis, Mo.

Shamokin & Mount Carmel Electric Railway company, Shamokin, Pa.; capital stock, $100,000; constructing and operating an electric railway in Northumberland county; Hon. C. M. Clement, Sunbury, Pa.

Shoshone Falls Electric Power & Irrigation company, Chicago, Ill.; capital stock, $25,000,000; to develop water for irrigation, power and light purposes, etc.; J. B. Schmalz, 509 Chamber of Commerce, Chicago, Ill.

Eliot Falls Electric Light company, Natick, Mass. capital stock, $30,000; to manufacture, use, distribute and sell electricity for heat, light and power; Arthur P. Dana, 941 Exchange building, Boston, Mass.

Hyndman Electric Light, Heat & Power company, Hyndman, Pa.; capital stock, $15,000; supplying light heat and power, or any of them, by electricity, to the public in Hyndman; John S. Weller, Bedford, Pa.

Mount Tebo Water, Light & Power company, Sedalia, Mo.; capital stock, $30,000; to construct and maintain water works, also to furnish electricity for light and power; D. E. Kennedy, Dempsey building, Sedalia, Mo.

Cripple Creek Telephone, Electric Light & Power company, Fremont, Colo ; capital stock, $100,000; to establish, maintain and operate telephone lines, electric light and power lines and power houses in the state of Colorado.

United Columbian Electric company, Camden, N. J., capital stock $800,000, to manufacture, sell, lease, buy, let and sub-let electric motors, dynamos, batteries, etc. Thomas P. Curley, Camden, N. J.

Suburban Electric Light & Power company, St. Louis, Mo.; capital stock, $10,000; to furnish electricity for heating, lighting and motive power to corporations and private individuals; Wm. C. and Jas. C. Jones, Laclede building, St. Louis, Mo.

Beaver Meadow, Hazelton, Mahoney & Shenandoah Railway company, Hazleton, Pa ; capital stock, $150,000; constructing and operating an electric railway in Carbon, Schuylkill and Luzerne counties, Pa.; John F. Finney, Shenandoah, Pa.

Eickemeyer-Field Manufacturing company, Yonkers, N. Y.; capital stock, $1,000,000; to manufacture and sell electric machinery and equipments. This company is formed by the consolidation of the Eickemeyer-Field company, Eickemeyer Dynamo company, and Yonkers Machine company.

ELECTRIC LIGHTING.

Milford, Mich., citizens are petitioning for electric light.

There are now forty-two electric lights around the French coasts.

J. H. Culver, J. M. Willard and E. E. Gibson have formed a new electric light company in Decatur, Ill.

The Franklin Electric Light company of Kansas City has made the city of Waco, Texas, a proposition for the erection of an electric light plant to be owned and operated by the city.

W. H. Harding, manager of the Central Electric Light company of Chicago, has agreed to equip his plant before December with a down draft smokeless furnace. The question of burning hard coal in the meantime is held in abeyance until some tests at the Edison company's plant shall have been made.

Probably the smallest electric light installation in the world is to be found in the little village of Bremen, near Dornbach, in Thuringia. It comprises a single arc lamp installed in the church, the lamp being operated when required by a small dynamo arranged in the village mill, and driven by the mill-wheel.

The General Electric company has organized an electric lighting company in the city of Baltimore whose plant will be unique. The central station will have, it is claimed, no less than 10,000 horse power. For the central part of the city the three-wire Edison system will be used; for the suburbs the Fort Wayne alternating system, while the Fort Wayne arc lights will be used throughout where arc lights are required. All wires will be underground.

A fire in the basement of the Auditorium Hotel, Chicago, was the cause of the blowing of nearly all the fuses on the incandescent circuits on Sunday night. All the lights were extinguished, of course, and the guests were considerably alarmed. Messengers were at once despatched from the office however, and the occupants of the rooms were reassured. Early in the morning a force of wiremen was put at work to repair the damage, and within forty-eight hours all the connections were made.

A plan to light by electricity the tracks of the Pennsylvania railroad between Broad street station and Bryn Mawr, on the main line, and between Frankfort and Broad street, on the New York division, is under consideration, says the Philadelphia *Record*. If the project materializes, there will practically be no further use for headlights on the locomotives running between these points, and should the line of electric lights be continued all the way to New York, which is neither impractical nor improbable, the entire roadway will be as light as day at all times, rendering headlights absolutely useless. The company is now constructing a mammoth electric light plant at Sixteenth and Filbert streets, which would afford ample facilities for an extensive circuit of lights if established, and there is enough land adjoining now in possession of the company to admit of extensive additions should they be needed. General Agent Latta states that the matter has been talked of for some time, but that nothing definite has been done in the matter.

ELECTRIC RAILWAYS.

An electric railway on the Sprague system is to be constructed at Genes, France.

The City Street Car company of Staunton, Va., will equip five and a half miles of its road with electricity. It will have seven motor and five trail cars.

The Tampa, Fla., Street Railway & Power company has decided to use the electric system, and will make arrangements at an early date for equipping its lines.

The Evansville, Ind., *Tribune*, says: "Electric cars are running regularly on Main street, between the St. George and Louisiana street, and the shave-tail's doom is nigh."

Two miles of street railroad has just been completed and put in operation by J. A. Bendure, constructing engineer for the Forest Park Electric Street Railway company, at Pittsburg, Kan.

It is hardly likely that the electric railway from Fort Wayne to Maysville, Ind., will be built. The committee appointed by the Maysville people to solicit subscriptions failed to raise more than one-tenth the amount.

The council of Radford, Va., has exempted the Radford Street Railway company from the condition of its franchise which requires the company to maintain eighteen inches of the street on each side of the road-bed in consideration of the company using electricity as a motive power.

E. S. Douglass, A. C. Wuerpel, W. B. Henderson and others have organized the Consumers' Electric Light & Street Railway company of Tampa, Fla., and purchased the equipment of the Suburban Railway company with other property. They will use the Westinghouse system.

The consolidation of the Ishpeming, Mich., Gas & Electric Light company and the Negaunee & Ishpeming Street Railway company is about consummated. The signatures of nearly all the shareholders have been secured to the agreement authorizing the consolidation, only about fifty shares yet remaining unsigned, and the committee has been so far unable to see the holders of these, owing to their absence from the city or similar causes. The consolidation, when finally effected, will date from October 1st.

It is said that the great electric locomotives that the General Electric company is now building for the Baltimore belt line tunnel will take current from overhead conductors of 8 square inches cross section, by means of a trolley. The voltage will be 700 approximately and the current for each motor 1,000 to 2,000 amperes. The armatures are directly on the driving axles. The driving wheels are 5 feet in diameter; speed, 30 miles an hour; electric horse power developed, 1,500; weight of locomotive, 90 tons; drawbar pull, 40,000 pounds.

TELEGRAPH.

The Postal company emphatically denies the rumor that the Western Union company is about to absorb it.

The Western Union Telegraph company will erect a telegraph line between Virginia Point and North Galveston in a few weeks.

Notification is given of the opening of a new submarine telegraph route between Europe and South America from Senegal to Pernambuco, in connection with the Spanish National and Eastern companies' systems between London and Cadiz.

The Pacific Postal Telegraph company announces a reduction of 20 per cent. in tolls between Seattle and British Columbia points. The cities to which the reduction applies are Victoria, Vancouver, New Westminster, Nanaimo and Chemanius.

As the result of a bogus dispatch, purporting to have come from Grand Chief Ramsey, of the Order of Railway Telegraphers, the telegraph operators and train dispatchers of the Atchison, Topeka & Santa Fe Railroad company went out on a strike on October 17th. Several hours afterward it was discovered that the alleged order was a hoax, and the men went back to work.

TELEPHONE.

In Columbia, Pa., the telephone company pays an annual tax of 50 cents for each of its poles.

The Bell Telephone company will put in a new system at Roanoke, Va., at a cost of $7,000.

The capital stock of the Pennsylvania Telephone company has been increased from $500,000 to $6,000,000.

The telephone girls of the Chicago exchanges wanted a holiday on Dedication day, and petitioned the mayor to compel the company to close its offices on that day. Their request was not productive of result, however.

The first long distance telephone message ever sent from Chicago to a daily newspaper in Brooklyn was received on October 21st by the *Standard Union*. Not only were the words of the correspondent distinctly heard, but his voice was clearly recognizable.

Down in Tennessee the telephone companies have a hard time to protect their wires, which are stolen with impunity. Small boys pull the wires down with forked sticks, while squirrel hunters make targets of the insulators. It is said that every buggy in one of the counties is patched up with telephone wires.

The Bell Telephone company of Buffalo is arranging for sub-central stations to relieve the pressure of work on the central station. It has secured two locations, one at 298 Bryant street, and one at the same number on Carolina street, near the junction of West avenue, and the work of connecting these with the central office is being vigorously pushed.

The capital stock of the Northwestern Telephone company, of Minneapolis, has been recently increased, and the company will begin a system of impovements. The old iron wires are to be replaced by copper wires and the double wire system will take the place of the grounded system. The metallic circuit will be in place by the end of next year. It is not probable that a line to Chicago will be built before three years.

MISCELLANEOUS.

Rumors of the consolidation of the General Electric and Westinghouse companies continue to be circulated, but apparently without authority.

It is proposed to construct dams on the St. Louis river, and to establish an extensive light and power plant for service at the head of Lake Superior.

The Chicago Athletic club is projecting an indoor athletic carnival to be held about Christmas. The programme includes a foot-ball game to be played by electric light.

The Corcoran Scientific School, a department of the Columbian University of Washington, D. C., has established a special course in electrical engineering. F. R. Fava, Jr., is professor of engineering.

A novelty in the hatching of eggs has appeared in the shape of an electric incubator. The special feature of this machine is that the heat of the egg drawer is automatically regulated to the fiftieth part of a degree. It consists of a tank incubator, heated by radiation from the bottom of a water tank, which is constructed on the multitubular system. When the egg drawer reaches the temperature of 104 degrees an electric thermostat connects a dry battery with an electromagnet, which actuates a damper, allowing the heat to escape through the open air instead of passing through the flues of the water tank.

A $242,000 damage suit against the Louisville Gas company and Louisville Electric Light company has been brought by the big dry goods firm of Kaufman, Straus & Co. and some twenty-five or more insurance companies. The suit is the result of the disastrous conflagration a year

ago which destroyed the building occupied by Kaufman, Straus & Co. and also their stock. It is claimed that the explosion of the electric light company's boiler resulted in the fire.

A new engine especially adapted for the exigencies of country-house life has recently been brought out. This machine will not only throw two powerful jets for fire extinction, but can also be used to drive a circular saw, churns, cream separators, dynamo for electric lighting and other mansion, farm and estate plants. The engine delivers 120 gallons of water per minute, and develops over six horse power. The pump can be put out of gear in a few seconds, and the hand put on the fly wheel to drive other machinery.

TRADE NEWS.

F. S. Terry, manager of the Electrical Supply company, Chicago, made a hurried trip to the East last week, and closed special arrangements with the Crocker-Wheeler Electric company for the handling on a larger scale of Crocker-Wheeler motors in the West. Mr. Terry announces that there has been a steady increase in the sales of the motor department since it was established.

The Jersey City & Bergen Railroad company is rapidly completing the equipment of its new power station at Jersey City, N. J., and with the thoroughness that always characterizes work done by the officials of the Pennsylvania Railroad company. The boilers are in place, and tests for efficiency are now being made. It will be remembered that the competition among engine builders for this contract was very keen. The Ball & Wood company of New York received many congratulations when its engines were selected to operate this station. Three engines are now in position, and the impression they make is a very favorable one and carries with it the conviction that they possess, to an unusual degree, requirements for heavy and exacting street railway work. The frames are very heavy and substantial, the bearings large and all the castings show good work both in the foundry and the machine shop. Mr. Thurston, the president of the company, expects to have his cars running in November.

The Eickemeyer Field company of Yonkers, N. Y.; the Eickemeyer Dynamo company, and the Yonkers Machine company have recently consolidated their interests and incorporated with a capital of $1,000,000 under the name of the first mentioned company. The stock is divided, $935.000 to the first name, $60,000 to the second, and $5,000 to the third. The certificate was offered to the secretary of state on a previous occasion, but he refused to receive it unless the tax of one-eighth of 1 per cent. for consolidating was paid. The company refused to pay it, claiming that the law of last year exempted it. The secretary contended that the law exempted the consolidation of only two companies, and not three. The case, therefore, was taken to the court of appeals, and the tax paid under protest awaiting the court's decision. This company, as is well known, has been doing an extensive business in motors and street car trucks, the demand for which has rapidly increased during the last year. This concern has now under consideration a number of important improvements to facilitate the manufacture of its machinery.

BUSINESS.

Recent shipments of the Ball Engine company of Erie, Pa., aggregate in the neighborhood of 8,000 horse power. The company states that it is now doing a business greater than ever before.

The Electrical Appliance company is placing on the market a new expanding wire guard to be known as the Acme, and has taken several large orders from different parts of the country.

The Security Insulator company of New York is to be congratulated upon the success which its improved insulators have met with. It is stated that up to date this company has sold as many as 175,000, a number of the recent orders being duplicates.

The improvement in the electric bells manufactured by Huebel & Mauger, of Brooklyn, in the way of an immovable post has created a demand for these devices, which keeps the factory working to its utmost capacity. During the past two months the company has received some large orders from the west and Canada.

Dynamos, motors and arc lamps that "have seen some usage" is Chas. E. Gregory's happy way of referring to the line of electrical goods that he now keeps in stock and which some might designate as second-hand. Mr. Gregory is now distributing among his friends a neat little volume of vest pocket size which he calls an electrical telephone directory. The name tells its own story except that in addition to the directory there is a portion for memoranda. "Gregory's directory" has already found a place in the pocket of almost every Chicago Electric club member.

Guillott's Automatic Metal Gasket company, Grand Crossing, Chicago, Ill., is sending to the trade a sample metal gasket that creates a very favorable impression. This gasket is of a peculiar soft metal that has the appearance of lead. Its chief feature, though, is its shape, which will be appreciated by practical men. It is intended for all kinds of steam joints, flanges and unions. It is claimed that it will not spread like lead or corrode like copper. The pointed ridges work into all the uneven parts of the iron, and they hold and make a tight joint on rough castings.

The Washburn & Moen Manufacturing company on Wednesday of last week made a public test of the Salamander wire at the Western Electric company's factory, Chicago, in the presence of a number of prominent electrical engineers and architects. This new wire, it is claimed, is so insulated as to insure absolute safety against danger of fires from overheating. Tests showing the peculiar properties of Salamander wire have already been referred to in the WESTERN ELECTRICIAN. Salamander insulation, it would seem, from the manner in which it withstands crucial tests, is likely to prove a formidable competitor amongst the wires now in the field.

Taylor, Goodhue & Ames, Chicago, are pleased with the success which has already attended their efforts, although they have been in the field less than a month. The new firm has secured the general selling agency for the Nutting arc lamp suitable for all circuits and the well-known Burton electric car heater. In addition to this, a large selling territory has been secured for specialties made by the Wagner Electric Manufacturing company and the Columbia Incandescent Lamp company. One of the firm's recent acquisitions, too, is the general western agency for the Philadelphia trolley, which made such a favorable impression upon practical men at the recent Cleveland convention. Taylor, Goodhue & Ames report business in all their line of specialties as excellent.

Following are a number of recent sales made by the C. & C. Electric Motor company through its New York, Chicago and Boston offices: Menominee, Mich., Electrical & Mechanical company, a 15 horse power and a 3½ horse power motor; 6, 4 and 3 kilowatt dynamos; Baydenoquet company, Nahma, Mich., a 12 kilowatt dynamo; Armour Packing company, a 25 and two 5 horse power motors; DeLaVergne Refrigerating Machine company, New York, 15 horse power motor. The company has on hand also orders filled and unfilled from a single crane company for over fifty machines consisting of one 20 horse power motor, nineteen 16 horse power motors, thirteen 12 horse power motors, nine 8 horse power motors, the balance being in sizes below 8 horse power. In addition to these it has sold the Laclede Power company, St. Louis, three 25 horse power motors and two 10 horse power motors; Heidt & Son, Jersey City, N. J., a 20 horse power motor; H. R. Worthington, Brooklyn, N. Y., 10 and 3 horse power motors; Harvey Street Car Works, Harvey, Ill., a 30 kilowatt plant; Midvale Steel company, Nicetown, Philadelphia, Pa., an 80 kilowatt dynamo and a Ball engine, including installation; Boston & Maine Elevator company (Simpson & Robinson), Charleston, Mass., a 20 kilowatt dynamo, lamps and installation; Home for Paupers, Long Island, Boston Harbor, three 12 kilowatt dynamos, three 5 and two 2 horse power motors.

The Standard Paint company, New York, the well-known manufacturer of P. & B. insulating compounds, added another factory last week to its plant at Bound Brook, N. J. To celebrate the occasion the company tendered a house warming to the employes and friends. On the inside the factory was strung along the sides and beams with red, white and blue bunting together with large branches of evergreen. In the middle of the floor a lemonade well of very neat design was patronized by all. This factory, which is 75 feet by 125 feet, two stories high, is to be used exclusively for the manufacture of the company's insulated paper for electrical purposes, and the many new articles to be placed upon the market. Three factories are used for the manufacture of P. & B. paint, and the plant covers three acres of ground. Power is transmitted from the engine room to the various factories by means of wire rope. The steam boiler, which is of 150 horse power, runs three horizontal engines. Owing to the manufacture of the P. & B. articles being carried on by peculiar processes, the bulk of the machinery in the factories was invented by the company. President Ralph Shainwald, of the Standard Paint company, made a short speech to the employes and officers of the company and to the many friends who had gathered to participate in the house warming. In conversation with the representative of the WESTERN ELECTRICIAN, William Griscom, Jr., superintendent of the factories, said that hitherto the company has been obliged to haul all freight over to the Central railroad, but about the first of the year it would build a private freight house on the canal which bounds the works on one side, thus doing away with this part of the transportation. He also stated that they were about to put in an automatic fire pump, and have a fire plug in each building, with fifty feet of hose attached to each plug. He also stated that the company was considering the advisability of putting in a new electric plant in place of the one now in use. The manufacture of the P. & B. compound was first started in California in 1885 by the Paraffine Paint company with Ralph Shainwald as president. This company is still in existence and is doing a very prosperous business, having recently enlarged quite extensively the works near San Francisco. The Standard Paint company was started two years later in New York also by Mr. Shainwald. These two companies, although virtually one, are managed entirely independently of each other, the Paraffine company doing business west of the Rocky mountains, and the Standard company working east of this point. Not only does the Standard Paint company do business in this country but it also has a large export trade in India, Australia, South America and various points throughout Europe. The features of the company's paper are that it is odorless, acid proof and water proof. The steady growth in the business of the Standard Paint company since its organization has been remarkable, and no little credit should be given to General Manager F. S. de Rende, who has been connected with the company since 1887.

ELECTRICAL PATENTS.

Issued October 25, 1892.

484,778. Telephonic Transmitter. Arthur T. Collier, St. Albans, Eng.

Two electrodes are adapted to rest in contact, one electrode being carried upon a suspended diaphragm, the other upon a yielding support, in such a manner that the electrode attached to the diaphragm hangs in unstable contact with the other electrode.

484,785. Magneto Electric Generator. Sydney Evershed, London, Eng.

The generator consists of closely fitting pole pieces energized by permanent magnets and an armature having holes parallel to the axis and narrow slots extending from the periphery to the holes to effect the winding of the coils, the coils being connected in pairs by means of two part commutators.

484,796. System for Adjusting to Temperature Watch Balances and Hair Springs. George E. Hunter, Elgin, Ill.

484,797. Mechanism for Timing and Adjusting Watch Balances and Hair Springs. George E. Hunter, Elgin, Ill.

484,822. Thermal Circuit Changer and Protective Appliance. Harry A. Rhodes, Denver, Colo.

484,825. Incandescent Lamp. Frank S. Smith, Pittsburg, Pa.

The invention consists in constructing the enclosing chamber of two parts, the greater portion being of glass, while the remaining portion is composed of a soluble material, which will unite with the glass portion and make an air tight chamber, but which will dissolve out or separate from the glass when immersed in the proper solvent, leaving the glass portion intact.

884,842. Wire Coupling. William E. Banta, Springfield, O.

The coupling consists in bending the ends of the wires outwardly and winding them with wires joined together and adapted to bite on to the wires under the coupling strain.

484,865. Automatic Cut Out. Charles E. Sanford, Brooklyn, N. Y.

484,867. Test Circuit for Multiple Switch-board Systems. Charles E. Scribner, Chicago, Ill.

The invention embodies an electro magnetic responsive device in the circuit of a telephone line, and adapted to be disconnected when the line is connected for use, and a circuit closing device controlled thereby and adapted to close a circuit with the circuit of the telephone line in which the responsive device is included.

484,869. Process of Separating Gold and Other Metals from their Ores. George J. Atkins, London, Eng.

484,877. Process of Separating Iron from Ore. Henry H. Eames, Baltimore County, Md.

The material containing the ore is ground or otherwise divided, and is then brought in contact with or proximity to a conductor through which a current of electricity is passing, the iron particles being thus gathered upon the conductor and then detached by shutting off the current through the conductor.

484,911. Ceiling Block. John J. Green, Boonton.

484,919. Electric Railway System. John H. Pendleton, Brooklyn, N. Y.

The system embraces a supply conductor, a sectional working conductor, interposed energizing sections, a primary branch for each section of the working conductor leading from the supply conductor and including an electro magnet and a secondary branch for each energizing section.

484,934. Closed Conduit for Electric Railways. Benjamin F. Sutton, Brooklyn, N. Y.

A flexible tube of insulating material is provided upon its bottom with an electrical conductor, and upon its top with a sectional conductor, which is adapted to be brought in contact with the electrical conductor by the pressure of the trolley wheel.

484,959. Electric Converter. Ludwig Gutmann, Fort Wayne, Ind.

The core of the converter is composed of superposed metallic plates separated by insulation, the alternate plates being electrically connected together

484,964. Electric Search Light. Louis Hills, New York, N. Y.

484,986. Trolley Pole Catcher. Montraville M. Wood, Chicago, Ill.

A normally loose rope is attached by one end to the trolley pole, and by the other end to a reel adapted to be actuated by a motor when tension is placed upon the rope.

484,990. Electrolytic Process and Apparatus. Henry Blackman, New York, N. Y.

485,013. Secondary Battery. William Main, Brooklyn, N. Y.

The cell has a hydrogen electrode consisting of a vertical conductive support inactive in the liquid, having an affinity for but not penetrated by mercury, and a coating of zinc and mercury on the surface of the support forming the active material.

485,017. Electric Soldering. Elias E. Ries, Baltimore, Md.

The method consists of fusing the solder at the point or line of union of the metallic articles to be soldered by heat radiated from an electrically heated body.

485,027. Telephone Support. George V. Benjamin, Ithaca, N. Y.

485,028. Electrical Switch. Gustav Binswanger, London, Eng.

485,054. Regulation of Alternating Current Generators. Gustav Pfannkuche, Cleveland, O.

The field magnets of the exciter are charged by the current generated in the alternating current generator, the currents first passing through a reducing converter, and then being straightened out by a suitable commutator before they reach the field coils of the exciter.

485,089. Standard Cell for Electric Batteries. Henry S. Carhart, Ann Arbor, Mich.

The cell consists of a mercury salt contained in a vessel and connected with one terminal of the cell, a zinc element connected with the other terminal, an electrolytic fluid in contact with the zinc and mercury salt, and a porous partition or diaphragm between the zinc and the mercury salt.

485,105. Insulator for Electric Railway Conductors. Charles T. Lee, Boston, Mass.

485,106. Insulator. Charles T. Lee, Boston, Mass.

The insulator is composed of a series of sheets of mica laid and pressed together and firmly secured by bolts or pins passing through the sheets.

485,128. Finishing Grids for Secondary Batteries. Albert F. Madden, Newark, N. J.

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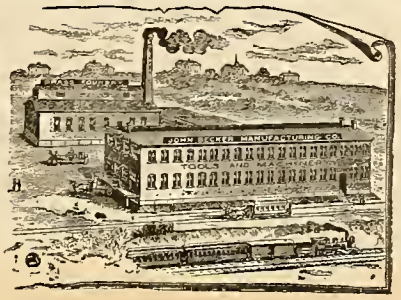

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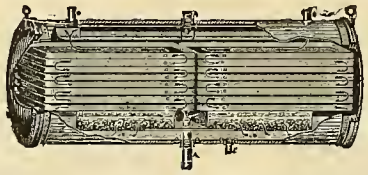

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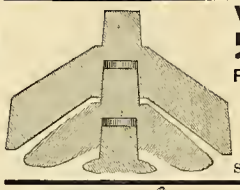

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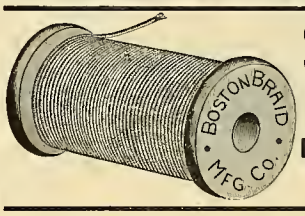

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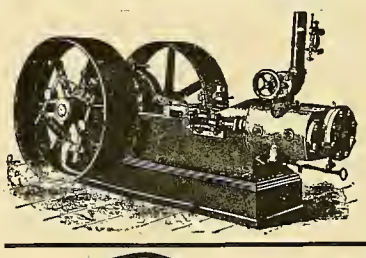

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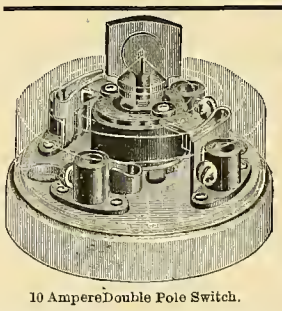

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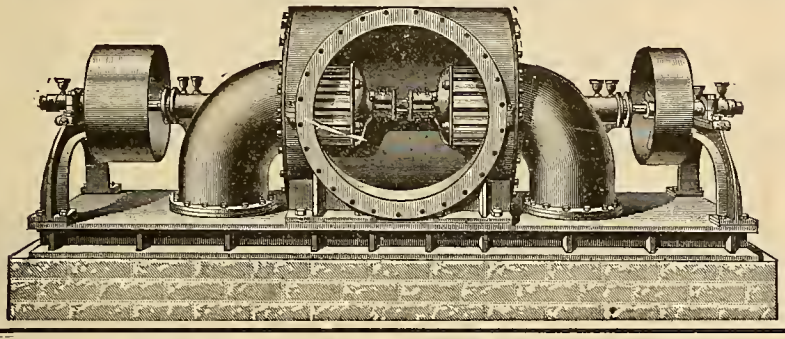

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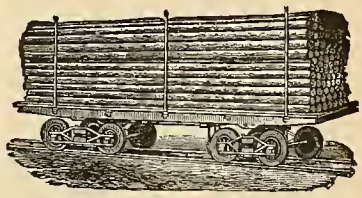

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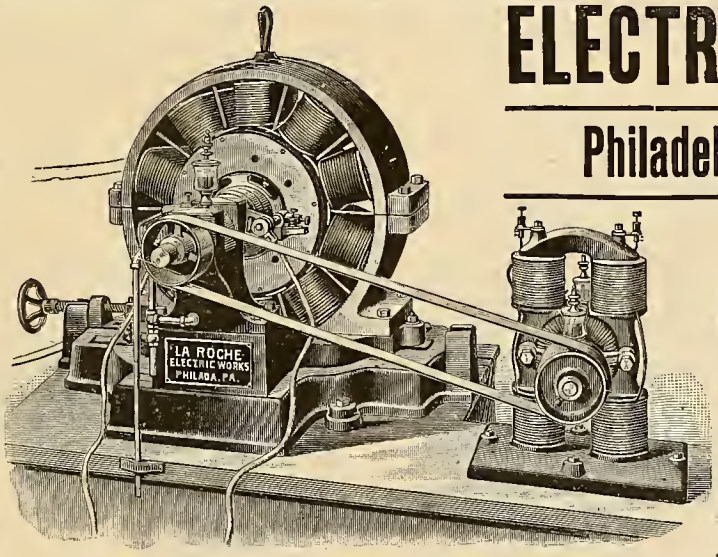

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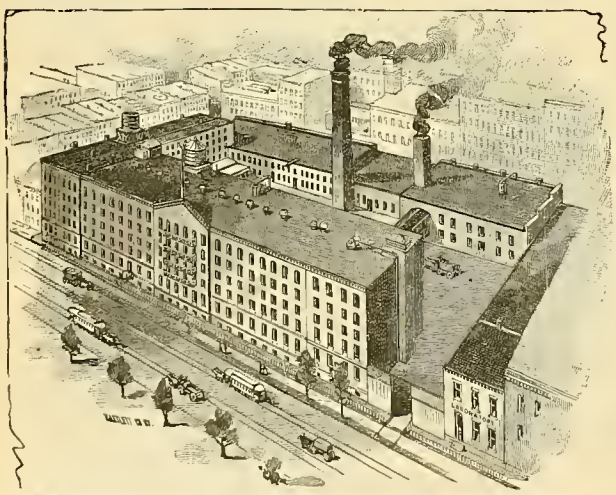

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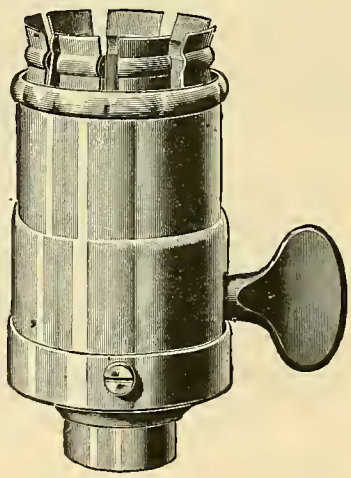

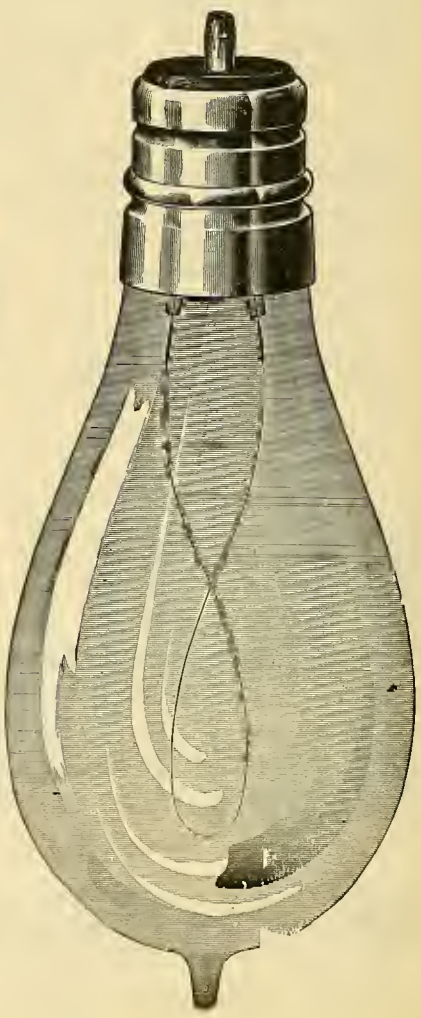

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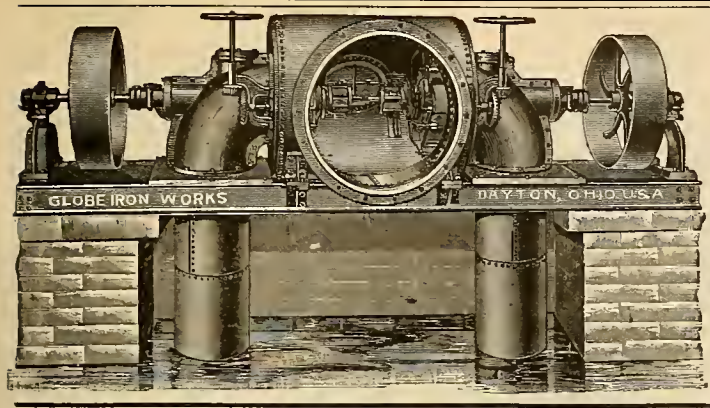

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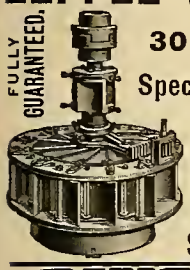

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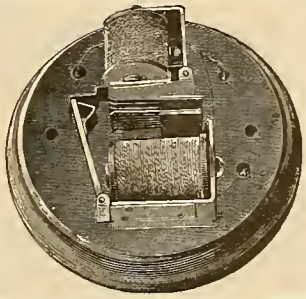

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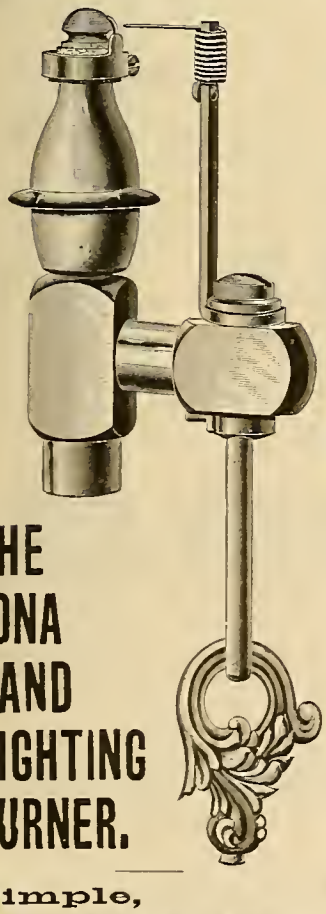

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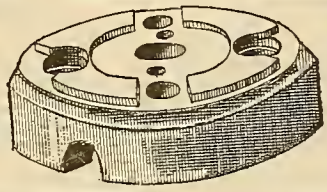

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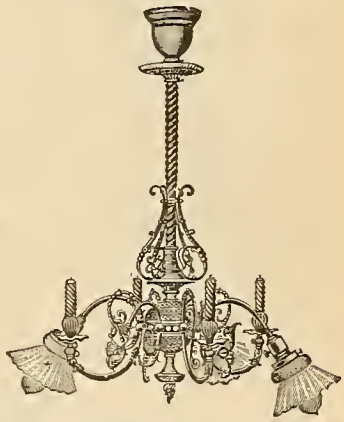

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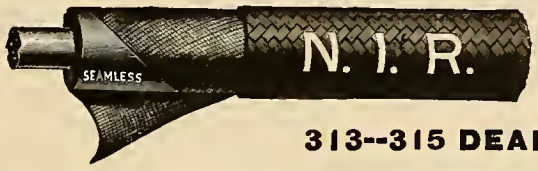

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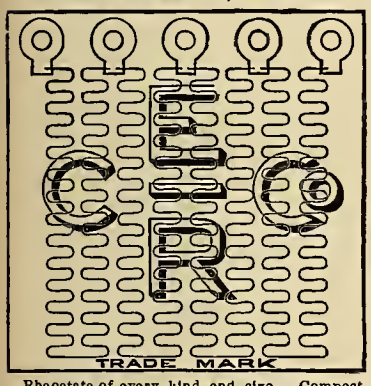

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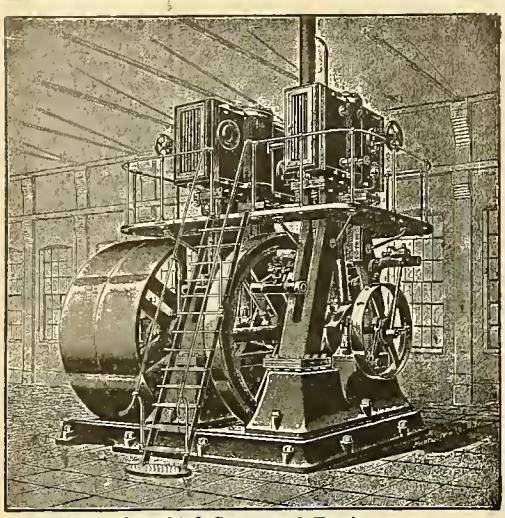

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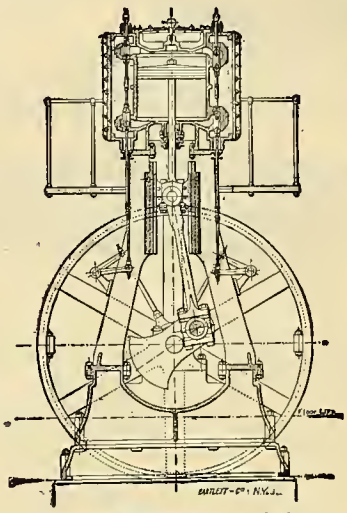

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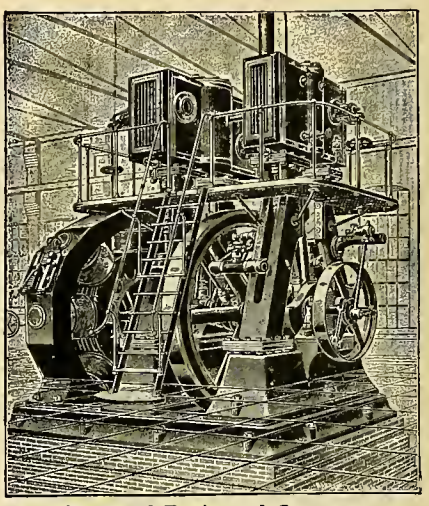

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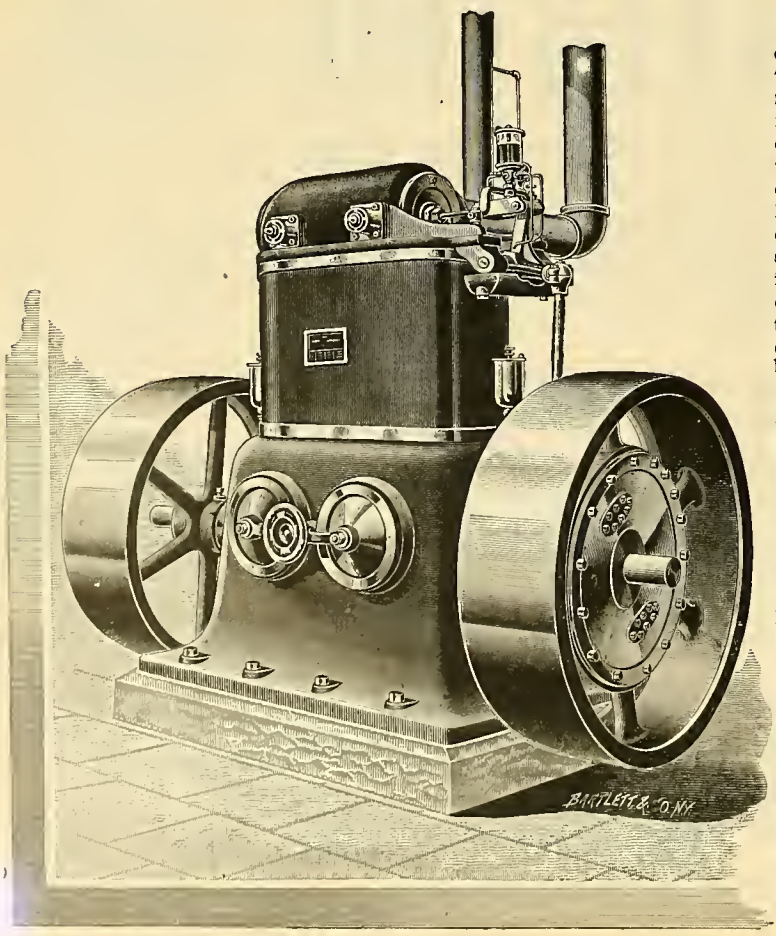

The Compound Engine, when non-condensing, so far from possessing an economy superior to the Simple Engine, has been decisively proven, "much to the disgust of the stockholder," to show normal economy only at or about its rated power, and to fall off in economy faster than a Simple Engine as the load falls off; moreover, very much faster under the extreme light loads that are common in Electrical Generation. This point is at last reluctantly admitted by the more candid builders of such engines, most of whom now advise against compounding for variable loads. The reason is in their inability to divide the load and range of temperature proportionately and automatically between the cylinders at all points of cut-off. Hence, the low-pressure cylinder expands its steam below atmosphere under a moderately early cut-off, thus converting itself into an Air Pump, and becoming a load upon the high-pressure cylinder instead of a co-laborer with it. This point was distinctly foreseen by the designers of the Westinghouse Compound Engine, and an entirely new principle was worked out, making expansion below atmosphere impossible under any load, however light. **For the first time in the history of Steam Engineering, either Simple or Compound, is built an Engine which maintains essentially uniform economy, irrespective of load,** and hence for the first time the Compound Non-condensing Engine has been made practicable. The results, demonstrated by test, show that where an ordinary Compound will range from 25 lbs. to 70 lbs. water per H. P per hour from full to quarter load, the Westinghouse Compound, between the same limits, will range from 23 lbs. to 29 lbs. We have not deceived ourselves in this matter, and propose that the facts shall be understood. To those interested in the nicer points involved, we will be pleased to send a reprint of the paper read by Mr. F. M. Rites on this subject at the late meeting of the American Society of Mechanical Engineers, at San Francisco.

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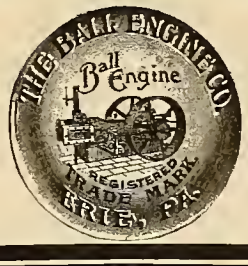

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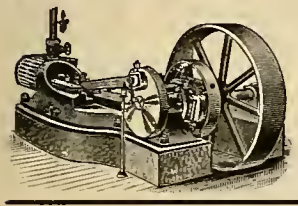

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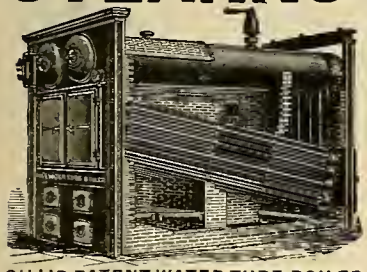

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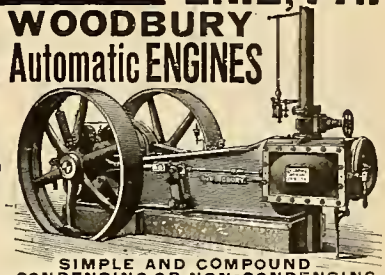
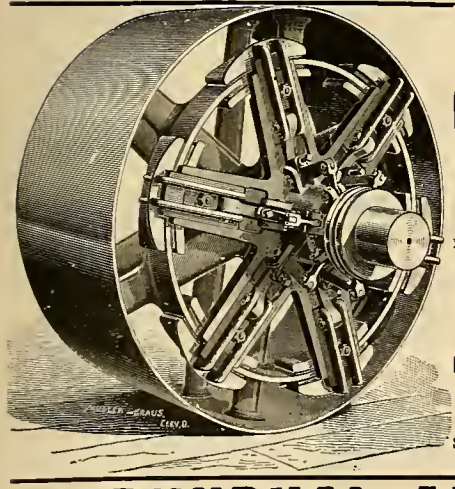


SIMPLE AND COMPOUND CONDENSING OR NON-CONDENSING.



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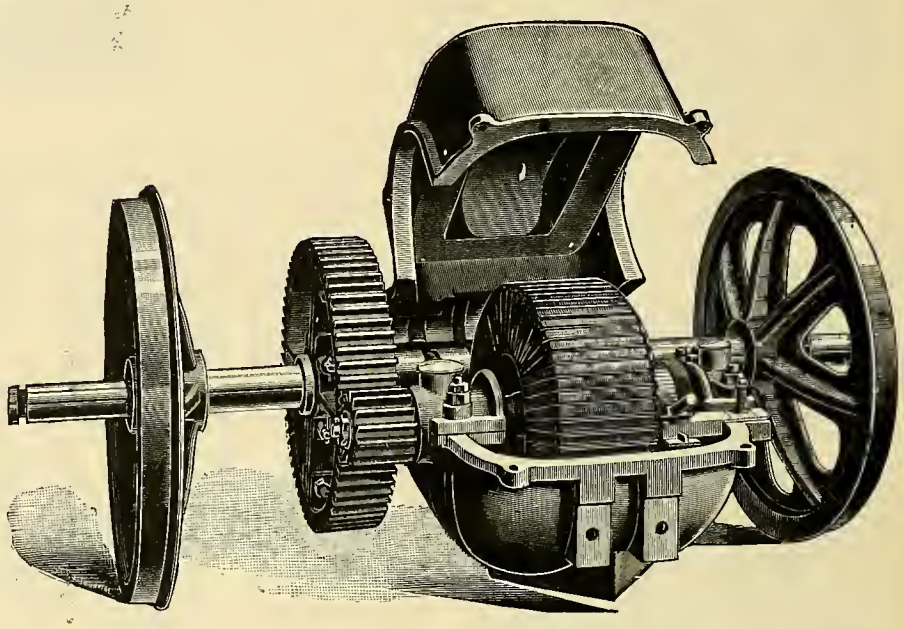

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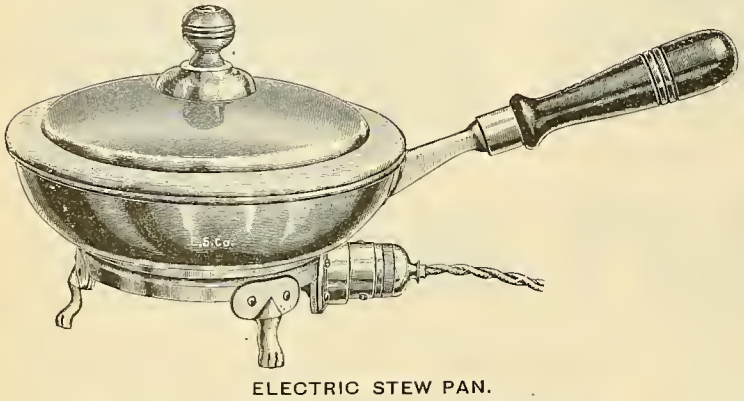

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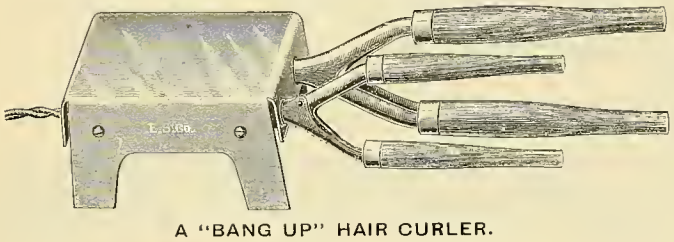

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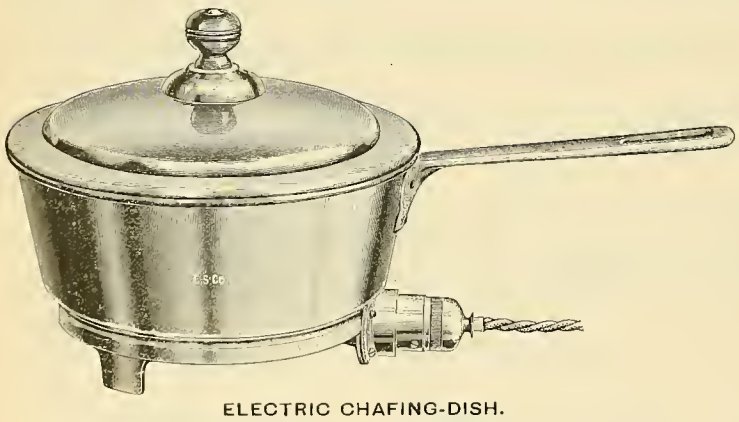

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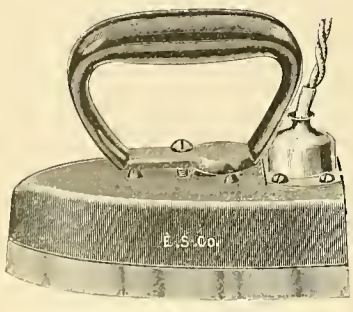

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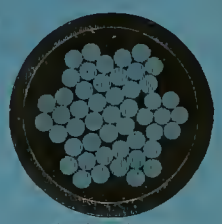
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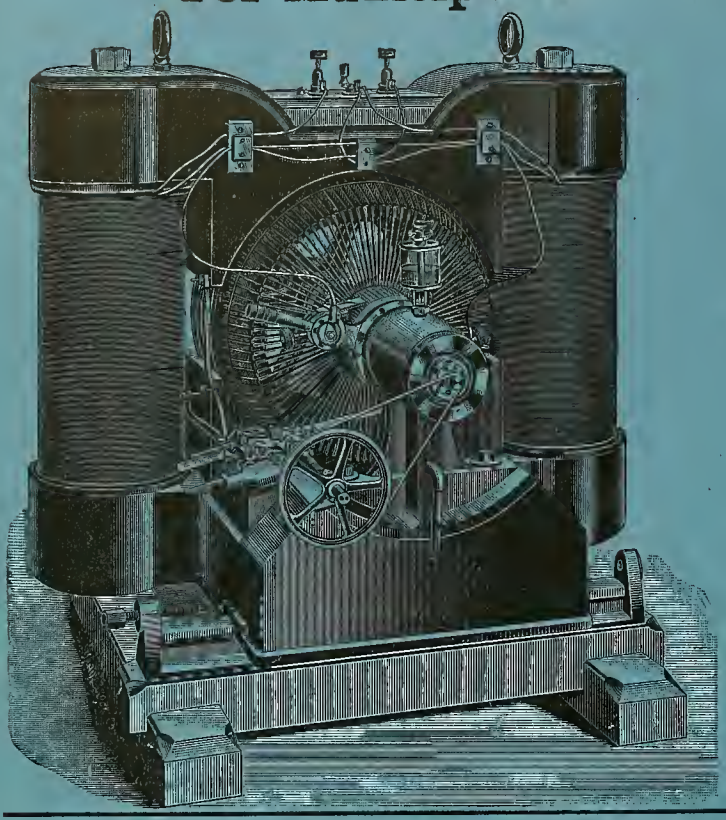

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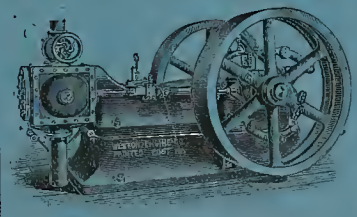

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INDEX AND CLASSIFICATION OF ADVERTISEMENTS.

ALPHABETICAL LIST.

American Battery Co..... ix
American Desk & Seating Co..—
American Electrical Mfg. Co..—
American Engine Co..... xii
Andrews & Co., A. H..... xiii
Babcock & Wilcox Co., The.... i
Baggot, E xiv
Baker & Co..... xii
Ball Engine Co..... xxi
Ball & Wood Co., The i
Beacon Vacuum Pump & Elec. Co.i
Becker Mfg. Co., John.....—
Beggs, J. E., Mch. & Supply Co.xiv
Bernstein Electric Co.....iv, xiii
Blanchard, Albert..... xxi
Boston Braid Mfg. Co..... xiv
Bowers Bros..... xix
Bridgeport Mach. Tool Wks.. xii
Brookfield, Wm..... xii
Brush Electric Co xix
Bryan, W. H.. xv
Bryant Electric Co ..... —
Buckeye Electric Co., The..... ix
Cabell, L. Breckinridge.....iv, xiv
Carpenter Enamel Rheostat Co. xix
Central Electric Co..... v
Chicago Rawhide Mfg. Co.... iv
Columbia Inc Lamp Co..... i
Columbia Mfg. & Supply Co..—
Crescent Ins. Wire & Cable Co. xiii
Crocker-Wheeler Electric Co.. xiii
Cushing, F. W..... xvii
Cutter, Geo ..... —
Cutter Electrical & Mfg. Co... ix
Dayton Globe Iron Works Co..xvii
Densmore Typewriter Co.....—
Diamond Electric Mfg. Co....—
d'Infreville, G..... xiv
Dixon Crucible Co., Jos..... xv
Dudley & Co., W. W..... xi i
Duplex Electric Co.. Ltd ..... x i
Eastern Electric Cable Co..... xiii
Eastman Kodak Co..... xiv
Edwards, W. S. Mfg. Co .....—
Electric Appliance Co xii
Electric Cons. & Supply Co.. xv
Electric Engr'g & Supply Co.. iv
Electrical Mfg. Co., The viii
Electric Secret Service Co.... xxi
Electrician Pub. Co xv, xvi, xviii
Electrical Construction Co., The.xiii
Electrical Eng & Supply Co. The. v
Electrical Supply Co., The ...xxiv
Elektron Mfg. Co..... —
Empire China Works... xxi
Enterprise Electric Co..... xix
Falls Rivet & Machine Co..... ix
Ferracute Machine Co..... —
Ford-Washburn Storelectro Co —
For Sale Advs. .....xii, xiii, xiv
General Electric Co.... ii, xxii
Great Western Elec. Supply Co ix
Greeley & Co., The E. S.....i
Gregory, Chas E..... xiii
Hart & Hegeman Mfg. Co.....—
Heisler Electric Co..... viii
Hill Clutch Works .. .. —
Hine Eliminator Co xii
Holmes, Booth & Haydens.... x
Hood & Co., Wm.... viii
Hughes Bros. Mfg Co..... xiii
Illinois Electric Lamp Co..... x
India Rubber & G. P. Ins. Co. xxv
Institute of Technology..... xix
Interior Conduit & Insulation Co. xv
International Okonite Co..... i
Jewell Belting Co..... i
Johns Mfg. Co., H. W.....—
Kartavert Mfg. Co... xix
Klipstein, A..... xiii
Knapp Electrical Works..... xxiii
Lake, J. H. & D., Co xx
Lake Erie Engineering Works. xx
Lane & Bodley Co..... xx
La Roche Electric Works.....—
Leclanche Battery Co., The .. x
Lefmann, Juliua xv
Leffel, & Co., Jas xvii
Link Belt Machinery Co..... xiii
Loud, H. M. & Sons Lumber Co. xiv
Mather Electric Co iv
Midland Electrical Wks.....—
Moore, Alfred F..... i
Morse & Co., A. M..... .. xii
Munsell & Co., Eugene..... xii
National Carbon Co. x
National Electric Mfg. Co.... v
National India Rubber Co.... i
New York Insulated Wire Co. xix
N. Y. Safety Steam Power Co xiv
New York & Ohio Co..... i
Otto Gas Engine Works..... xxi
Osborne Steam Engineering Co. xiii
Ostrander & Co., W. R..... xxi
Page Belting Co..... —
Partrick & Carter Co..... viii
Pearson & Co., W. B..... xx
Pelton Water Wheel Co x
Penn. Electric Engineering Co x
Perkins Elec. Switch Mfg. Co. xiv
Phoenix Glass Co..... —
Porter-Leavitt Elec. Motor Co.—
Queen & Co..... xiii
Racine Hardware Mfg. Co.... xii
Railway Equipment Co.....vi, ix
Redding Electric Co..... xvii
Riea Electric Specialty Co.... x
Roebling's Sons Co., J. A iv
Rose Elec. Light Supply Co...—
Samson Cordage Works. xii
Sawyer-Man Electric Co.... xxvi
Scott Electrical Mfg. Co..... viii
Schuyler Electric Co..... xx
Sechrist, Albert..... xvii
Shawmut Fuse Wire Co x
Shultz Belting Co..... —
Siebert, G..... xii
Siemens & Halske Electric Co —
Sioux City Elec. Supply Co... xiii
Sioux City Engine Works.... xxi
Smith, A. T..... xx
Smith, Thos. G. Jr..... xiv
Sperry Elec. Mining Mach. Co. xix
Standard Electric Co..... xxvi
Standard Paint Co x
Stanley Electric Mfg. Co.....—
Stearns Mfg. Co..... xxi
Steuben Lamp Works..... xiii
Sterling, W. C..... xv
Stilwell & Bierce Mfg. Co. xiv, xv
Sturm, Ernst..... xiv
Sunbeam Incand. Lamp Co.. xxv
Taylor Engine Co..... xxi
Union Hardware Co..... xiii
Utica Elec. Mfg. & Supply Co. x
Van Nuis C. S.....—
Vulcanized Fibre Co..... xv
Waddell-Entz Company..... xii
Wannopee Pottery Co..... xx
Washburn & Moen Mfg. Co.. —
Western Electric Co.....xiv
Westinghouse, Church, Kerr & Co..... xvii
Westinghouse Elec. and Mfg Co..... xi, xvi
Weston Engine Co..... i
Worthington, Henry R..... —

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Annunciators.
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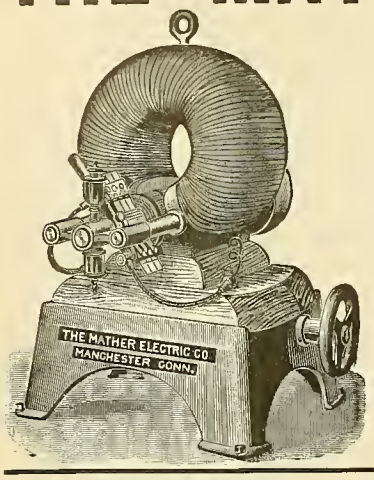

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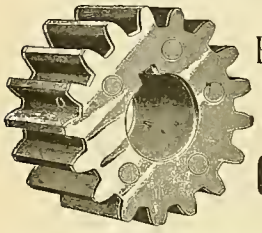

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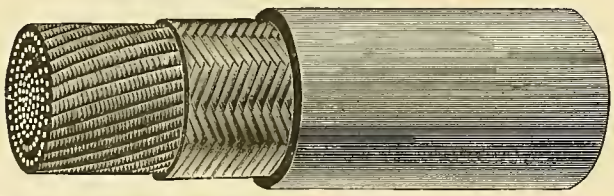

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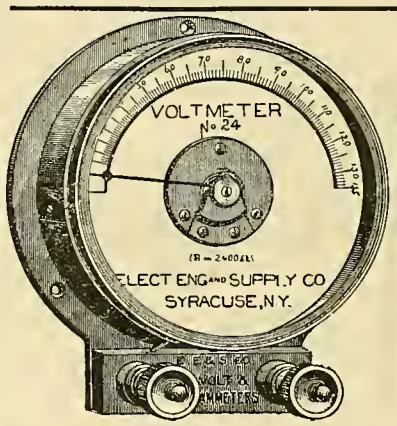

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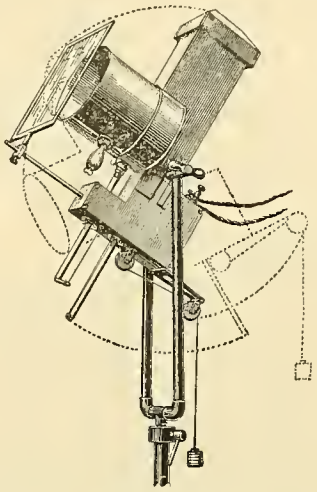

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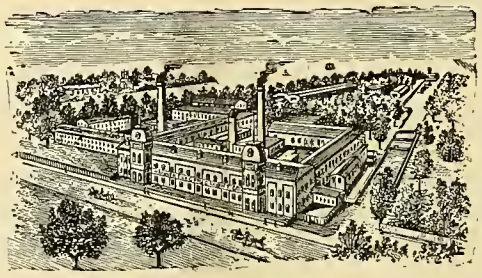

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Motors for Alternating and Direct Current Circuits.

STORAGE BATTERY INSTALLATIONS FOR ALL SERVICES.

OFFICE, DREXEL BUILDING, PHILADELPHIA.

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—WE MAKE A SPECIALTY OF—

Bells, Disque Leclanche Batteries, Gas Lighting Apparatus, Bronze goods and a full line of supplies for hotel and house work.

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BRILLIANT! BRILLIANT! BRILLIANT!

HIGH GRADE INCANDESCENT LAMPS.

THE ELECTRICAL MFG. COMPANY, OCONTO, WIS.

Lamps for all Systems. **Any Voltage or Candle Power.**

DIRECT CURRENT LAMPS.
ALTERNATING CURRENT LAMPS.
RAILWAY CIRCUIT LAMPS.

FILAMENTS WITH OR WITHOUT HOOKS.
MINIMUM CURRENT CONSUMPTION, with
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Before purchasing elsewhere send in a trial order for Brilliants. Lamps furnished to consumers in quantities at factory prices.

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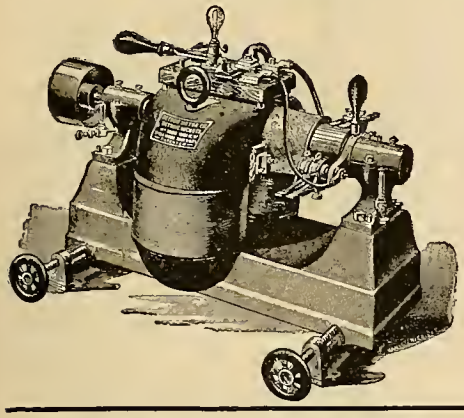

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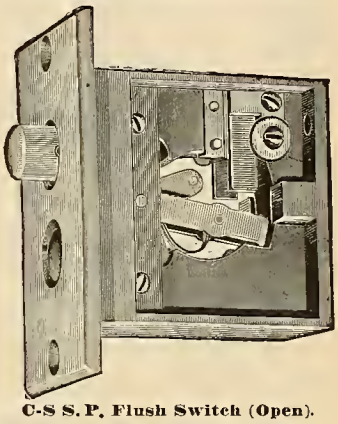

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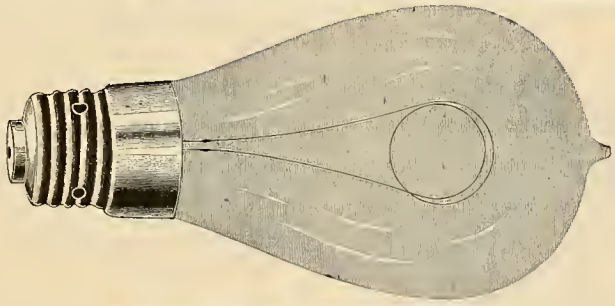

FROM OUR GINGER JAR.

BUCKEYE ELECTRIC CO.: CINCINNATI, OHIO, August 18, 1892.

DEAR SIRS:—We are so full of gratitude for your perseverance in placing the "**Buckeye**" Lamp with us that we must let it out or explode. In our watch making department, where the best light possible is required, we have found yours thoroughly satisfactory, being especially bright, clear and steady; in fact, nature itself—something we have not found in any other make tried. A lamp that will satisfy **our** watch makers must indeed be a "Jim Hun." Very truly yours, O. E. BELL & CO., Manufacturers and Jobbers, Jewelry and Watches.

THE BUCKEYE ELECTRIC CO., CLEVELAND.

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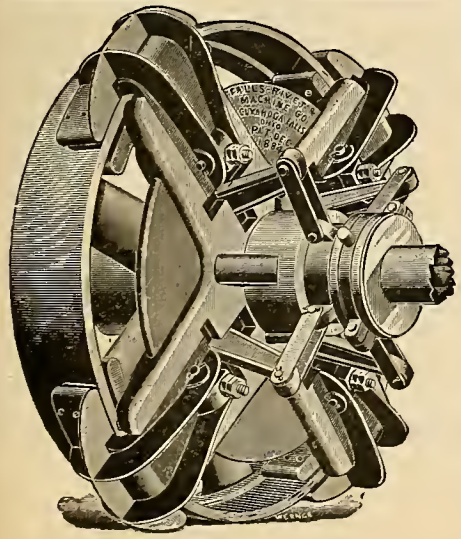

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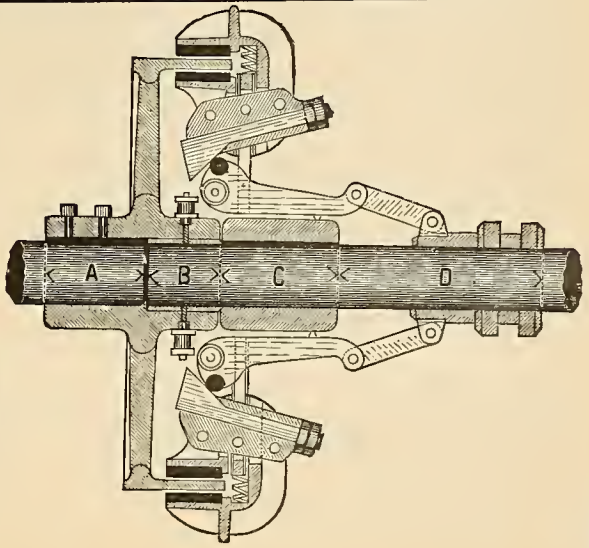

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ACKNOWLEDGED TO HAVE THE HIGHEST MERIT IN ALL THE RECENT COMPETITIVE TESTS.

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HIGHEST GRADE
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SEND FOR CATALOGUE
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GONDA TRADE MARK BATTERIES.

THE STANDARD OPEN CIRCUIT BATTERIES OF THE WORLD,
And the best made anywhere.
SEND FOR CIRCULAR & PRICES.

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Bare and Insulated Wire.

Underwriters' Copper Electric Light Line Wire, Copper Magnet Wire, Flexible Silk, Cotton and Worsted Cords for Incandescent Lighting. Round and Flat Copper Bars for Station Work. Insulated Iron Pressure Wire.

TRADE MARK "K.K."

PATENT "K. K." LINE WIRE

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For Electric Light, Electric Railways, Motors, Telegraph and Telephone Use.

Agents for the Washington Carbon Company, Carbons for Arc Lighting.

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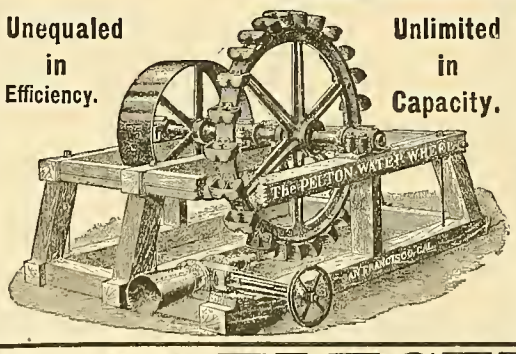
Gives the Highest Efficiency of any Wheel in the World. Over 2,000 in use.

Unequaled in Efficiency.



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Affords the most simple and reliable power for all mining and manufacturing machinery. Adapted to heads running from 20 up to 2,000 or more feet. From 20 to 30 per cent. better results guaranteed than can be produced from any other Wheel in the country.

ELECTRIC TRANSMISSION.

The advantages the Pelton Wheel affords in the way of a uniform and reliable power, close regulation and the facility of adaptation to varying conditions of speed and pressure, have brought it into special prominence and extensive use for this class of work. All applications should state amount and head of water power required, and for what purpose, with approximate length of pipe line. SEND FOR CATALOGUE.

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☞ It having come to our notice that our patent rights are being infringed upon, intending purchasers are hereby warned that all such infringements will be duly prosecuted.

PELTON WATER MOTORS. Varying from the fraction of 1 to 15 and 20 horse power, unequaled for all light running machinery. Warranted to develop a given amount of power with one-half the water required by any other. ☞ Send for Motor Circular. Address as above. Deliveries made from San Francisco or New York, as may afford the most favorable freight rates.

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Lamps for any System, Voltage or Candle Power.

MAKERS OF THE CELEBRATED

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SPECIALTIES:

Illinois Alternating Lamp.

Send for Trial Order.

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LAMPS.

EFFICIENT.
LONG LIFE.
NO DECREASE IN CANDLE POWER.

SOCKETS.

SIMPLE.
ORNAMENTAL.
RELIABLE.
CHEAP.

Our new lamps not only do not infringe the Edison patent, but they are fully covered by patents of our own.

By means of an important discovery the burner is rendered stable, its efficiency increased, its life prolonged, and its normal candle power maintained.

The prices for our new incandescent lamps and sockets will be a surprise and satisfaction to all users.

OUR PRICE LIST WILL BE FURNISHED IN NOVEMBER.

Our reason for not now announcing prices is due solely to the fact that we desire to fix them with reference to the economies which are being effected in their manufacture in very large quantities by the use of special machinery.

The efforts of the agents of the General Electric company to induce our customers to exchange generating apparatus of our make for Thomson-Houston generating apparatus is fully explained by the fact that

THE THOMSON-HOUSTON COMPANY PAYS US,

through the Consolidated Electric Light Company, five cents for every incandescent lamp it makes, for the right to sell such lamps for use in connection with generating apparatus of its own manufacture only.

While we do not sell our new lamp for use in connection with Thomson-Houston generating apparatus, the present users of the same may avail themselves of our new lamp by substituting our generating apparatus, the quality and efficiency of which will fully warrant the cost.

NOTE.—We are in receipt of numerous letters from all parts of the country congratulating us upon the perfection of a new and better lamp, and we are abundantly assured that the tactics employed to secure exorbitant prices for apparatus as illustrated in connection with the World's Fair lighting, by threatening not to supply lamps unless all apparatus was purchased from "The Trust," will not prove effective. We are also assured that the competition resulting from our independent course is widely appreciated.

Do not hamper your business by long time contracts to purchase lamps and machinery exclusively of any one concern.

We shall be prepared to supply these lamps in large quantities, beginning December 1st.

STANDARD SCREW GLASS INSULATORS

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RECENT FESTIVITIES

Have broken in somewhat on the regular routine of business.
We have shown all our visiting friends our

UNEQUALED FACILITIES

For taking care of their business, and are again busy taking orders for

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and General Supplies.
Are you "wid" us or "agin" us?

ELECTRIC APPLIANCE COMPANY,

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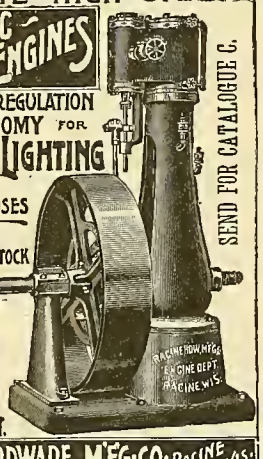
RACINE HIGH SPEED
AUTOMATIC ENGINES
SUPERIOR REGULATION AND ECONOMY FOR ELECTRIC LIGHTING AND GENERAL PURPOSES
16 SIZES CARRIED IN STOCK
WE TEST EACH ONE OF OUR ENGINES BEFORE SHIPPING
FOR PRICES AND CATALOGUE ADDRESS ENGINE DEPT.
SEND FOR CATALOGUE C.



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Electric Light Plant
FOR SALE.

As Receiver, appointed by the Circuit Court of Livingston County, Ill., in a suit to settle a partnership, I shall on the 19th day of November, at 2 o'clock P. M., at the south door of the Court House in Pontiac, Ill., sell to the highest bidder for cash the entire electric light plant and franchise of the late firm of H. A. Foster & Co., situated in Pontiac, Livingston County, Ill. This plant is in active operation, is doing all the electric lighting, public and private, in the city, a place of 3,200 inhabitants. The plant is now running 28 arc and 700 incandescent lights and is all in good running order and repair.

A. W. COWAN, Receiver.

MICA All Sizes and Qualities

For Electrical Purposes.

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PLATINUM

For all kinds of Electrical Use. Sheet or Wire of any Degree of Hardness.

Special Attention given to Platinum for Incandescent Lamps.

WE CARRY THE LARGEST STOCK IN AMERICA.

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SAMSON BRAIDED CORD.

Is the most durable for hanging Arc Lamps, Trolley Cord, Covering Field Magnets, Sash Cord, etc., etc.

Send for Samples and Prices.

SAMSON CORDAGE WORKS,
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THE LATEST AND BEST

SLOW SPEED, MULTIPOLAR DYNAMO.

ADVANTAGES: Slow speed, small floor space, direct driven, self-oiling bearings, little external magnetism, etc.

MADE BY THE **DUPLEX ELECTRIC CO.,**
Limited,
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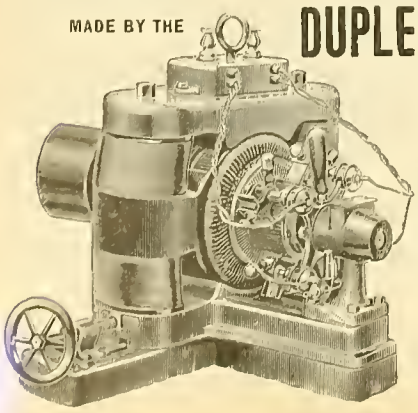

Boston Office—H. C. Hawks, Manager 620 Atlantic Ave.
Chicago Office—Archer & Rusling, Managers, 1325 Monadnock Building.
Kansas City Mo., Office—L. C. Bair, 806 Walnut Street.
New York Office—W. H. Gordon, Manager, 115 Broadway.
Philadelphia Office—Chas. E. Russell, 18 South Broad St.

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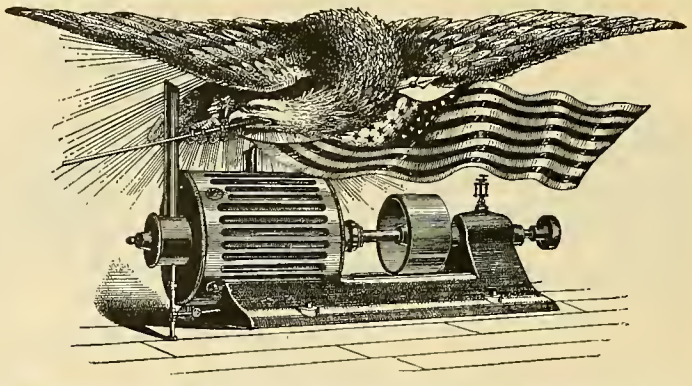
Lincoln, Neb.—Bigelow Electric Supply Co., 112 S. 13th St.
Providence, R. I.—Drake, Payson & Whittier, Cor. Washington & Eddy Sts.
Tarpon Springs, Fla.—W. D. Wilson.



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This Engine revolutionizes the manner of applying steam in generating power. It can be regulated so as to run at any speed desired, up to

1000 OR MORE REVOLUTIONS PER MINUTE !

It is not a rotary Engine, yet the motion of its parts is such that there are no "dead centers." It takes steam and exhausts four times at each revolution. For

SPEED, SIMPLICITY AND ECONOMY,

this Engine has no equal. It possesses many striking advantages over all other Engines, either slow speed or so-called high speed. Its speed is closely regulated by a sensitive and reliable automatic governor. Built of any required size,

FOR ALL STATIONARY AND MARINE PURPOSES.

It can be **coupled directly** to dynamos, fans, blowers, fire engine and other rotary pumps; in fact, to **any** machine requiring great velocity. It is smooth running and **noiseless.** Being light and compactly built, it takes up less room than any other Engine of equal power. No heavy foundations are required. This Engine is

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No skilled engineer is required.

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Scrap and Native Platinum Purchased.
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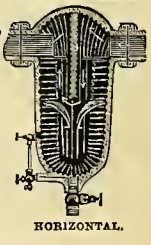
HINE'S ELIMINATOR.
THE ACKNOWLEDGED SUPERIOR OF ALL
Steam Separators and Oil Extractors.

VERTICAL.

In twelve trials in the "Cornell" Separator test, it averaged 98 7-10 per cent Dry Steam. Outstripping all competitors.

Send for Circular and Cornell test report.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HINE ELIMINATOR CO., 106 Liberty St., NEW YORK.

This advertisement appears every other week.

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LATHES

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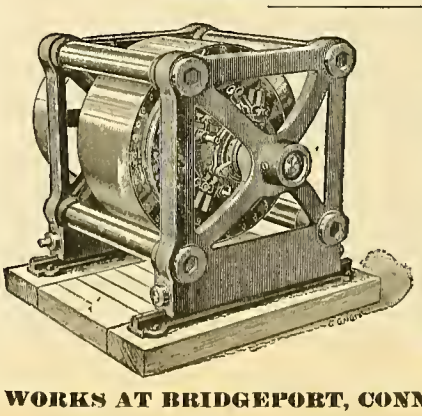
The WADDELL-ENTZ COMPANY,

203 BROADWAY, NEW YORK.



Improved Slow-Speed Generators and Motors. "DIRECT-DRIVEN" Slow-Speed Generators for Electric Lighting and Power. Low Running Expense. Insulated Wire and Flexible Cords. Estimates furnished. Isolated Plants a specialty.

PHILADELPHIA, 501 Girard Building.
BUFFALO, 50 Terrace.

WORKS AT BRIDGEPORT, CONN.

Western Electrician.

EVERY SATURDAY.

Vol. XI. CHICAGO, NOVEMBER 12, 1892. No. 20

The Opening of the First Strowger Telephone Exchange.

In the WESTERN ELECTRICIAN of August 6th there was presented an illustrated description of an automatic telephone system that had been devised by A. B. Strowger. At the time this article appeared the company exploiting this apparatus had finished its experimental work and had just commenced active operations, having established offices in New York and Chicago. Since then the Strowger company has been hard at work, and on Thursday of last week the management gave a public exhibition of its automatic telephone exchange system.

The first town to employ the Strowger equipment was La Porte, Ind., and it was in this place that the public test was made. A large party of prominent Chicagoans and electrical experts was invited to visit La Porte to inspect the new system, and a special train was chartered for the occasion. Two well filled coaches, therefore, left the Lake Shore depot, Chicago, on Thursday morning and after a sumptuous luncheon en route the party was landed at its destination at about 1 P. M. At La Porte the visitors were welcomed by the mayor and escorted by the town band to the Strowger exchange. After a number of speeches the exchange, and in fact the whole system, was turned over to the guests with instructions from the management to handle it as they saw fit, and satisfy themselves as to its practicability.

For the benefit of those who are not familiar with the details of the Strowger equipment it should be explained that the system is designed to be worked without the aid of operators at the exchange. In other words, as its name implies, it is an automatic system, the Strowger machines taking the place of the girls at the switchboard thus making automatically, or rather at the will of the subsciber, all connections.

In the La Porte system there is on each subscriber's telephone shelf (the ordinary Bell subscriber's outfit) a row of keys, five in all. These keys are marked units, tens, hundreds and thousands, the fifth key being the "release key." To obtain a connection the subscriber taps out the desired number on his little key-board. This number registers automatically on this particular subscriber's exchange machine, each subscriber having one Strowger mechanical operator. Through the action of the exchange apparatus the wire of the subscriber is connected with that of the telephone he desires to reach. The connection is made simultaneous with the taps on the key-board. A subscriber thus places his transmitter and receiver in direct connection with those of another by successively pressing his keys which cause the exchange circuit closer to move.

For instance, if a man at telephone "71" wishes to place himself in connection with telephone "15" he can do so by pressing the key marked tens once, and the key marked units five times. His circuit closer at the central office is then in contact with wire terminal 15, and the person at the telephone No. 15 can take down his receiver and the two are then able to converse with each other.

The switching device in which each subscriber's line terminates at the exchange, and which is, so to speak, the heart of the Strowger system, although somewhat complicated in appearance, is quite simple in operation. This automatic switch connects with every line of the system. Through an ingenious mechanism, the electrical impulses sent out by the subscriber act to bring the exchange end of his line into electrical contact with whatever other subscriber's line he may desire to connect with. In brief, the subscriber through the aid of electricity virtually takes into his hand the far distant exchange terminal of his line and slides it over a row of contacts representing the whole number of subscribers until he reaches the one he wants.

THE OPENING OF THE FIRST STROWGER TELEPHONE EXCHANGE.

From the above it will be understood that each subscriber has one set of keys, and is represented at the exchange by one Strowger mechanism. The La Porte telephone directory shows fifty-five subscribers, and as each one of these subscribers, is connected with one Strowger machine in the central exchange there is required, therefore, in the exchange a total of at least fifty-five machines. The Strowger company states, however, that the total number of subscribers on the system is seventy-five.

The exchange at La Porte which is illustrated in the cut, is simplicity itself. There are installed in it at present eighty machines, and human operators are, of course, decidedly at a discount. These eighty machines occupy merely a space that would be devoted to a fair sized bookcase—in fact, at first glance, one is inclined to believe that the eighty little machines actually have been ranged along the shelves of an ordinary glass front bookcase. In another room there is a rack carrying a battery of gravity cells. This completes the exchange equipment, with the exception of a subscriber's outfit for the attendant.

In the La Porte system five wires run to each subscriber; a ground return is used. The five wire cable from each subscriber connects his keyboard and telephonic apparatus with his particular Strowger machine at the exchange. The lines are, of course, all aerial.

Among the points of superiority claimed for this system may be mentioned: 1st, a great saving in cost of equipment; 2d, the expense of operators required in the ordinary exchanges both day and night is entirely avoided; 3d, a costly and troublesome switch-board is unnecessary; 4th, no cutting off of conversation by operators at the central office; 5th, disconnecting by the pressure of a single key.

This system, its exploiters state, has been already adopted in the Dominion of Canada, and it is also being installed at Fort Sheridan, Ill., where an exchange will be in operation within a few weeks.

The Strowger Automatic Telephone Exchange of Chicago, was incorporated Nov. 18, 1891, under the laws of the State of Illinois; capital, $5,000,000; A. Mayer, president, A. B. Strowger, vice-president, J. Harris, secretary.

Electrical Communication with Lightships.

Superintendent Houghton of the New York Maritime Exchange was before the Lighthouse Board recently to urge that lightships and outlying lighthouses be connected with the life saving stations on shore by telegraph, telephone, or otherwise, so that prompt intelligence may be transmitted to those interested of vessels sighted in distress or needing assistance. Although the subject has for some years been before our government officials, as it has been in other maritime countries, the project has never been realized here, owing to the lack of means. Situated as the lightships generally are upon exposed portions of the coast, swinging with the tide and wind and anchored with long stretches of cable and subjected to strain incident upon gales, heavy seas, floating ice, etc., means have not yet been devised to make inboard connections on the lightships likely to be effective. It is, however, believed that such connections can readily be made, and at the coming session of Congress a bill will be introduced appropriating $50,000 to cover the expense of the necessary experiments. As the value of a single ship, saved by prompt advice of her being in peril, will more than tenfold cover the entire appropriation, the bill will, it is hoped, meet the prompt approval of Congress and be enacted into law.

The sum of $25,000 has been deposited in a bank at Prescott, Arizona, to begin work on the new electric railway. G. W. Stone of San Francisco is contracting for the electric light plant, and it is expected that the entire enterprise will call for an expenditure of $500,000.

The General Electric Company in Chicago.

Interest always attaches to operations of large size, either in activities of a social, scientific or commercial nature. Men and things of unusually large dimensions, great religious, social or philanthropic projects, vast undertakings in science and art, and the conduct of big business houses excite attention from their mere size alone. The subject of this article belongs to the class last named, and it is with the idea of giving its readers, particularly in the West, an idea of the manner in which business is conducted at the largest district office of the largest electrical company in America, that the WESTERN ELECTRICIAN devotes considerable space this week to the development and present standing of the General Electric company in Chicago.

The immense volume of business at present transacted is a result of a process of growth, as in the case of every other commercial house, although the period of time that has elapsed since the business was first established in Chicago until the present day is much shorter than in the case of almost any other business enterprise of like magnitude. As everybody knows, the General Electric company is a consolidation of the Thomson-Houston Electric company and the Edison General Electric company. A brief review of the career of these two companies in Chicago, therefore, will not be uninteresting.

It was early in 1883 that the first Thomson-Houston office was opened in Chicago. George L. Crossman was the first manager, and a small office was secured in the Montauk block on Monroe street, between Clark and Dearborn. Not long afterward a store was secured at 109 Wabash avenue, north of Adams street, and the next move was to the Pullman building, which was the location of the company's office when S. A. Barton came out as manager. This was in 1886. In the meantime Mr. Crossman, who did the pioneer work, retired and went back to Lynn, his native city, where he is now a successful manufacturer of shoe boxes. Mr. Crossman did good work for the company, but he was quite a young man, and did not find the electrical business in the West congenial. For a brief period the office was in charge of Mr. Benton, who was unacquainted with the details of the electric lighting business, and he in turn was followed by Herbert Wadsworth, who acted as temporary manager until Mr. Barton, the general manager of the company, took charge of the western territory. This was on June 1, 1886, but for the better part of a year previous the company had recognized the great value of the West as a field for the introduction of electric lighting, and Mr. Barton had spent much of his time traveling between Boston and Chicago. It was finally decided to put the western office in direct charge of the general manager, leaving the headquarters in Boston under the control of the vice-president and board of directors. The wisdom of this decision was speedily made manifest. Mr. Barton took charge of the work with comprehensive intelligence and great energy, and succeeded in building up a great business. In the spring of 1888 the offices were moved from the Pullman building to a three-story building especially erected for the company at 148 Michigan avenue. The results of Mr. Barton's experienced direction were now fully apparent; the business had assumed large proportions and had been subdivided into several departments. Mr. Barton also took much interest in the general electrical growth of Chicago, taking a prominent part in the conduct of the electric club, of which he was president for a considerable period. Late in 1889 Mr. Barton resigned as western manager of the Thomson-Houston Electric company to accept the presidency of the Brush Electric company of Cleveland. His departure was greatly regretted by the electrical fraternity of Chicago, and the farewell reception given by him at the Chicago Electric club will long be remembered by the fortunate participants. Mr. Barton was succeeded by B. E. Sunny, who had been president of the Chicago Arc Light & Power company. Mr. Sunny remained in charge of the Michigan avenue office until the consolidation of the Thomson-Houston and Edison companies last spring, when he was appointed as the western manager of the General Electric company. In June of this year the Thomson-Houston force was removed to the Edison building at 173 and 175 Adams street, where the offices illustrated by the accompanying pictures are located. Mr. Sunny has proved a worthy successor to Mr. Barton, and his successful management of the western business is well known.

FIG. 2. THE GENERAL ELECTRIC COMPANY IN CHICAGO.

FIG. 1. THE GENERAL ELECTRIC COMPANY IN CHICAGO.

The beginnings of the Edison business in Chicago go back to December, 1881, when George H. Bliss opened an office in the Major block, at the corner of La Salle and Monroe streets. Mr. Bliss had previously handled Mr. Edison's inventions, and when companies were formed to exploit the newly invented incandescent lamp Mr. Bliss was summoned to Menlo Park to become instructed in the new system, with the idea of establishing a western agency. He was the representative both of the Edison Electric Light company and the Edison company for Isolated Lighting, the former company owning the patents and franchises. Mr. Bliss entered upon his new duties with much enthusiasm. It is interesting to note that the first incandescent lighting plant in the city was installed in the old Rand & McNally building on Monroe street. Here an isolated installation of 120 8 candle power lamps was wired in January, 1882, the first in the West. The next plant was of 60 16 candle power lamps, and was placed in the basement of Marshall Field's retail store. A month or so after this J. W. Doane's fine new residence on Prairie avenue was lighted by 275 16 candle power lamps, current being supplied from an isolated plant in the barn. At this time everything connected with the art was still in a comparatively crude state, and L. Stieringer, now in charge of the decorative lighting at the World's Fair, came on to Chicago especially to design the fixtures for Mr. Doane's house. Not a gas burner was placed in the house, and Mr. Doane's residence was thus the first in the United States to be lighted exclusively by electricity. On June 1, 1882, the Western Edison Light company was organized with a capital stock of $500,000, with exclusive rights to the parent companies' patents and franchises in Illinois, Wisconsin and Iowa. This company superseded Mr. Bliss' agency, but that gentleman was made the first general superintendent, in which position he continued for three years and a half. Gen. Anson Stager was the first president of the company, and continued in that position until his death, when John M. Clark, now United States collector of customs at Chicago, succeeded to the position. Among the stockholders of the company were Marshall Field, John B. Farwell, John Crerar, J. W. Doane, Judge Caton, D. H. Ogden, D. H. Louderback and others. The company's first office was at the corner of Wabash avenue and Randolph street, but it afterward moved to the Adams Express company's building on Dearborn street, in the store now occupied by the

Fort Wayne Electric company. The Western Edison company did considerable business. Among other installations credited to it is the first central station plant in the United States, which was put in operation at Appleton, Wis., in the fall of 1882. Early in the year 1886 Mr. Bliss resigned as general superintendent, and was succeeded by H. Ward Leonard, who had been the Edison agent at Cincinnati. About a year after this the affairs of the Western Edison company were wound up, as it was found that the company had a manufacturing clause in its franchise, which interfered with the designs of the United Edison Manufacturing company, which had been organized in New York. Part of the stockholders of the Western company exchanged their stock for that of the parent company and others went into a new local company, the Chicago Edison company, which was organized in 1887, with the exclusive franchise of installing and operating Edison plants in Cook county. After the old company was disorganized, Mr. Leonard, with E. M. Izard, opened an office in the Rookery, and the Leonard & Izard company acted as the representative of the United Edison Manufacturing company for some time. In the fall of 1889 the Leonard & Izard company sold out to the newly formed Edison General Electric company and a district office was established at Chicago, with C. C. Warren as district manager and F. B. Badt as district engineer. Mr. Warren resigned in the spring of 1890, and Lieut. S. D. Greene, formerly connected with the Sprague Electric Railway company, was made temporary district manager. This place was taken by John I. Beggs, who had been general manager of the Edison Illuminating company of New York city, on the 1st of August, 1890. The offices were at this time on the first floor of the Rialto building. Mr. Beggs made a number of changes after coming here, bringing several men from New York to take charge of the different departments, among them Gilbert More, as assistant. Mr. More died in the following fall in North Carolina. Prof. Badt resigned in the fall of 1890 and was succeeded by D. C. Jackson of the Sprague Electric Railway company of New York. The Edison General Electric company moved to the building at 173 and 175 Adams street in the latter part of August, 1891. The business during all these changes increased continually, and the office help was gradualllly increased. After the consolidation with the Thomson-Houston company Mr. Beggs resigned his position as district manager and Mr. Sunny took charge of the combined business of both offices. Mr. Beggs is now the superintendent of the central station department in the New York office.

There were naturally many changes resulting from the consolidation of two large office forces, with several duplicate departments, and some little confusion resulted. At the present time, however, the work has been well systematized and the various departments are working smoothly. The Thomson Houston departmental system has been adopted. The territory covered by the Chicago office embraces Southern Wisconsin, Michigan, Nebraska, Illinois, Northern Indiana, Iowa, Indian Territory, Oklahoma, Missouri, Arkansas, Mississippi, Texas, Louisiana and Kansas.

The building now occupied by the company, an exterior view of which is given in Fig. 6, is located on the north side of Adams street between La Salle street and Fifth avenue. It is of brick, five stories high, with a street frontage of 50 feet and a depth of 178 feet, and is entirely devoted to the use of the General Electric company. The first floor, an illustration of which is given in Fig. 2, is used partly as a general salesroom and showroom, in connection with the supply department, and partly for the fixtures department, the apartments of which are shown on the left in the illustration. The second floor is mainly devoted to the auditing and bookkeeping departments, with offices for the superintendent of construction and superintendent of central stations, with a large room for draughtsmen in the rear. The mailing department is also on this floor. On the third floor are the reception room and private office of Mr. Sunny, fronting on the street, and the offices of the railway, central station lighting, isolated lighting, purchasing, supply, meter, motor and mining departments. Desk room for a number of salesmen is also provided on this floor. Fig. 1 gives a glimpse of the general manager's reception room, with a portrait of Mr. Sunny. Figs. 4 and 5 are also views of this floor. The former shows the portion near the front of the building and the latter the rear end. The portraits are those of heads of departments who have offices on this floor. The fourth and fifth floors are devoted entirely to the storage of the stock of lamps, wire, fixtures, etc., that it is necessary to carry, the basement being utilized for storing heavy machinery. The building is equipped with a complete system of speaking tubes, centering at a switch-board, by means of which conversation is readily carried on between departments. There is also a telephone system in the building and an extensive annunciator system. The office force at present consists of about 200 people, including salesmen, and 22 stenographers are required to attend to the correspondence. Two elevators give access to the different floors and the building is, of course, equipped with a plentiful supply of incandescent lamps, current being secured from the Chicago Edison station.

In addition to the office building the company has a six-story warehouse on the West side, located west of Halsted street, on the line of the Northern Pacific tracks.

The departments and dependent offices of the Western district are now officered as follows:

Accounting department—W. J. Kehl, manager; G. H. Atkin, assistant.

Advertising, etc.—Jesse Scribner.

Auditor—Geo. Martin; P. H. Anderson, assistant.

Central station lighting department—John L. Martin, manager; Messrs. Searle, Hills, Wheaton, Fisher, Cotton, Ross, Davidson, Stedman, Dee Foote.

Collections and credits—W. J. Ballard and C. L. Wakefield.

Constructing and engineering department—E. C. Noe, superintendent; W. C. Upham, assistant.

Fixtures department—Franklin Overbagh, manager.

Isolated Lighting department—J. W. Johnson, manager; Messrs. Buell, Snowden, Polglase.

Legal department—J. S. Cummins.

Meter department—P. J. McFadden, manager.

Mining department—Lieut. F. B. Badt, manager; S. D. Flood, assistant.

Motor department—Geo. P. Nichols, manager; S. C. Platt, assistant; Messrs. Colton, Mullen, Beckwith, Wetherell, Calkins.

Purchasing department—J. H. Livsey.

Railway department—Theodore P. Bailey, manager; Geo. K. Wheeler, assistant; B. J. Arnold, consulting engineer; Messrs. Horne, Brewster, Elliott, Allen.

Shipping department—G. M. Ellis.

Superintendent of central stations—H. S. Manning.

Supply department—W. E. Moore, manager; Messrs. Boyer, Bunce, Ferris, Raggio, Rosenthal, Baldwin.

Dallas office—W. T. M. Mottram, manager; W. H. Morris, assistant.

FIG. 3. THE GENERAL ELECTRIC COMPANY IN CHICAGO.

Kansas City office—C. A. Ross, manager.

Omaha office—W. F. White, manager; Messrs. J. H. White, W. J. McManigal.

St. Louis office—W. L. Arnold.

The various departments present features of much interest. The most attractive one, from the point of view of the casual visitor, is undoubtedly that devoted to fixtures. Franklin Overbagh, the manager of this department, was detailed by the executive department of the Edison General company about a year ago to organize the western branch of the fixture business, with headquarters at Chicago and with the principal show and stock rooms at this point. To properly show the varied designs manufactured by the company showrooms covering large floor space is necessary and thus the ground floor is largely used for this purpose. The main entrance doors are of massive oak and guarded with wrought iron grill work, relieved with burnished copper; at either side of the doors are heavy wrought iron escutcheons with the company's name in aluminum. Through the mosaic tiled vestibule entrance is made to the first display room, finished in colonial style; then follow other rooms furnished and decorated to correspond with various periods of architecture and decoration, such as the Louis XVI., Louis XV., Renaissance and Moorish styles. In these rooms are hung the work of the skilled artisans employed by the company. Beautiful specimens of brass, wrought by hand, finely chased and showing days of labor, are especially noticeable in the Louis XVI. room. Many of these fixtures are in

burnished gilt and ormolu. The adjoining room, with its bronze and old copper work, is in striking contrast. Here the furnishings and colors are in red and dark blue, and the fixtures most striking and ornate in outline. The rooms are all beautiful, and fixture work is shown in almost every shape imaginable. A view of one of the handsomest rooms, with a portrait of Mr. Overbagh underneath, is shown on the left in Fig. 3.

Auditor George Martin has an office on the second floor, a view of which is shown in the center picture in Fig. 3. In this general department there are about sixty men. Mr. Martin has been with the Thomson-Houston and General Electric companies five years, and is the chief financial officer of the western district. His duties include the approval of all vouchers covering payments of money, countersigning checks, the custody and disposition of notes, stocks and bonds, discounting notes, the placing of fire and employes' insurance, purchasing goods, the approval of requisitions on the main office for merchandise for stock or for direct shipment, the compiling of inventories and distribution of information to heads of departments regarding merchandise, stock on hand, and the quarterly auditing of the books and accounts of the Chicago office and plants owned. It will thus be seen that Mr. Martin has plenty to do. The business is conducted almost as that of an independent house, and Mr. Sunny has entire control, all heads of departments reporting to him. George Martin's portrait is the topmost one in Fig. 3.

The railway department was established about the first of June, 1888, and Theo. P. Bailey, who for several years prior to that time had represented the Thomson-Houston company in its lighting department, was placed in charge of the work. Mr. Bailey reports that since the organization of the department of which he is the head there have been sold generators to the extent of 59,236 horse power, 48,386 horse power in motors, and that 1,155 miles of track have been equipped, with 1,418 motor cars. This equipment is distributed throughout the West and with it some remarkable work is being accomplished. At Denver, Colo., the cars make an average daily mileage of 211 miles; at Peoria, Ill., 180 miles; at Springfield, O., 160 miles. The largest installation with respect to number of cars and miles of straight-way track is the St. Louis & Suburban railway at St. Louis, Mo. This line is 19½ miles long and on account of its splendid equipment the cars attain a very high rate of speed, averaging on the suburban portion about 30 miles per hour. This line carries express and mail cars and through this medium has largely increased its earning capacity. It was originally part cable and part steam, both of which, after a succession of failures, growing out of irregular and unreliable service, were abandoned, and the entire system equipped electrically with Thomson-Houston apparatus. Another notable installation made by Mr. Bailey's department is at Cedar Rapids, Ia., where the steam dummy line connecting Cedar Rapids and Marion was abandoned, and electrical equipment substituted. The speed on this line is about 34 miles per hour and heavy baggage and freight cars are transported from one city to the other, a distance of nearly six miles, by means of the electric line. This department has equipped roads in Denver, Colo., Des Moines, Ia., St. Louis, Mo., Detroit, Mich., Indianapolis, Ind., San Antonio, Tex., Kansas City, Mo., Peoria, Ill., Pueblo, Colo., Quincy, Ill., and Salt Lake City, Utah. A portrait of Mr. Bailey occupies the central position in Fig. 4.

FIG 4 THE GENERAL ELECTRIC COMPANY IN CHICAGO

FIG. 5. THE GENERAL ELECTRIC COMPANY IN CHICAGO.

On June 1, 1886, there were about 75 central stations in the territory that is now embraced in the western district of the General Electric company, using about 4,500 arc lights and no incandescents. Within the space of six years the number has been increased to 521 central stations using Thomson-Houston apparatus, 38,000 arc lights and about 650,000 incandescents. In connection with the local companies using Edison apparatus the grand total of incandescent lamps reaches about 1,000,000. Among the notable lighting stations embraced in the territory of the western office of the General Electric company are the cities of Chicago, Milwaukee, Omaha, Springfield, Ill., Kansas City, Burlington, Peoria, San Antonio, Lincoln and almost every other city of importance. Chicago has pre-eminence in possessing the largest arc light central station in the territory using Thomson-Houston arc apparatus. The central station lighting department is in charge of John L. Martin, who was with the Thomson-Houston company for a number of years. His picture is given in Fig. 4, at the left.

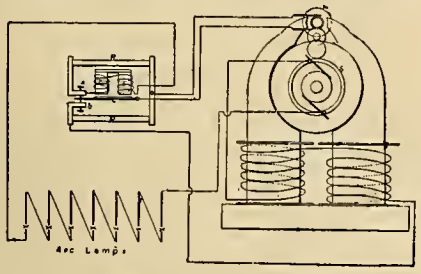
James W. Johnson, whose portrait is given in the upper right hand corner of Fig. 5, is at the head of the isolated lighting department, and is also a Thomson-Houston man. His department has to its credit many important installations, including that at the Masonic Temple, Chicago, and several important buildings in St. Louis.

The legal work is attended to by Attorney J. S. Cummins, who has an office on the third floor. Outside counsel are quite often employed, but most of the work of this character falls to the share of Mr. Cummins, who is a competent lawyer, and has a constant retainer from the company and an office in the building instead of outside.

Probably the supply department has a wider range than any other department of the company, and there is a great multiplicity of detail in connection with its operation. Among other things the supply department controls the sale of lighting and railway generator parts, stationary and railway motor parts, arc lamps, incandescent lamps, underground cable, conduit and tubing, insulated copper wire cable, bare copper wire, bar and rod, iron wire, rope and cable, railway line supplies, car and station equipment appliances, ampere meters, volt meters, lightning arresters, and all instruments, poles, cross arms, insulators and all outside wiring devices and supplies, sockets, cut-outs, switches and all inside wiring devices and supplies, house goods, interior conduit, linemen's tools, shades and fixtures. In addition to the large, handsome store in the Adams street building of the company, the supply department has established branch supply stores at Milwaukee, St. Louis, Omaha and Detroit, and several others throughout the district will shortly be organized. These stores are all in charge of competent resident managers, under the direction of the department at Chicago. This department is in charge of W. E. Moore, who was formerly connected with

the Edison company. Mr. Moore's portrait is shown on the right in the group shown in Fig. 5.

Lieut. F. B. Badt, well known to the electrical fraternity of Chicago and elsewhere, looks straight at the observer from the central portrait in Fig. 5. He has charge of the mining department, which has made installations at Great Falls, Mont. (electrolytic refining of copper); Denver, Colo. (tunnel mining); Juneau, Alaska; Streator, Ill. (coal mining); Calumet, Mich. (copper mining); Ishpeming, Mich. (iron mining), and Lake Linden, Mich. Elec-



THE LEEDS ARC LIGHT DYNAMO.

tric mining is one of the latter developments of electricity, and is capable of much extension in the hands of so experienced an electrician as Prof. Badt.

The motor department is under the management of Geo. P. Nichols, who has been connected with the Thomson-Houston company for eight years past, beginning at the factory at Lynn, when the names on the pay roll were less than 200. When he first took charge of the motor department a one horse power motor was an object of curiosity and a five horse power machine was considered a monster. This department has been successful in making new applications of the electric motor in the western territory. Some of its notable installations are the drawbridges in Chicago and Milwaukee, the tramways at the Pioneer Fire Proof Construction company and Northwestern Terra Cotta company, Chicago, the electric transfer tables at the World's Fair, Illinois Central Railroad company, Union Pacific Railroad company and elsewhere, and the isolated power plant at the Armour Packing company, Kansas City, of over 700 horse power in motors and generators. Mr. Nichols' picture is shown in Fig. 5, on the left.

The very general use of recording meters as accessories of central station lighting and power plants has resulted in a large and increasing sale of the Thomson recording watt-meter—so large, in fact, that it was deemed advisable to give the entire charge of this branch of the business, both at the Lynn factories and at the general offices, to a separate department, which should give exclusive attention to the exploiting of this meter. The meter department of the Chicago office is in charge of Parmalee J. McFadden, with headquarters in the Adams street building, while the testing, calibration, etc., of the meters is done at the testing room in the Michigan avenue building. The sale of the Thomson-Houston transformer is also conducted by the meter department. Mr. McFadden was formerly an Edison man, but has shown himself fully equal to the demands of the new department. His portrait, with a view of his office above, is shown on the right, in Fig. 3.

The other departments are all in good hands. Mr. Noe, at the head of the construction department, is a capable and experienced engineer, while the shipping and purchasing departments are well taken care of by G. M. Ellis and J. H. Livsey. H. S. Manning is efficient as superintendent of central stations, while Mr. Scribner, the advertising manager, known to his intimates as "Scrib," is courteous, obliging and a general favorite.

From the above it will be seen that the General Electric company occupies no mean position in the commercial institutions of Chicago. Its management is imbued with the true Chicago spirit of enterprise, and still further improvements and enlargements may be expected in the future. The people of Chicago, and the electrical fraternity in particular, have a right to be proud of it.

The Brotherhood of Electrical Mechanics has ceased to be an organization in Chicago. Two weeks ago that organization voted to join its rival association, the Brotherhood of Electrical Workers. This order has organizations in forty-nine cities of the United States. The annual convention will be held in this city November 12th.

Proposals will be received by the secretary of the treasury at Washington, D. C., until Nov. 17th for manufacturing and putting in position combination gas and electric light fixtures in complete working order in United States buildings at Denver, Colo., El Paso, Texas, Los Angeles, Cal., and Eastport, Maine. Partial bids on one building will not be received. Specifications, drawings and blank forms of proposals will be furnished by the department.

The Leeds Arc Light Dynamo.

The accompanying cut and diagram of connections illustrate a system of series arc lighting evolved by the engineering firm of Greenwood & Batley, limited, of Leeds, England. This machine is an automatic arc light dynamo for twenty lights with regulating gear. The field magnet poles of the machine have two small projections, which serve as a magnetic field for a small flat ring armature, provided with an ordinary commutator and a pair of brushes receiving a small current through an automatic reversing switch. This switch consists of an electro magnet excited by the main current, an armature which can make contact with either of two terminals, and two resistances, consisting of carbon rods about ½ inch diameter and six inches long. The slightest variation of the current in the main circuit will cause the armature to make contact and send a current through the motor armature in one direction or the other, thus causing it to revolve in either direction. The brush holders of the dynamo will move slowly, and thus adjust the position of the brushes to suit the electromotive force demanded by any number of lamps arranged in series. There is no "hunting," it is claimed, with the regulating gear; the power used in working it is very small, and the efficiency of the whole machine at various loads is stated to be very high. The cuts are from the London *Electrical Review*.

Electric Stations as Insurance Risks.

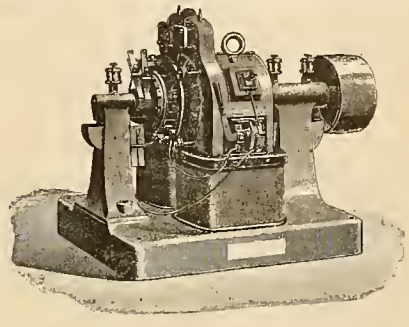
Judging from the following self explanatory letter which has been sent by Geo. P. Low, electrical inspector for the Pacific Insurance Union of San Francisco, to each electric lighting or railway concern within its jurisdiction on the Pacific Coast, electrical interests may look for a valuable paper on the subject of "Electric Stations as Insurance Risks," to be read before the coming annual meeting

FIG. 6. THE GENERAL ELECTRIC COMPANY IN CHICAGO.

of the Fire Underwriters' Association of the Pacific. Central station managers will be quick to discern the importance of such appeal as Mr. Low promises to make on their behalf, and it is to be hoped that the electrical fraternity will fully comply with the reasonable request made, and furnish all information asked for. As stated the letter explains itself:

I have been asked to prepare a paper on "Electric Stations as Insurance Risks" for the coming annual meeting of the Fire Underwriters' Association of the Pacific, and inasmuch as you are most certainly interested in securing a proper understanding by fire underwriters of the central station as a fire risk, I take the liberty of asking your assistance in the preparation of the paper named.

You must be aware that the belief is growing among fire underwriters that electric light stations as a class are undesirable risks; and I think you will concur with me in the opinion that this belief is not as it should be. To refute it, and to prove such assertions as will be made by carefully gathered, and reliable statistics will be the aim of the paper, the success of which will entirely depend upon the individual efforts of each company in answering fully and honestly each question asked. Of course, all correspon-



THE LEEDS ARC LIGHT DYNAMO.

dence will be strictly confidential, and in no instance will the name of any company be mentioned, nor will a reference to any particular concern be made. Only aggregate results will be quoted.

What is desired is the detailed information which will be derived from your replies to the questions asked in the accompanying slip. If the conviction is to be carried that the properly constructed central station should not be classed as a hazardous risk, and if the benefits resulting from such a conviction are to be enjoyed, then you, and you personally, must assist me in the task I have undertaken. As an electrician, and one most deeply interested in everything that will contribute to the advancement of electricity, I urge you to appreciate the importance of this effort to be made on behalf of electrical interests, and reply fully to each question asked, using a separate slip for each year during which your station has been operated. I am sure this will afford an array of statistics that will prove conclusive.

Mr Low asks that all communications on this subject be filed with him not later than December 1st. The questions referred to are as follows:

What is the valuation (cost) of your station building, exclusive of real estate?

What is the valuation (cost) of all dynamos and electrical equipments contained therein?

What is the valuation (cost) of the boilers, engines and all machinery, other than electrical, contained therein?

In what year was the station erected?

Is the building of stone, brick, frame or of corrugated iron?

What power do you use: steam, or water, or both?

Is your power plant used for your station exclusively, or does it furnish power to some adjoining industry? Or do you obtain power from an adjoining industry?

What is the nature of such adjoining industry?

What is your nearest or greatest exposure?

Is the plant contained in a building occupied by other industries, and what?

What is the amount of insurance carried for the year above named?

What did this insurance cost in premiums?

What gross losses by fire, if any, have you sustained during the year named?

What insurance have you received on these losses?

Of above losses, what insurance loss if any was sustained by fires caused by electricity?

What insurance loss if any was sustained by fire from causes other than electricity?

What insurance loss was occasioned on dynamos alone?

What caused the fire in your station?

What is the character of your station: is it a lighting and power, or railway generating plant, or both?

Do you use the alternating or direct current system of incandescent lighting, or both?

Do you furnish arc lights?

What is the total number of dynamos in your station?

What is the total valuation of the dynamos in your station?

What is the valuation of switch-boards and electrical equipment other than dynamos?

What is the population of your city for the year above named?

Was your city in a healthy or unhealthy commercial condition during the year named?

Did it have a boom?

The board of trustees of Sacramento, Cal., has passed a franchise granting the Folsom Water Power company the right to bring into Sacramento, by wire, electric energy from the Folsom dam for lighting and motive power purposes. This is in addition to the railway franchise.

The deepening of the Saugus river at the wharf of the Thomson-Houston river works at Lynn will allow schooners drawing twenty feet of water to reach the wharf, and coal and iron will be received in this manner. The coal sheds will be erected at once. The means of transferring various parts of electric apparatus from one factory to another will be by electric cars on a standard gauge track. Thus the same cars can be used as on the steam railroad.

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CORRESPONDENCE relating to electricity, or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

PAGE.

The Opening of the First Strowger Telephone Exchange. Illustrated 245
Electrical Communication with Lightships..... 245
The General Electric Company in Chicago. Illustrated..... 246, 247, 248, 249
Leeds Arc Light Dynamo. Illustrated..... 249
Electric Stations as Insurance Risks..... 249
Editorial..... 250
Keep the World's Fair Open Evenings..... 251, 252, 253
American Institute of Electrical Engineers..... 253
The New Ahearn Electric Stove. Illustrated..... 253
The Cutler Non-Induction Ammeter. Illustrated..... 253, 254

DEPARTMENTS.

Correspondence..... 254, 255
New Incorporations..... 255
Electric Lighting..... 255
Electric Railways..... 255
Telegraph..... 256
Telephone..... 256
Miscellaneous..... 256
Business..... 256
Trade News..... 256
Electrical Patents..... 256

ATTENTION was directed recently to the statement that the New York, New Haven & Hartford Railroad company was contemplating the introduction of electricity on its system. This was afterward denied by the superintendent of the road and an interesting controversy ensued. The latest development is the announcement of President Clark to this effect: "If electricity as a motive power becomes commercially practicable the two inside tracks of the four now under construction between New York and New Haven with their improved grades and alignments and absolute freedom from grade crossings, will prove especially adapted to its use." Under such conditions it is not only possible but quite probable that the electric system will be introduced. It has already been shown that projectors of the electric railway have sufficient faith in its practicability to introduce it under far less favorable circumstances, and guarantee its efficiency.

AN interesting retrospect of the electric lighting business in Chicago is included in the article on "The General Electric Company in Chicago," presented in this issue. Eleven years includes the entire history of the business, as it has developed commercially in Chicago, at least so far as incandescent lighting is concerned, and the arc can boast of a history but little longer in this city. The growth of the industry in that period of time has been so remarkable that it is only by looking back at the first steps, which are hardly more than of yesterday, that an adequate idea of the wonderful rate of progress can be gained. Now electric lighting constitutes only a portion of the business brought together by the consolidation of the two great companies that united in the corporation forming the subject of the article named. Railways, electrical decorations, mining operations and stationary motors now figure very largely in the total volume of transactions. What new departments will be developed in the next ten years it is difficult to surmise, although electric heating gives promise of being one of them. Perhaps at that time the art will have advanced to a degree proportionate to the first decade, but this seems hardly possible. The formative period has passed, and the electrical business appears to have settled down on a permanent basis.

IN another column there is presented a description of a new automatic telephone system that has recently been installed in La Porte, Ind. This equipment is exciting considerable interest, and the daily papers have been predicting that the days of the telephone operator are numbered. In the new system the exchange connection is made automatically, or rather, by the far distant subscriber. Each subscriber has at his end of the line a key-board carrying, say, five keys representing units, tenths, hundreds, thousands and a "release key." A five wire cable connects these keys with the automatic device in the exchange. This device in the exchange is the heart, so to speak, of the system. Each subscriber is represented in the central office by one of these machines, and his line is in electrical connection with it, as is every other line of the entire system. There must be, therefore, as many automatic machines in the exchange as there are subscribers; each of these mechanical operators, though, occupies but a small space. The operation of the system is as follows: To make a connection with a distant subscriber one first manipulates the keys to make the desired combination. The electrical impulses thus sent into the exchange act upon electromagnets in the automatic machine in such a manner as to swing a contact bar. This bar connects with the first subscriber's line and it swings over a disk carrying contact pins which represent and connect with every other line of the system. The subscriber's keys control this bar in the exchange machine, and through them it may be made to contact with any line terminal of the system. In other words, to explain the system in a sentence, it may be said that each subscriber, through the automatic device, may bring the far distant terminal of his line into electrical connection with the line of any other subscriber without the intervention of a human operator. The La Porte system has not quite 100 subscribers.

THE legal controversy between the telephone and electric railway companies has not yet been concluded, but it is a source of satisfaction that the litigants are at last brought face to face over the principal points at issue. For several years there has been continual litigation over questions of minor importance, but at last it appears that these have been cleared away and the main features of the controversy presented for consideration. Many interesting points affecting the respective rights of street railway and telephone companies generally were considered in the case of the Hudson River Telephone company against the Watervliet Turnpike & Railroad company, which was reported in the last issue of the WESTERN ELECTRICIAN. The court decided that there was no question of prior equities involved, but merely a strictly legal one. It was found that the turnpike company's use of electricity in propelling its cars rendered the operation of the telephone company's system at all times difficult and sometimes impracticable, and this disturbance could not be avoided by the turnpike company without a complete change of the system adopted by it, and the use of more expensive and dangerous motors. To require such change to be made would be, in the opinion of the court, to grant to the telephone company by decree of the court that which the legislature had expressly withheld.

Another important ruling in this decision was that the use which the telephone company was making of its grounded wires was a part of its system of telegraphic communication through public streets, and was subject to the condition that it should not incommodate the use of the streets by the public. It was an indivisible franchise, the court decided, and was in its entirety subservient to the lawful uses which might be made of those thoroughfares for public travel. The telephone company, by the manner in which it utilized its franchise, accorded to the public the unrestricted right of passage, and it could not question the form in which such right should be enjoyed so long as it was of lawful origin, and was used with care and skill. The turnpike company's system was of that character, and the telephone company could no more justly complain of its loss from that source than it could if by the jarring of loaded vehicles up and down the street its delicate and sensitive instruments were impaired or destroyed.

There is still another question involved which, however, the court was not called upon to decide. The turnpike company allowed the electric current to escape directly from the rails into the ground, and the most serious loss which the telephone company sustained resulted from the current spreading upon the telephone company's grounded wires. This the turnpike company claimed it had a perfect right to do. The court, however, was not prepared to say that a person, even in the prosecution of a lawful business upon his own land could gather there by artificial means a natural element like electricity, and discharge it in such a volume that, owing to the conductive properties of the earth, it would be conveyed upon the lot of his neighbor with such force as to interfere with the rightful enjoyment of the use of his property, and not be liable for the damages resulting therefrom. However, this point was not further considered, as the court was not asked to rule upon it.

IF any doubt existed that the WESTERN ELECTRICIAN represented the sentiment of the electrical people in demanding the repeal of the rule providing for the closing of the World's Fair at 7 P. M. "except in such cases as the management shall direct for special evening entertainments," it would be dissipated at once by a perusal of the vigorous interviews printed in this issue. These expressions of opinion are from all the leading cities of the East as well as from Chicago and are all of one tenor—an indignant protest against this disastrous blow to the electrical interests at the exposition. The man or corporation engaged in any branch of the electrical business that is not earnestly opposed to this ridiculous provision has yet to be heard from. This is a fact worthy the attention of the august commissioners even, and it will be brought forcibly to the attention of these gentlemen. The electrical interests of the entire country are aroused and united, and if this obnoxious rule is persisted in, it will be retained directly in the face of the unanimous opposition of that important section of the business community which is relied upon to give the exhibition the most distinctive stamp of modern progress. The interviews given represent diverse and competitive branches of the electrical business, but there is no faltering or hesitancy. All are united. "I will do all I can;" "Call on us for any assistance in our power;" "We regard the action of the commission as an outrage"—these are some of the expressions of the members of the electrical fraternity in opposition to the evening closing rule.

It is not enough to say that the rule is simply a sort of safety valve arrangement, giving the management authority to close the fair evenings whenever it shall be thought advisable to do so, and that in practice "special evening entertainments" will be given three or four nights a week. This would prove a very unsatisfactory arrangement, both to the general public and to the electrical exhibitors. Thousands of visitors will want to "take in" the fair every night they are in town, in order to utilize all the time possible. By the arrangement proposed the visitor could go, and the beautiful electrical effects could be exhibited, only on evenings especially designated for "special entertainments." This would be an awkward and totally unnecessary method, which would cause great annoyance. How much better in every way it would be to have the exposition open on the evening of every day on which the gates swung in to the general public. With this clearly understood, does anyone doubt that the grounds would be thronged from nine o'clock in the morning until, say, eleven at night? With the grounds open in the evening there will be the additional advantage that many persons will remain at the park for supper, and the throng will disperse more gradually than if all went home between six and seven o'clock. This will greatly aid in simplifying the transportation problem—one of the most serious that the exposition authorities are called upon to face. With all these disadvantages, why should the evening closing rule be adopted, against the undoubted wish of the general public and in face of the unanimous protest of the electrical fraternity? What is the reason? The only one that we have heard urged is the question of expense, but the experience of the Paris exposition of 1889 seems to demonstrate conclusively that the evening will prove far more profitable than any equal period of time in the daytime.

The national commission should not forget that if the rule in question is enforced the electrical display will be greatly curtailed, as shown by the interviews presented in this issue of the WESTERN ELECTRICIAN. The gentlemen who framed this rule must be prepared to face the responsibility of cutting down one of the most interesting exhibits at the fair. Do they care to do this?

The rules have not yet been adopted by the local directors, although in ordinary course the local board would have passed upon them first, the commission having power to change or amend. It is to be hoped that the directory will make a strong effort to secure the repeal of this obnoxious regulation, which is totally unwise and unjust, without a single commendable feature.

Keep the World's Fair Open Evenings.

The rule adopted by the national commissioners providing for the closing of the World's Fair grounds evenings at 7 o'clock has been pretty thoroughly discussed since attention was directed to the matter by the WESTERN ELECTRICIAN last week. Those who have had experience in large industrial exhibitions found it hard to bring themselves to believe that the commissioners had adopted such a rule. Several electrical concerns that have been preparing extensive displays have written the WESTERN ELECTRICIAN concerning the matter, and some of them have signified an inclination not to make an exhibit if the seven o'clock closing rule was not modified. All who are interested in the fair recognize the necessity of a reconsideration of this obnoxious rule, and a formal protest addressed to the executive committee has been prepared, and has already been quite extensively signed. This protest has been placed in the rooms of the Chicago Electric club.

Further evidence of the opposition of the electrical fraternity to the proposition is presented in the opinions gathered by representatives of the WESTERN ELECTRICIAN, which are appended, together with abstracts of letters received at this office from the leading electrical concerns of the East. It is the unanimous opinion that a great mistake has been made, and that prompt measures should be taken to insure a reconsideration and repeal of the offensive rule.

MATHER ELECTRIC COMPANY, Boston: We heartily indorse your views in regard to the matter of closing the fair evenings.

F. P. LITTLE & Co., Buffalo, N. Y.: We think it would be a great drawback to the electrical features of the exposition to close before 11 P. M.

MYRON A. KNAPP, Chicago: Of course I want the grounds open at night. Put me down as being in favor of keeping the gates open as late as possible.

BRYANT ELECTRIC COMPANY, Bridgeport, Conn.: In our estimation, it would completely spoil the electrical exhibition to close it one minute before seven o'clock.

J. P. BARRETT, chief of department of electricity, World's Fair: The fair ought to be kept open until nine o'clock at least. You can quote me as decidedly opposed to closing at night.

JAMES W. QUEEN & Co., Philadelphia: It will certainly detract much from the electrical display, which will form so great a part of the fair, if the buildings are not open during the evenings.

BOSTON INCANDESCENT LAMP COMPANY: We certainly believe that such action would be a serious misfortune to electric companies that intend exhibiting their lamps and apparatus, and we trust you will do all in your power to bring about a reconsideration.

LA ROCHE ELECTRIC WORKS, Philadelphia: Should the fair be closed evenings we shall refuse to exhibit, as most of our display will be in the evening. We consider it a serious mistake, and believe that a great many other electrical companies will follow in our footsteps in this matter.

PROF. ELISHA GRAY, Highland Park: From the standpoint of the exposition I think it would be a very bad plan. Financially speaking, they would lose a great deal. As for the electric light man, if the fair is closed after dark, he will have no show at all. Of course, some of the tired exhibitors might like it.

S. D. GREENE, gssistant aeneral manager General Electric company, New York: I certainly think that it would prove very inadvisable to close the fair evenings. The closing hour should be 10:30 or 11 P. M. and not 7, in order that the electrical display may be fully appreciated.

NATIONAL INDIA RUBBER COMPANY, Bristol, R. I.: We think that it would be a great misfortune, not only to those personally interested in electricity, but to the general public, should the national commission of the World's Columbian Exposition decide to close the Fair evenings at seven o'clock.

BRADBURY-STONE STORAGE BATTERY COMPANY, Lowell, Mass.: We consider it hardly a fair thing on the part of the national commission to close the fair at seven o'clock in the evening. We fail to see what advantages the illuminating features are to receive. We should think ten or seven o'clock would be but just.

ELECTRIC GAS LIGHTING COMPANY, Boston: There is no question in our minds that to close the World's Columbian Exposition evenings at seven o'clock would prove a great obstacle to the attainment of the best results. Such a policy would appear to us as most decidedly detrimental to the electrical interests.

DAVIS ELECTRICAL WORKS, Springfield, Mass.: We agree with you in the matter of keeping the fair open evenings until eleven o'clock, as it would undoubtedly be a great disappointment to the general public, particularly those who come from distant countries, and we hope a more favorable reconsideration may be obtained.

JAMES P. TOLMAN, president Samson Cordage Works, Boston, Mass.: We shall be very much disturbed if the national commission shall insist upon its plan of closing the fair at seven o'clock every evening. We shall feel that the fair loses much of its good to the public unless the entire exposition is kept open during the evening.

STANDARD ELECTRIC COMPANY, Philadelphia: If the commission persists in this edict it will certainly have the effect of disappointing a vast multitude of visitors to the exhibition, and work incalculable injury to the electrical exhibitors. I trust the protest of all electrical manufacturers will be so vigorous that the management will be forced to see their mistake.

JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J.: We think that such a proceeding will prove detrimental to electrical interests, and disappointing to the general public. It is only at night that the enchanting beauties and marvels of electricity can best be shown. We therefore hope that the decision of the commission does not include the electrical department.

WATERHOUSE, GAMBLE & Co., Hartford, Conn.: We most heartily indorse your effort, and will vigorously support a measure to induce the national commission of the World's Columbian Exposition to consider favorably the keeping open of the Fair until 11 P. M., instead of closing at 7 P. M. To all interested in bona fide electrical display this seems to be a matter of importance, and there is no room for discussion.

THE C & C ELECTRIC MOTOR COMPANY, New York: Your representative advised us to-day that the managers of the World's Columbian Exposition in Chicago were considering the advisability of closing the exhibition each evening at 7 o'clock. Will you kindly let us know the facts in regard to this matter, for such a course would greatly hurt the effectiveness of our exhibit and we trust that this report is unfounded.

E. E. KELLER, Chicago, To me the idea of closing the fair in the evening seems absurd. What is the use of a great electric lighting plant if the greater part of it is not to be utilized? I think that the grounds should be open until eleven o'clock on the evening of every day. The authorities have cut off a large proportion of the revenue of the exposition wholly without reason. You can say that I am decidedly in favor of opening the gates in the evening.

SAWTELL COMPANY, Boston: We regard the action of the commission as an outrage upon one of the leading industries of the world. It is practically a fatal blow to one of the most attractive features of the exhibition, as it practically prohibits the display of lights, and no satisfaction can be realized for the great labor and expense which attends the preparation of exhibits. We earnestly protest against the closing of the exhibition at an earlier hour than 11 P. M.

AUTOMATIC SWITCH COMPANY, Baltimore, Md.: Please permit me to express my great regret and disappointment at this decision, which I think will unquestionably insure a failure for the electrical display, and as the electrical department is such an important factor in the exposition, the whole enterprise must greatly suffer. I sincerely hope this very unwise decision may be revoked at once, the sooner the better, as some important exhibits might be withheld on account of it.

REDDING ELECTRIC COMPANY, Boston: We note with much surprise that the national commission of the World's Columbian Exposition has decided to close the fair evenings at seven o'clock. Believing that this movement would be fatal to most electrical exhibits, we think it would be well if the influential papers would take hold of the matter, and endeavor to have this decision reversed. We know that you will do what you can to protect the electrical industries.

CRESCENT INSULATED WIRE & CABLE COMPANY, Trenton, N. J.: For our part we think this a very unwise step on the part of the commission. The closing of the fair before nightfall will certainly ruin nearly all the electrical features of the exposition, and this would unquestionably be a serious disappointment to the general public as well as to those interested in the general electrical trades. We hope that you will compel a reconsideration on the part of the national commission.

WADDELL-ENTZ COMPANY, New York: In view of the interesting nature of the electrical exhibits, which can be seen to their best advantage during the evening, it would seem advisable to make an effort to have the fair opened at least certain evenings in the week; otherwise the electrical features of the exposition would lose much of their value and interest to the general public. We are glad to know that your able paper will take some action in this matter, and wish to assure you that you have our hearty co-operation.

PAGE BELTING COMPANY, Concord, N. H.: We have learned, with much regret, that it is proposed to close the exhibition at 7 o'clock in the evening, by which action the electrical portion of the exhibit will be neutralized almost entirely. It is our opinion that it should be kept open to a later hour. Eleven o'clock, we understand, is thought of by some, but 9 or 10 o'clock, we think, would at least be an advantage, and will be very fair for all parties. We trust this will be taken into consideration, and the decision of the board reversed.

DUPLEX ELECTRIC COMPANY, Corry, Pa.: It is our opinion that this is a serious mistake, as it will not only deprive the electrical manufacturers from showing their goods to the best advantage, but will be a great disappointment to the general public, as the electrical exhibit will lose much of its value by not being seen in the evening. We understand that you are trying to have a reconsideration of this decision of the national commission, and if there is any way that we can co-operate with you for this end, we would be pleased to do so.

WILLIAM LEE CHURCH, Westinghouse, Church, Kerr & Co., Boston: We should certainly consider the closing of the exposition early in the evening a serious mistake. It would be fatal to the electrical interests. This would be my very strong opinion unless I heard cogent reasons presented to the contrary. It would unquestionably be a serious disappointment and damage to exhibitors, and I think would tend to lessen interest on the part of exhibitors and doubtless lead to a curtailment of their investment and enterprise.

BEACON VACUUM PUMP & ELECTRICAL COMPANY, Boston: We could not imagine a move that would be more detrimental to the successful exhibition of electricity in general. It would be far better to open the exhibition at noon and close at 11 P. M. Surely the management could not expect lamp manufacturers to be contented with a day illumination. We are not prepared at this writing to state whether, under such conditions, we would decide not to exhibit; nevertheless it gives us much concern, and we sincerely trust you will succeed in bringing about the desired change.

O. W. Meysenburg, American representative of the Siemens & Halske interests, was seen at his office in the Monadnock building, Chicago. Mr. Meysenburg was evidently a very much disgusted man. In fact, when first asked for his opinion of the proposition to close the fair in the evening, he declined to talk, "because," he remarked, "my views would be too harsh." After being pressed for an opinion Mr. Meysenburg finally said in a very decided manner, "I am not quite ready to talk for publication on this matter, but I will say that I consider the proposition to close at nights so senseless that it is not worthy of the consideration of an intelligent man."

ELECTRICAL ENGINEERING & SUPPLY COMPANY, Syracuse, N. Y.: We are very much chagrined at the thought that from the present outlook the World's Columbian Exposition will be closed at seven o'clock in the evening. We shall feel that any electrical exhibit placed there will be almost entirely worthless, so far as the exhibit in practical use is concerned, and would, in our judgment, consider half-past ten or eleven in the evening the best hour for closing. We most vigorously protest against any action that would bring about the closing of the gates at seven o'clock. We trust that the commission may be induced to reconsider the matter and change its decision.

F. S. TERRY, Chicago: I cannot understand how a body of intelligent men could make such a move. Why it is absurd. It would be better to close the fair during the day than at night. The greatest feature of this exposition will be the electrical applications. The idea of exhibiting electric lighting apparatus in the day time makes me think that such a display would be about as interesting as to show sleighs and snowshoes in the far South during the summer. The whole affair looks as though some one wanted to show authority. We cannot appreciate what the injury will be to our business if the fair is closed at night. The electrical people should come together and take decided steps to have this matter righted.

STANLEY ELECTRIC MANUFACTURING COMPANY, Pittsfield, Mass.: We are very much surprised to learn that it has been decided to close the World's Fair every evening at seven o'clock, and certainly trust that this is not final, but will be reconsidered and an exception made, at any

rate, in the case of the electricity building. We have assumed, as we suppose others interested in the development of electricity have, that at the World's Fair would be seen one of the grandest and most interesting displays of electric lighting that has ever been shown; but surely if the exposition is closed at seven o'clock every evening, all opportunity for doing this will be lost. We trust that a very vigorous protest will be made.

G. A. McKinlock, Chicago: Why the evening will he the choice time to visit the fair, and I think many will want to visit it in the afternoon and evening. I remember when I was in Moscow in 1891 and visited a French exposition, then in progress there, it was at five o'clock that the crowd gathered. To be sure in Moscow sunset was not until ten o'clock, but the people seemed to prefer the evening. There was no electrical display either. Yes, by all means let us have the fair open at night, but for the sake of what will be a hard worked lot of employes. shut down as much machinery as possible. The closing at night would, of course, lessen the gate receipts, and stockholders, should, therefore, have a natural aversion to any such proceeding.

Franklin Electric Company, New York: We desire to enter our emphatic protest against the action of the commissioners. The extensive preparations in progress among many electric companies indicate that their exhibits will be upon a magnificent scale; in justice to these companies and in consideration of the rapid strides that have been recently made in opening and developing new fields for the practical application of electricity, every opportunity should be given exhibitors to make their demonstrations under the most favorable conditions. Such will not be the case if the fair is to be closed early in the evening. We trust you may be successful in your efforts to remove the handicap which the action of the commissioners has placed upon electrical exhibits.

W. H. McKinlock, Chicago; "As a stockholder in the World's Fair I must say that it would be a great mistake to close the gates in the evening. A great number would undoubtedly want to go out to the grounds after supper. The Chicago boys, for instance," he said with a smile, "will all want to take their girls. But seriously, besides this, Chicagoans, to a large extent, would want to go to the fair in the evening. Most all of us, you see, will have plenty of business on our hands during the day, besides having to attend to visitors. The fair will surely be a loser financially if it is finally decided to close at night.

Ball & Wood Company, New York: As we will make a large exhibition of engines especially for electric lighting in connection with the Brush Electric company of Cleveland, this decision of the national commission will virtually deprive us and many other exhibitors of the principal benefits we hope to derive from our exhibit, and we are very much surprised, especially in view of the electric lighting interests which will be represented, that an opportunity has not earlier been given to protest against this action. The long summer days, which in Chicago make daylight extend much after seven o'clock, will practically render electric lighting superfluous, and in our opinion the exhibition ought to be open at least until nine o'clock. We trust that you will do what you can to reverse this decision.

E. S. Greeley, president The E. S. Greeley & Co., New York: We have received word from Chicago to the effect that the National Commission of the World's Columbian Exposition has decided to close the fair every evening at 7 o'clock. This will, of course, be a great disappointment to the general public, and we shall consider it very detrimental to the electrical department of the exposition, and we sincerely hope that every effort will be made to have the World's Fair Commission recede from this position if it has already been taken. The doors of the exposition should be open until 11 o'clock p. m , certainly until 10 o'clock, and I trust that there will be a united effort on the part of every one interested in the success of the fair to cause a change in the programme, and keep the doors of the fair open in the evening. We enter our protest against closing at 7 o'clock.

Chas. D. Shain, New York: Such action would, in my opinion, be a very serious detriment to the electrical effects as well as to the fair in general. Unquestionably the evening is the proper time to display the electrical features of the exposition, and I am at loss to understand why the commission should take the action stated. It would appear to me that it would result in great pecuniary loss to the fair interests. As a former resident of Chicago, and having the interests of that great city very much at heart, I sincerely hope that you will induce the fair commission to reconsider the matter and give the electrical people some fair return for the enormous expense which they must necessarily incur, and allow the exposition to remain open during such hours of the evening as will permit of a proper display of the electrical features.

Keystone Electric Company, Erie, Pa.: If the electrical exhibit, which, in this exhibition, must be the one in which the greatest interest will be centered, is to he thus shorn of its opportunity for display, why go to the vast expense of fitting for it? Exhibitors will certainly be slow to do it. To a large proportion of visitors the electrical display will be the only one of interest, and such display could only be a success when shown in the night. As we see it, thousands of people would visit the exposition at night for the sole purpose of seeing this display, which in this case would exceed anything heretofore attempted. We earnestly hope you may be successful in having the decision of the commission reconsidered and a fair opportunity given to witness this great electrical display.

A. S. Terry, Chicago: Since it has been decided that the fair should remain closed on Sunday, there seems to have been left no opportunity for those persons who may be so situated that they cannot secure time to visit the fair during the daytime. As the fair will not be opened very early in the morning and but few people will visit the grounds before ten o'clock, it will afford those who have charge of the exhibits an opportunity to secure the necessary rest and will not over-tax them. The design of the exposition is largely educational, and every possible means should be adopted to afford facilities for the people to get the full benefit. Under any circumstances there must be thousands of people in the city who will be so confined during the day that it will be impossible for them to visit the fair at all unless it is open in the evening. Every effort should be used to induce the managers of the exposition to have it open to spectators until at least ten o'clock.

William E. Baker, Chicago: It has always been my impression that the exposition would be kept open until ten or eleven o'clock at night. Perhaps this impression arose from the spending of such an amount of money in lighting the grounds, as it did not seem reasonable that this expense should be undertaken unless use was to be made of it. It will make a great difference to us, if the grounds are closed as early as six or seven o'clock. It also seems to us that the greatest advancement made since the last exposition in any one department is in the line of electrical apparatus, and therefore, that the exhibition of electrical apparatus will be of great interest to many people. Certainly, the early closing of the gates will interfere with this exhibition of electrical apparatus very materially. It seems to us that the statement of expense of keeping the gates open in the evenings must be overstated, unless the first cost of the electrical apparatus and installation, which is already contracted for, is taken into consideration.

B. E. Sunny, Chicago: I cordially indorse the view of the Western Electrician on this question of closing the World's Fair during the evening, as expressed in the editorial printed in the last issue. I am unable to see the wisdom of expending over a million dollars for electric lighting apparatus and then closing the gates of the grounds at dusk. Unquestionably the people will be eager to attend the exposition evenings to see the beautiful electric light effects and many other attractions. Provision has already been made to gratify this wish, and I am at loss to understand why the commissioners should at once cut off a large source of revenue and render a large portion of the electrical plant idle just when it would naturally be most active. Realizing the marvelous extent of electrical development within the last few years, particularly in America, the authorities of the exposition have made preparations for a lavish use of electricity for lighting, railways, power transmission, vessel propulsion and decorative effects. The fair was to be abreast of the times and an exponent of this electrical age. Now, however, the national commission has taken a step in the opposite direction by adopting a rule that will greatly curtail the effect of the electrical display. This action will have an unfavorable effect on the electrical people and do much injury to the fair, in which we all have such a warm interest. The public will be dissatisfied because admission to the grounds is refused in the evening and the electrical men will consider that they have been treated unjustly. There will thus be two just sources of complaint against this rule with no good whatever resulting from it, so far as I can see. It should be remembered that this rule will spoil the effect of the electrical exhibit to a very great extent, and discourage exhibitors. This is a point of much importance, deserving the careful consideration of the World's Fair management. The General Electric company, for one, will contract its exhibit very materially if the rule is not repealed.

William J. Hammer, New York: The electrical department will doubtless prove one of the largest and most attractive features in the World's Fair. Up to the present its magnitude and importance seem to have been fully appreciated by the commissioners and every facility extended to insure the success of this department. Should the decision closing the grounds at seven o'clock be sustained, I am convinced that many of those now contemplating elaborate exhibits involving enormous outlays of capital and labor would decide not to exhibit at all, or to greatly curtail their displays. I have visited from twenty five to thirty international exhibitions, including nearly every electrical exhibition which has been held in Europe and America, and while I see the wisdom of closing many of the other buildings in the evening I feel sure that the electricity building should be kept open until eleven o'clock. The Paris Exposition of 1889 affords an excellent comparison for the World's Fair authorities. The only large building kept open until eleven was the great machinery hall containing almost the entire electrical departments; beside this the sculpture gallery, which was practically one of the main entrances to the grounds, and the Eiffel Tower were kept open. These attractions together with the electric fountains, the bands of music, colored lights, the restaurants and cafes in the grounds themselves, made the exposition wonderfully attractive at night, as the millions of evening tickets sold will testify. Personally I should like to see the art gallery also open at night, but by all means let the grounds be kept open, and the electricity building as well. The industrial exhibitions held annually in various parts of this country testify to the enormous crowds which visit such places at night. The World's Fair in Chicago will draw the largest evening attendance ever known; the financial results will prove most gratifying to the management, and the electrical department will prove the most attractive feature to the public at large.

W. R. Mason, Chicago: It seems to me that a very grave error has been made, and that it should be rectified at the earliest possible moment. It is unpleasant for anyone interested in the success of the fair, and especially for a Chicago man, to criticise decisions arrived at by the commissioners, but in this case we must think that they have not looked into the matter as thoroughly as the question deserves. This is clearly an age of electricity, and the visitors at the fair will count the electrical display as one of the most attractive, if not, indeed, the greatest feature of the fair. A proper electrical display, and one which will be expected by visitors, cannot be made in the daytime, and it seems hardly fair, when exhibitors are going to great expense in designing attractive novelties, that they should now be told that no time will be given them to properly show such exhibits. The very fact of there being such a magnificent electrical display will be a strong drawing card for the fair. Those of us who have lived in New York city will remember how the very insignificant lighting displays made with gas at the fairs of the American Institute were popular features of the display. The grandest, the most instructive, the most modern and the most magnificent feature of the Columbian Fair, and the strongest drawing card, will be the electrical display. The commissioners are interested in having the fair succeed beyond the hopes of the people, and they are also interested in making it financially successful. No private enterprise would think of closing such an attractive exhibit at seven o'clock, and it seems to me that it is only necessary to call the attention of the commissioners to this matter to have them make a change now—a change which will certainly be demanded when the fair opens. It has been intimated that the commissioners have taken this means of proving to Congress that it is necessary to have the fair open on Sundays. This, however, cannot be possibles, as it would surely defeat any such action by Congress. There is an honest difference of opinion regarding the necessity or advisability of opening the fair on Sundays, but such matter will come before Congress next winter, and will undoubtedly he decided to the satisfaction of all concerned.

George Cutter, Chicago: You have asked my opinion regarding closing the World's Fair evenings, and I am almost sorry for having expressed a willingness to give you this opinion, because I am a great admirer of the quality of the work done by the World's Fair officials. While some of their decisions have been different from my conclusions on the same questions, I have great admiration for the broad gauge policy displayed by the managers of the World's Fair. On this particular decision, however, I have positive views contrary to those of the World's Fair people. I have

had charge of important electrical installations in several large exhibitions in this country and in Europe, and the result of this experience satisfies me that the best time to exhibit many lines of goods, especially in the electrical department, is in the evening. The decision to close the exhibition in the evening has puzzled me very much, when I think of the great cost to the World's Fair for electrical installations which are of no use in the daytime. The greatest crowds that I have met in exhibitions in London, Paris, Berlin, Barcelona and St. Petersburg have been in the evening. A large part of the best electrical exhibits are of no use by daylight. The attractive and beautiful effects which can be produced by electric lighting would of themselves draw great crowds to the exhibition; the outlining of the buildings with incandescent lamps, the variety of beautiful effects in fountains and other special electrical displays, are only possible in the evening. I had already made calculations for spending many evenings at the World's Fair, and thus be able to see many things which I cannot take time from my business to attend to during the daytime. It is a bitter disappointment not to be able to go to the exhibition two, three or four evenings each week next summer. I am confident that many people feel the same way, and dislike to be deprived of the opportunity of studying the World's Fair as thoroughly as had been expected. While this is emphatically the case with many business men in Chicago, it is especially so with the laboring classes, and I feel that it is depriving many people of good opportunities of visiting the World's Fair, and that it very materially influences our interest in this fair. It is expected that the business men in electrical work in Chicago will be very busy next summer entertaining visitors to the World's Fair. These duties, coupled with the fact that business will be difficult to handle in Chicago next year, make it almost impossible for many of us to devote the time to the World's Fair which we believe it deserves, and I do not think we should be deprived of the opportunity to study the exhibition during the evening. It does seem as though closing the exhibition evenings and Sundays was making it a great burden for most of us to visit the exhibition at all, and there is no doubt but that it interferes very materially with our being able to derive very much from the exhibition. The decision to close this exhibition evenings makes me feel much less inclined to devote the time and money at first contemplated toward extending the hospitality of the electrical community of Chicago to visitors, because the only result that I see from that is an opportunity to show ourselves good entertainers without having the benefit which such an exhibition should render. I must lend my strongest support to any movement tending toward opening the exhibition evenings.

GEORGE H. MEEKER, Chicago: The action of the commision is a great disappointment and one that will result disastrously to the enterprise. It should be remembered that Chicagoans contributed the first ten million dollars subscribed for the capital stock, and that this stock was taken largely by the working classes. The World's Columbian Exposition, moreover received from Congress a free gift of $2,500,000 and also issued $4,000,000 worth of debenture bonds, payment of which was guaranteed by the anticipated gate receipts. Now all this has been done with the understanding that the exposition was to be open until 11 P. M. each night. Many people in Chicago, under the proposed arrangement, will be unable to devote more than one day to the fair, while with evening displays they could go at least 25 times. This would make a great difference in the gate receipts. It would also seem that the people who are here from all over the world would naturally want to see as much in a short time as possible. One of the directors estimated that about one-half of the exposition gate receipts would be derived from the population within a radius of 250 miles of the city of Chicago. It would seem that the other half, coming to Chicago, as they will, at a time when everything will be crowded, will want to see the whole show in one week. This is a thing which they cannot do if the exposition is to be open only from 8 A. M. to 7 P. M., for the experience of the past expositions has shown that it would be impossible to get more than a general idea in a week's time. Beside this, there is to be taken into consideration the large number of people, particularly women, whose physical strength is not equal to a twelve hour constant strain of sight seeing, and these people would, were the exposition open evenings, put in four or five hours sight seeing in the day, then go home and rest, and put in four or five hours in the evening, which would mean double gate receips to the Exposition company. Beside all this there is to be taken into consideration different concerns that have paid large amounts for privileges for the selling of different articles. Some are paying a percentage on their net receipts, notably the Elevated Railway company. The closing of the exposition at seven o'clock means a severe financial loss to the gentlemen who have bid for privileges, as well as the stockholders of the Exposition company, and if the action of the National Commission in the closing of the grounds at 7 P. M. is confirmed, it means that it will require 8,000,000 people to go through the gates from May 1st to October 31st between the hours of 8 A. M. and 7 P. M. to pay the debenture bonds; and in this case it is doubtful if the stockholders ever see anything in return for the money they have paid for stock. If the Exposition company had stated this before it secured the amount for the fair capital stock, the gift from Congress, and the subscription to the debenture bonds, it is doubtful if it would have received a subscription for 25 per cent. of this whole amount. Concerning the electrical part of the exposition it may be said that the public cares nothing for electricity unless it produces light, and is not to be interested in electrical matters in the daytime. It is at night, when they can see the beautiful features of incandescent lighting and the many combinations and clusters of revolving lights, that the people generally will be interested. If the fair is kept open at night the most important feature will be the electrical display. At no previous exposition has it ever been possible to make such an electrical show as will be undertaken at the World's Fair. Then again comes the point, why has the exposition expended several millions of dollars in putting in an incandescent light plant of 100,000 lamps capacity, an arc lighting plant of nearly 6,000 lamps capacity, a motor capacity of over 3,000 horse power and an enormous steam plant? Is this all to remain idle in the buildings when the public is most interested? I believe that if a careful calculation was made, it could be found that the World's Columbian Exposition has expended at least $5,000,000 for an electrical installation which, if it is to close at 7 P. M., is of no value to it; but were the exposition to be open as originally intended until 11 P. M. it would mean at least $10,000,000 in increased gate receipts. The World's Columbian Exposition is in reality a great show, the directory of which may be likened to theatrical managers. The action of the national commission in closing the gates at 7 P. M., and thereby depriving the public of evening amusement, is like running a show without a star, or a circus without an elephant. The only people who will derive benefit from this early closing scheme are those who run the numerous side shows that the World's Columbian Exposition has no financial interest in. The only possible defense of the commission that I can imagine is "to have certain indefinite gala nights in which electrical fountains will be exhibited." People don't want to pay 50 cents to see an electric fountain play at Jackson Park, when they can take one of Yerkes' grip cars and see a similar exhibition at Lincoln Park for 5 cents. Every one knows that one fountain is very much like another, resembling a display of fireworks in this respect. The World's Fair managers may say "We have not power enough to run this immense amount of electrical machinery." If this is so it is easy enough to stop the day load and throw the entire load at night on the electrical machinery. What I believe the public wants to see at night is an electrical show, and were it not for the penny wise and pound foolish action of the World's Columbian Exposition, they would see such a sight as the world has never seen before; that of a block of ground nearly two miles long, covered with the largest buildings in the world, in one blaze of electric light.

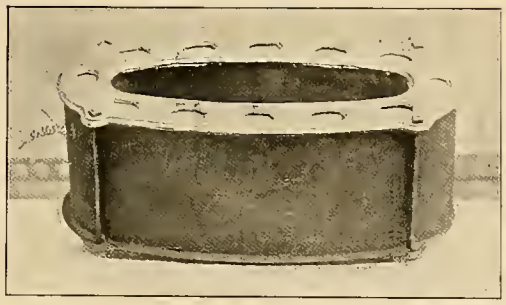
American Institute of Electrical Engineers.

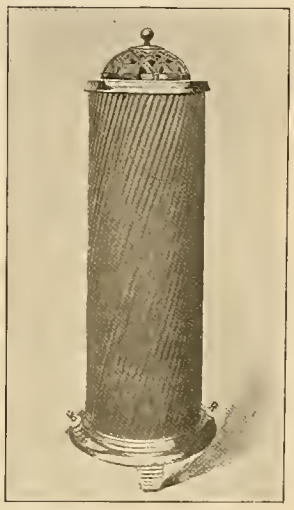
The American Institute of Electrical Engineers will meet at New York, November 15th, when the paper presented by Dr. J. B. Williams, at Chicago, in June, will be brought up for discussion. The title of this paper is "Oil vs. Air as an Insulating Medium." The author will make actual tests, showing the relative merits of the insulating qualities of air and oil, after which the paper will be discussed.

Tests will also be made of samples of various kinds of insulated wire. As the object of these tests is to show the comparative merits of all kinds of insulations, members are especially requested to send to the secretary in advance of the meeting, and as soon as possible, samples of all the kinds of insulated wire, also samples of insulating materials, such as mica, vulcanized fibre, ebonite, etc., for comparison with oil and paraffin. These samples will be designated by numbers, and no names of manufacturers will be used in connection with these tests. The samples of wire should be about four feet in length, small sizes preferred, and the insulating materials in sheets about two inches square and $\frac{1}{16}$ inch thick if possible.

New Ahearn Electric Stove.

The readers of this journal will remember a recent article entitled "The Ahearn Electric Heater in Canada." Since the publication of this description of what is without doubt the most extensive electric heating plant in the world, the work of introducing the Ahearn heating apparatus in the United States has been begun by the Railway Equipment company of Chicago, which is sole manufacturer outside of Canada. The Ahearn heaters are now being made in a great variety of patterns at the company's factory. The accompanying illustration Fig. 2 shows the latest style of Ahearn electric stove. This heater is intended for office or parlor service. It is about three and a half feet high, and the picture shows very clearly its tasteful design. Fig. 1 shows the latest form of car heater.





FIGS. 1 AND 2. THE AHEARN ELECTRIC STOVE.

The construction of these cylindrical air heaters is such as to make them, it is claimed by the designer, most efficient in their action. A special feature is the heater's hollow form and the winding and insulation of the heating wire around the inner tube so as to concentrate the heat upon the inner tube and leave the outer casing, practically speaking, cool.

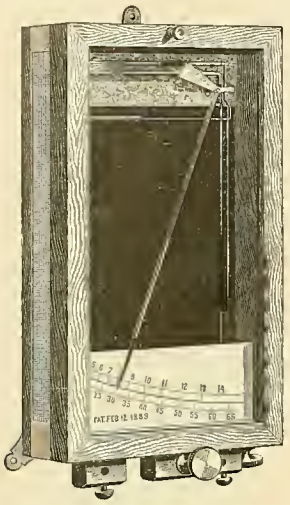
The manner in which this arrangement has the effect of promoting a constant circulation of air through the heater will be readily appreciated. The air streams in constantly at the bottom to be heated by the inner tube, and then passes out at the top. The winding of the heating wire, too, it should be stated, does not cover the entire surface of the inner tube, but is terminated some distance from the top of the tube. The reason given for this construction is that, as the hottest part of the heater is at its top, there would be at that point, with the winding continued to the top, too great a concentration of heat, which would lead to a rapid deterioration of the wire.

The Cutler Non-Inductive Ammeter.

Many ammeters now on the market have the objection that they depend on a magnet for their action, so that their readings are easily affected by large masses of iron that may be present in central stations. And even where they can be used at a distance from the dynamo room it has been found that the magnets in two such instruments placed side by side on a switchboard may spoil the readings. What is more, the accuracy of magnetic instruments is affected by a change in the speed of the dynamo, this being specially noticeable with alternating currents.

For these reasons there has been a call for non-magnetic ammeters, and it was to meet this demand that H. H. Cutler, Chicago, designed the instrument illustrated herewith.

This meter depends for its action on the difference in expansion between two fine wires, one of which is traversed by the current to be measured, while the other compensates for changes in the temperature of the room. For heavy currents a shunt is placed at the back of the instrument so that the small-sized wire can be used. The two wires are fixed at one end and kept taut by flat springs carrying knife edges. A yoke resting on these bearings carries a light pointer, the leverage being such that quite a small expansion of the measuring wire will move the



THE CUTLER NON-INDUCTIVE AMMETER.

needle across the scale. This instrument is practically deadbeat and is not affected by any amount of iron near it. It is equally accurate for direct and alternating currents and has been thoroughly tested in practice during the last six months.

The cut shows a double scale ammeter reading up to 65 amperes, and it will be noticed that the scale is much longer than on most instruments. The Cutler non-inductive ammeters are built in sizes ranging up to 160 amperes to meet the varied requirements of different stations, and are put on the market by George Cutter of Chicago.

Desirable Sites for Factories.

To THE TRADE: The tendency of the present age leans toward the concentration of industries as well as of capital, thus creating great commercial and financial centers. To these great centers of commerce flow not only the idle capital, seeking a market, but also the most skilled labor, both of which are the most essential factors for the successful manufacturer. A number of outside manufacturers have already realized the great advantages that Chicago affords in this direction, as it not only possesses the above stated conditions, but is one of the greatest railroad centers in the United States, and they have removed their plants to the immediate vicinity of Chicago. We beg to inform you that we are the representatives of Alpine Heights, a tract comprising 720 acres of the most beautifully located land anywhere around Chicago, situated on the Wabash railroad, 23 miles from Chicago's courthouse, and that we are in a position to submit inducements of a character that would make it profitable to you, should you have under consideration the removal of your plant, or the erection of a new factory. We also beg to state, that our land is 150 feet above Lake Michigan, making the location, from a sanitary point of view, a most desirable one. Should your firm not entertain the idea of a removal, or the establishment of a branch factory, we will thank you, should it be in your power to do so, to lay this matter before parties that you know have matters of a similar nature under contemplation, and who would thus be in a position to entertain our proposition. Hoping to hear from you, we beg to remain, yours very respectfully, W. W. WATSON & Co., 225 Dearborn street, Chicago, Ill.

CORRESPONDENCE.

New York Notes.

NEW YORK, November 5.—To put it mildly the electrical people of the East are, as far as can be learned after an active canvass, most decidedly opposed to the absurd plan to close the World's Fair grounds after dark. I have forwarded you quite a number of interviews with men prominent in electrical matters both in and about New York city and also in the New England states, and these will substantiate the statement made above.

New Yorkers who live on Staten Island and go home after dark will soon see Liberty in her new dress of electric lights. For the past week, a partial notion of the whole new lighting has been afforded by the sight of so much that has been acomplished by the men who have the work in hand. The goddess now wears a fiery diadem every night. It is composed of two parallel rows of incandescent lights, whose globes are of white, red and blue glass arranged in regular succession. Each of these rows is made up of twenty-seven lights, every one of which has a power of fifty candles, making a total power of 2,700 candles. The general effect as seen from the Battery is a fiery crown upon the brow. The torch is illumined with a single arc light of 6,000 candle power, which is to have a large reflector to multiply its luminosity. In addition to this a skylight is to be inserted in the top of the torch. The effect of this will not be observed on a clear night; but whenever the air is misty, or contains dust or fog in any quantity, the skylight is expected to throw the light high up in the air and to cause intense luminosity overhead. This skylight will contain glass of different colors, which will make a general effect of a softer and more genial light than the ordinary electric carbon affords. To crown the whole, a powerful searchlight, placed on the ground in front of the statue, will be turned full on the face.

W. F. O.

Northwestern Notations.

MINNEAPOLIS, November 5.—Willis A. White has petitioned the district court, Minneapolis, for the appointment of a receiver for the Riggs Electric company to protect a judgment of $752.98 secured against the company.

The Northwest General Electric company has sold to A. J. Leitch the electric light plant at White Bear Lake.

The crossing of electric wires at St. Cloud, the other day, occasioned the burning out of a telephone box and the laying off of 50 instruments.

The Winona Electric company has sold its electric light plant to the Northwest General Electric company, which will operate it under the title of the Winona General Electric company. A new station will be built next year in the same building with the power plant for the electric street railway. It is reported that similar deals are contemplated by the Northwest General company in other northwestern cities. The Winona company is captalized at $200,000, and the purpose of the corporation stated in its articles is very comprehensive.

A large force of men is now busy at Brainerd, Minn., laying track for the new electric car system.

The new electric light outfit, located in the roller mill at Spring Valley, is giving excellent satisfaction.

At the recent fair at Superior the electrical features were quite conspicuous. The Northwest Electric company had an effective display. An electric fountain attracted much attention.

Another car has been added to the Interurban service and the time has been lengthened a little for the winter schedule. The day service is at intervals of six minutes and cars leave from 6 A. M. to midnight. There are twenty cars in service and the round trip, with a 9-minute layover, takes just two hours.

The St. Paul street railway situation has not changed very materially. Mr. Lowry has practically refused to resume the conference, and the aldermen are going ahead with the idea of putting through the proposed ordinances requiring the starting up of a horse car line to Como and an electric line from Charles street to Minnehaha.

There was a false alarm in one of the papers about a strike of the employes of the Twin City Rapid Transit company. The officers of the Electrical Workers' Union and all concerned deny the rumor.

A coroner's jury decided that a motoneer on a Minneapolis electric car was to blame for the death of a small boy who was killed while jumping from another track to avoid an approaching car.

The citizens of Grand Forks, N. D , are getting anxious about the electric cars they have been expecting. The officers of the company say they have not abandoned the enterprise, but have purchased materials and will rush construction when they get started. The company gave a $5,000 bond against damage to property, and not for the completion of the work, as some people supposed.

H. R. Caulfield, in charge of the electrolytic construction of the Butte & Montana company, and Charles A. Potter, chemist of the New England Electrolytic company at Central Falls, R. I., have been at Great Falls for some time and will soon leave for Rhode Island.

The Sauk Rapids electric street cars have materialized.

Dundas, Minn., is calling loudly for electric lights.

The Duluth Street Railway company expects to start up a twelve-minute service on the new Lakeside line within a few weeks. The council is considering the advisability of ordering a line from Superior street to East Eighth street.

At South Superior men are at work extending the tracks as far south as Sixty-fourth street and on Central avenue to Clough avenue. A line from South Superior to the East End via Stinson avenue is talked of.

Two of the twenty thirty-four-foot vestibuled motor cars ordered by Mr. Lowry for the Interurban line have arrived. They are brilliantly lighted by seven chandeliers. They will be run by fifty horse power motors.

A telephone line between Melville and Martinsdale, N. D., is talked of.

The new electric system at Sioux City, Ia., will be started up shortly, delayed cars having been shipped.

The city of Duluth has sued the street railway company for $1,687 30, the amount it cost to fix a viaduct so electric cars could be run over it.

Manager Freedy, of the Fargo Telephone company, and W. J. Joyce, of the St. Paul company, have been off on a hunting trip.

St. Louis, Mo.

ST. LOUIS, November 5.—The mayor has given his approval to the ordinance regulating the erection of electric wires, so it is now a law. The requirements of this bill were given in the WESTERN ELECTRICIAN of July 30th.

A number of city officials of Fayette, Mo., spent several days in St. Louis last week, investigating the merits of the various forms of electrical and steam apparatus, for the city lighting plant, for which $12,000 worth of bonds were recently sold. The committee consisted of Mayor Deatherage and councilmen W. F. Turner and Stonewall Pritchett. They left this city for Chicago without reaching any decision.

The council committee on Street Railways, is giving its attention to the Delmar avenue and Clayton and Grand avenue, and the Union Depot Electric Railway bills now before the municipal assembly. It is expected that early action will be taken on these bills.

The St. Louis Dressed Beef & Provision company is now putting in an isolated electric lighting plant, sold them by H. H. Humphreys, St. Louis, manager of the Western Electric company.

The St. Louis capitalists who are putting in a central station for public and private lighting at Edwardsville, Ill , have incorporated the Edwardsville Electric Light & Power company, with a capital stock of $20,000. Material for the line construction has already reached there, and work is in active progress.

It is reported that six miles of the grading of the Chicago & St. Louis Electric railway, recently begun at Edinburg, Illinois, have already been completed; and the contractors are rapidly pushing the work on the remaing eighteen miles of their section.

The Board of Public Improvements has directed that the Missouri Electric Light company place under ground its wires for the incandescent lights in Waverly and Benton Places.

The Missouri Electric Light and Power company has in its hands, another case of theft of current for incandescent lights. It is prosecuting this case with good prospects of securing a conviction. It will be remembered that the last case failed on account of a technicality.

The executive committee of the proposed Electric Club is pushing its work energetically, and rapid progress is being made in securing the pledges of one hundred original members.

Among recent incorporations is the Connecting Electric Railway company, of St. Louis, with a capital stock, of $2,000, one-half paid. The incorporators are: James D. Houseman, Jr., one share; F. W. Raeder, 18 shares, and George Munich, one share. No information is obtainable as to the plans of this company.

The Marion Electric Light & Power company, of Marion, Ill., has contracted for its complete equipment including Brush electrical apparatus, an 80 horse power Ideal engine, and Springfield boilers.

The city of St. Louis has recently ordered the Laclede Gas Light company to erect a large number of additional 30 candle power incandescent lights at various points throughout the city. In order to be able to handle this work properly the Laclede company has ordered through the Inter-State Complete Electrical Construction company, of St. Louis, a fourth Heisler series dynamo, having a capacity of 450 32 candle power lamps. B.

Milwaukee, Wis.

MILWAUKEE, Wis., November 5.—The supervisors of the town of Lake have granted three very important franchises to the Milwaukee Street Railway company. Two are for a line to Cudahy and the other for a line to the south along the Howell road. The line to Cudahy—for only one line will be built—will of course materially enhance the value of property along its route and the company, by having the choice of two routes, is in a position to be benefited by the natural desire of the property owners on

both of the rights of way to secure the proposed electric road. One of the franchises is for a line along the new Chicago road thence across country to the Packard road and thence to Cudahy. The other franchise is for a line along Pennsylvania avenue to the Northwestern railroad right of way, thence to the Packard road and thence to Cudahy. According to the franchises, the electric line must be completed to St. Francis by Sept. 30, 1893, and to Cudahy by Dec. 31, 1893. It will be operated as part of the Villard system. It is provided that cars must be run at least every half hour and the board reserves the right to regulate the operation of the line.

The other franchise granted by the Lake authorities is for a line along the Howell road to the town hall, a distance of two miles beyond the city limits. The road is to be built by Sept. 30, 1893. A single fare is to be charged from the end of the line to the center of the city. The town authorities have voted to widen the road to 100 feet, the abutting property owners agreeing to dedicate the land needed for the improvement. Some time ago a bonus of $30,000 was raised by the people who owned land in that vicinity, and the money will be paid to the Villard company. The Howell road line will traverse what promises to be a fine residence district, and the Cudahy line will tap a flourishing manufacturing suburb.

The stand taken by the mayor and the Board of Public Works regarding the condition of the Hinsey electric road referred to last week has borne fruit. The officers of the company at once informed the city authorities that they would take immediate steps to put the tracks in good condition. No time was lost in putting in new bond wires for the return circuit. The company's action has satisfied the city officials.

Engineer John B. Cromwell, of the Hinsey electric railway, has distinguished himself by spearing three German carp in the river near the power house. Carp had never before been found in the river, but some were planted in the lake here about ten years ago.

Judge Johnson, of the circuit court, holds that drivers of wagons crossing electric railway tracks must exercise a reasonable amount of care or suffer the consequences themselves. In a case in which the owner of a pie wagon sought to recover $500 because the wagon was wrecked by an electric car on the Becker line, the court found that the driver was contributorily negligent and ordered the jury to find for the defendant. A similar case has never before been decided in Wisconsin. The plaintiff will appeal to the state supreme court.

Charles F. Pfister has begun suit against John A. Hinsey, the Northern Trust company, the Milwaukee Electric Railway company, and the Northern Badger Illuminating company to recover a claim of $15,000; and suits against Carl Busacker, John Pratt and others to recover claims of a few hundred dollars each.

In Milwaukee's great fire, which caused a loss of from $4,000,000 to $5,000,000 the electrical interests did not suffer materially. The Chicago long distance line was temporarily injured, but an emergency cable was laid, and in a day or two the line was working as usual. The telephone company lost a total of twenty-six instruments. The homes of some of the telephone girls were in the burned district, a fact which, with the extraordinary number of calls, made things very lively at the exchange. One fire alarm box and two police alarm boxes were destroyed. A police alarm cable "head" was burned. A $3,000 dynamo which had been brought here by the Northwestern railway for the Blatz Brewing company, as well as a smaller dynamo for the John Shroeder Lumber company and one for the Zoehrlaut Leather company were burned in the railroad freight houses.

There is a fair prospect that Oconomowoc will be lighted by electricity next spring. George L. Wilsey, H. H. Shufeldt and others have incorporated the Oconomowoc Electric Lighting company, and, if encouraged by the municipality, will build and put in operation a first-class electric plant. They have asked for a franchise to put poles and wires in the streets for a contract to light the city for a term of years. There seems to be no doubt of the franchise being granted, and a contract made by the city and the company. The standing of the projectors has created a feeling of confidence in the enterprise.

The people of Racine are still without street cars. The mule and horse cars have been discarded, and the electric cars have not yet made their appearance. The leading streets are torn up in order to allow track laying, and the completion of the road. The management of the road expects that the line will be in operation by December 1st. The people, however, are not counting on electric cars before New Year's. Nearly $200,000 have been spent in the work and it is believed that the line will be a very good one. C.

Detroit, Mich.

DETROIT, MICH., November 5.—The electric lighting plant of the Warrenburg Electric Light & Power company, was recently destroyed by fire; loss $20,000; no insurance. The fire is reported to have been started by sparks falling on the roof. The plant will be rebuilt at once.

Specifications for the electrical work on the new Planters House building have just been completed. The incandescent electric lighting plant will be the largest isolated plant in the city, outside of the exposition. There will be some 3,800 16 candle power lamps.

After long deliberation the Cass Avenue Railway company has placed its order for power plant. The E. P. Allis company, of Milwaukee, will furnish three Corliss engines, each rated at 1,000 horse power capacity. They are to be delivered in four months. John O'Brien, of this city, builds the boilers, which are to be twelve in number, each 66 inches in diameter, by 22 feet long, having twenty two 6-inch flues. The boilers will be set with the Springfield down draft smokeless furnace.

PERSONAL.

Hollis French of the Massachusetts Electrical Engineering company, Boston, was in Chicago last week.

Charles Wirt, electrical engineer with the Electrical Supply company, Chicago, was in New York last week on a flying business trip.

H. L. Lufkin, for six years connected with the C. & C. Electric Motor company of New York, and who during the past two years has acted as general sales agent, has accepted a position with the Crocker-Wheeler company of New York.

Frank X. Cicott, managing director of the *Railway World*, London, has been in Chicago for several days visiting his many friends. Mr. Cicott will be remembered through his connection with the Electric Merchandise company some years ago, he and W. R. Mason being pioneers in the electric railway supply business. Mr. Cicott will sail from New York for London the latter part of November.

Mr. and Mrs. Francis B. Badt entertained a large number of their friends Tuesday evening in honor of their distinguished guest, K. Iwadare, of Osaka, Japan, at their home, 6506 Lafayette avenue, Chicago. The rooms were bright with flowers, and the costumes of the ladies, who, by request, appeared in Japanese dress, presented a pleasing picture. A mandolin orchestra furnished music, and refreshments were served in the dining room. Among the guests were the following gentlemen and ladies: B. E. Sunny and wife, J. B. Carney and wife, L. S. Hills and wife, J. G. Loeber and wife, W. A. Kreidler, S. D. Flood and Misses Clara Church, K. O'Donnell and N. O'Donnell.

NEW INCORPORATIONS.

Lansing City Electric Railway company, Lansing, Mich.; capital stock, $100,000; electric street railway in Lansing; Jay P. Lee, Lansing, Mich.

Colorado Electric Light & Power company, Rico, Colo.; capital stock, $50,000; to furnish electricity for light, heat and power to the town of Rico.

Phœnix Tramway company, Phoenix, Arizona, and Denver, Colo.; capital stock, $200,000; to build an electric or other railway in Phœnix, Ariz.

Peru Electric Manufacturing company, Peru, Ind.; capital stock, $100,000; to manufacture, buy and sell electrical supplies, specialties and appliances.

Oconomowoc Electric Lighting company, Oconomowoc, Wis.; capital stock, $30 000; to erect and maintain an electric light plant; M. Parks, Oconomowoc, Wis.

Hyde Park Railway company, Scranton, Pa.; capital stock, $50,000; constructing and operating an electric railway in Lackawanna county; Jessups & Hand, Scranton, Pa.

Grangeville Mill & Power company, limited, Grangeville, Idaho; capital stock, $5,000; to construct and operate mills, electric plants and waterworks; Wallace Scott, Grangeville, Idaho.

Warsaw Gas & Electric company, Warsaw, N. Y.; capital stock, $50,000; light, heat, etc.; consolidation of the Warsaw Electric Light & Power company, and the Citizens' Gas Light company under the above name.

Merchantville Light, Heat & Power company, Merchantville, N. J.; capital stock, $50,000; to manufacture, distribute, and dispose of gas and electricity for lighting, heating, fuel and power purposes; E. A. Armstrong, Camden, N. J.

People's Gas & Electric company, Little Falls, Minn.; capital stock, $50,000; to erect and operate gas and electric works, manufacture, generate, sell and furnish gas and electricity for light, heat and power; own and operate street railways and other railways; Taylor, Calhoun & Rhodes, Little Falls, Minn.

ELECTRIC LIGHTING.

Morrilton, Ark., is to have an electric light plant.

The city of Wapakoneta, O., contemplates erecting an electric light plant.

A company is being organized to supply the town of Stanton, Mich., with electric light.

The citizens of West Point, Ga., will vote on a proposition to issue bonds for an electric light plant.

The Northwestern Electric Light & Power company of Chicago has increased its capital stock from $25,000 to $50,000.

The town of Holly, Mich., has contracted with the Holly Electric Light & Power company to light the place with electricity.

The business men and taxpayers have petitioned the council of Milford, Mich., to contract for a system of electric lighting for the streets of the town.

A. A. Tibbe has been granted the franchise for lighting Washington, Mo., with electricity, and an arc and incandescent light plant will be erected at once.

The proposition to the council of Moline, Ill., for the purchase of the city's electric light plant for $16,000 has fallen through, as the city was unwilling to surrender the right to ever again light its own streets.

W. D. De Celle was the lowest bidder for lighting the city of Fond du Lac, Wis., with electricity. Should he receive the contract he will rebuild the street railway, erecting a plant of sufficient capacity for electric lighting and street railway purposes.

The Brush Electric company has just completed the installation of a 30 arc light plant at the factory of Benedict & Burnham, Waterbury, Conn., and a 60,000 watt Brush alternating plant at Cornwall-on-Hudson, N. Y., both of which plants were recently sold by A. D. Dorman of the New York office of the Brush company.

ELECTRIC RAILWAYS.

The Tramway company of Manchester, Colo., will extend its electric line soon.

The Consumers' Electric Light & Street Railway company will build an electric railroad at Tampa, Fla.

The Central Electric Railway company of Carondelet, Mo., will build a road from Bellefontaine cemetery to Ira avenue and Davis street.

Springfield, O., capitalists have secured an option for a right of way to Clifton and expect to build an electric railroad between the two points.

A survey has been made extending the route of the electric street car line to the university at Denver, Col. Work will soon be begun on the extension.

The Lansing, Mich., City Electric Railroad company, has been organized and has purchased the railway system of that city from the Continental Trust company of New York.

The St. Catharines, Ont., electric railway, which has been in liquidation, was sold on October 22d. Gen. Dawson, of St. Catharines, was the purchaser, paying $20,000 for the road.

The suburb of Muncie, Ind., known as the West Side is clamoring for an electric street railway, and the Delaware County Land Improvement company is authority for the statement that a contract will soon be let for a plant.

At Nashville, Tenn., the board of public works and affairs has agreed to give the United Electric Railway company time to take up its tracks on Spring and Third streets. The city council has a bill pending before it granting rights of way in the city to the East Nashville Electric Railway company.

"Some time ago," says the *Milwaukee Journal*, "some adventurous gentlemen promised to have an elevated electric railroad between Milwaukee and Chicago and a company was organized. The work has not yet been commenced but the projectors say the road will be built; they are waiting just now, possibly to get the benefit of the experience of others, as second-hand experience is much cheaper than the new article."

One of the queer sights yesterday morning, says the Portland, Me., *Argus*, was a man standing on top of a Westbrook car, holding the trolley pole against the wire while the sparks flew about his head and the car swept on at the usual rate of speed. The head of the pole with the truck had pulled off and the only way to get the car to a point where repairs could be made was to put a human attachment on the pole. It might be thought a dangerous position, but so long as the roof of the car was dry it made a poor conductor and there was little danger of receiving a shock.

Rapid transit between Seattle and Tacoma, Wash., is a project which has been agitating the minds of investors for the space of two years, and several roads have been projected, but the unsurpassable barrier always presenting itself has been a right of way through the Puyallup Indian reservation, which it was impossible to secure. This has been overcome, however, by the Rapid Transit Railway company, which has entered into an agreement with the county commissioners, receiving permission to occupy a thirty foot space of the county road, providing the remaining thirty feet be graded and put in condition for travel by the company. Surveyors have been put to work to estimate the cost of the road, which will be twenty-eight miles in length, equipped for electricity, using the overhead trolley system, and it is expected to make the trip in something under an hour, giving a half hour service. Early milk and vegetable trains will be run into Seattle and Tacoma by this rapid transit line, and special attention will be paid to through cars between the two cities.

TELEPHONE.

Communication by telephone has been established between Portland, Seattle and Tacoma, and the line will be opened to the public in a few days.

TELEGRAPH.

The dispute between the telegraphers and the company on the Gulf, Colorado & Santa Fe railroad has been settled. The settlement is regarded as satisfactory by the committee representing the operators. The company gives an increase in salaries, besides agreeing to pay overtime. It is also stipulated that any operator dismissed shall have the right of appeal to a grievance committee, and if the dismissal he found to he unjust he shall be paid for the term of suspension.

Heretofore the Western Passenger association has been doing all of its telegraph business with the Western Union company, but will hereafter give the Postal company 6 per cent. of it. Certain lines in the association are patrons of the Postal company, and they insisted that it should be given a show, whereupon the matter was docketed and made one of the subjects for consideration at the bimonthly meetiag. Arrangements were entered into to let the Postal in on a basis corresponding to the amount of patronage it receives from members independent of the association business as compared to what the Western Union does.

The experiment recently entered upon by the farmers of a Michigan township of installing their own telegraph line has proved, as the local papers put it, "a signal success." The subscribers, who numbered about a dozen, divided equally between them the cost of the installation, which was $200, and they arranged that when another subscriber wished to join the circuit he could put up his own wires, secure an instrument, and bear his proportion of the expense of maintaining the system. Each house has a letter by which it is called, and whenever one farmer's wife wishes to invite her neighbor to tea, the ticker is resorted to. The line is also used in inquiring for mail at the post-office, by which many miles of useless and weary travel are saved during the year. The line is eight miles in length, and was put up at the instigation of a young telegrapher, who undertook to teach telegraphy to one member of each family interested.

MISCELLANEOUS.

The recent strike at the Jenney Electric Works at Indianapolis has been settled to the satisfaction of all concerned. The shop is to remain independent, and there will be no discrimination for or against union or non-union men.

The first regular meeting of the year of the Electromathean society of Grand Rapids, Mich., occurred on the evening of October 28th at the high school building and was the occasion of an address by Mr. Carman on the subject of the electric search light.

TRADE NEWS.

The Electrician Publishing company, 6 Lakeside building, Chicago, carries the largest stock of electrical books—with possibly one exception—of any publishing house in the United States. Send for new catalogue.

The C. & C. Electric Motor company, of New York, is now very busy. It reports business as increasing, especially in the neighborhood of Chicago. Since the first of the year the sales of C. & C. motors throughout the West have far exceeded anticipations.

"Houston's Dictionary," "Trams," by C. B. Fairchild, editor of the *Street Railway Journal*; "Dynamo-Electric Machinery," by Thompson, and all other leading works on electrical subjects are kept constantly in stock by the Electrician Publishing company, 6 Lakeside building, Chicago.

T. A. Pamperin of the Electrical Manufacturing company, Oconto, Wis., was in Chicago on Monday of last week in consultation with Wm. Hood & Co., general western agents for the Brilliant incandescent lamp, made by this company. The factory is turning out 1,000 lamps a day, and the outlook for trade is excellent.

The Central Electric company, Chicago, reports the heaviest sales for Okonite wire in the month of October that it has ever experienced. The Washington carbons are finding a ready sale, several of the largest companies throughout the country having contracted with the Central Electric company for all the carbons they use. The company reports having several handsome orders for large construction jobs, and feels convinced that the next two months will be very busy ones.

Thomas G. Smith, Jr., of Cincinnati, who has until recently been engaged in the sale of high grade engines and apparatus for complete steam plants, has severed his connection with all firms he formerly represented, and will devote his attention strictly to consulting engineering, in the line of designing and making specifications for electric light and power plants, and the equipment of buildings with necessary machinery. He has now under his direction several plants, which will embody some novel features.

Last week another trial trip was made with the storage battery car of the Bradbury-Stone Storage Battery company, of Lowell, Mass. This company had a car specially constructed for it by the Ellis Car company, of Amesbury, Mass. It was equipped with a 30 horse power Detroit motor, and McGuire trucks. The batteries used were type "X." There were 140 cells in all. This car is also fitted with an electric fare register, electric lights and electric call bells. The run was made between Dover and Great Falls. It was reported that the car climbed hills rapidly and smoothly, and the trip was pronounced a success in every way by all those present.

L. Breckinbridge Cabell, mining expert, of 53 Broadway, New York, has recently had placed in his hands 2,500 acres of gold properties located in the United States of Colombia South America. It is Mr. Cabell's purpose to organize a company with a capital of $25,000 on a basis of 2½ cents on the dollar, with the privilege of purchasing pro rata at 5 cents on the dollar. This money will all be spent for machinery to be employed in the development of the mine. This property has transportation facilities by water within fifteen miles. A stream of water having an average of 2½ feet of depth during the dry season, running through the property, gives an advantage for washing the gold.

BUSINESS.

A very neat little illustrated catalogue has just been issued by the Colburn Electric Manufacturing company of Fitchburg, Mass., describing its electric generators and motors.

The Westinghouse Electric & Manufacturing company of Pittsburg has just issued several pamphlets describing its electric railway apparatus. It only need be said of these little books that they are made up in the tasteful manner so characteristic of Westinghouse publications.

It has been a difficult matter for the Electrical Supply company, Chicago, to fill orders for Shield Brand wire as rapidly as desired, but the factory reports that it is working double time to catch up with the demand. Letters that have been received from central station managers speak very highly of thiswire.

E. M. Brown, with the Scott Electrical Manufacturing company, 89 Liberty street, New York, has been in Chicago making an active canvass in the interests of his house. The Scott company manufactures focusing arc lamps for photo engraving, electro-calcium lamps for theatrical use, and series and multiple series lamps for high and low tension circuits.

The electrical punster of the Electrical Supply company, Chicago, undertook a herculean task in the preparation of the preface of the little catalogue of railway fixtures that his company distributed at the recent street railway convention. Catalogues, though, are usually consulted by turning over the leaves from the back, and this perhaps is the reason that nothing serious has as yet happened to a number of hardy convention delegates.

The Meyersdale Electrical Manufacturing & Construction company of Meyersdale, Pa., has closed the contract for a central station at Everett, Bedford county, Pa., for 800 16 candle power lamps, and at Hyndman, Pa., another contract for a central station for 600 incandescent lamps. The Hyndman Hardwood Door & Trim company of Hyndman, Pa., have also been furnished an isolated plant of 100 lights by the same company.

The Standard automatic time cut-out is a new and useful device. It can be applied to either incandescent or arc light circuits. It can be set to cut out a circuit of lamps at any hour or fraction of an hour. It is customary for advertising purposes to keep electric lamps burning after business hours. Heretofore it has been necessary to employ persons to turn them out at the desired time, entailing additional expense. By the application of this device it is only necessary to wind the clock movement, set the cut-out hand to the hour desired for breaking the circuit, and the machine "does the rest." By the application of the Standard automatic time cut-out the main circuit is completely cut out, at the same time automatically switching out the meter from the house service, thereby preventing any registration by the meter.

The Curtis Regulator company, formerly of 63 Beverly street, Boston, has removed to 29-33 Haverhill street, where it has extensive salerooms and offices in a large new building of five stories and basement, measuring 75 by 45 feet. The great increase in the business of this concern has necessitated this move, as well as the building of an extensive new factory in Charlestown. This structure is of a most substantial construction with heavy brick walls, and measures 105 by 45 feet, and is five stories in height. It is supplied with a 100 horse power Ball high speed compound engine and a locomotive boiler. The building is equipped with its own dynamo and electric lights, and a track of the Boston & Maine railroad runs into the premises. With these facilities the Curtis Regulator company is prepared to accept orders for all kinds of high class machinery work, patent articles and specialties. It has been successful in this line of business for upward of fourteen years, and is considered throughout the trade the first, oldest and one of the best in its line.

ELECTRICAL PATENTS.

Issued November 1, 1892.

485,181. Dynamo. William H. Elkins, Cambridge, Mass.

Two sets of commutator brushes are provided upon the commutator, one of which is connected to the external circuit through a set of field magnet coils; the other set of brushes being connected to the first set through an additional set of field coils.

485,220. Dynamo Electric Machine. David Pepper, Jr., Philadelphia, Pa.

485,221. Automatic Governing Device for Electric Pumps. Francis A. Pocock, Lynn, Mass.

485,239. Regulator for Dynamo Electric Machines. Elihu Thomson, Lynn, Mass.

485,252. Underground Electric Trolley System. Ruben B. Ayres, New York, N. Y.

485,256. Apparatus for Winding Wire. Frank B. Chase, Chicago, Ill.

485,279. Combined Telegraphy and Telephony. William W. Jacques, Newton.

The invention relates to the use of the same or neighboring line wires for both telegraphing and telephoning, and consists in placing in a telegraph circuit between the main line wire and the source of electric energy of the telegraph apparatus, an electrostatic inductive resistance and an electro magnetic inductive resistance, thereby preventing disturbance of the telephone current by the telegraph current.

485,281. Incandescent Lighting. John Landin, Stockholm, Sweden.

485,284. Armature Core for Electric Motors and Dynamos. Anton J. Lehman, New York, N. Y.

The armature core is composed of gauze of magnetic material rolled upon itself, thereby permitting the passage of air through the core.

485,286. Car Truck. Alexander T. Loyd, Chicago,

485,287. Electric Lighting System. William H. Mac Kay, Roanoke, Va.

485,293. Electric Arc Lamp. John A. Mosher, Chicago, Ill.

A fibre plug is provided in the upper end of the carbon rod and a spring contact carrying the lighting current co-operates with the plug to cut out the lamp at the end of the movement of the rod.

485,311. Telephone. Anthony C. White, Boston, Mass.

The invention embodies details of construction whereby finely divided conducting material which is used as a variable resistance medium between two electrodes is prevented from packing.

485,319. Galvanic Battery. Walter A. Crowdus, Memphis, Tenn.

485,327. Electric Arc Lamp. Edward R. Knowles, Middletown, Conn.

485,334. Electro Magnetic Telegraph Apparatus. Alfred G. Safford, Washington, D. C.

485,336. Self Induction Device. William Stanley, Jr. Pittsfield, Mass.

The core or magnetic circuit of the device is common to all the combinations or sections of the coil, and each individual convolution or coil section is surrounded by the core or magnetic circuit.

485,337. Circuit Switch. Marvin E. Sullivan and John Doss, Denver, Colo.

485,343 Method of and Apparatus for Electro Deposition of Metals. Charles R. Fletcher, Boston, Mass.

485,347. Electric Arc Lamp. Henri Japy, Beaucourt, and Oscar Helmer, Paris, France.

The carbons are suspended at opposite ends of a chain or equivalent flexible suspensory so that the carbons are caused to simultaneously approach and recede from each other, and the focal point remain fixed; the feeding of the carbons is accomplished by clock work.

485,351. District Alarm Box. Charles W. McClellan, Chicago, Ill.

485,352. Electric Signal. George McIntosh, Stonington, Conn.

An auxiliary circuit of low amperage through the commutator operated by the motor is provided, which auxiliary circuit makes and breaks the circuit of high amperage for directly operating the signal.

485,367. Electrical Door Trip for Engine Houses. Adam Bosch, Newark, N. J.

485,379. Electric Bell. John R. Hard, New York, N. Y.

485,423. Alloy. Henry G. O'Neill, Louisville, Ky.

485,424. Electrical Heater. Henry G. O'Neill, Louisville, Ky.

The heater body is provided with grooves or depressions and made of steatite; high resistance wires are seated in these grooves or depressions and sealed and insulated therein by a non-conducting cement of steatite composition.

485,425. Electric Intermutator. Henry G. O'Neill, Louisville, Ky.

The intermutator comprises automatic means for rapidly and intermittently distributing an electric current in full force to a number of points of service.

485,446. Switch Operating Device. Benjamin Bartelmes, Brooklyn, N. Y.

485,473. Electric Danger Signal for Moving Trains. James McCart and Arthur G. Judkins, Trenton, Mich.

485,478. Incandescent Electric Lamp. Edward Pollard, Cambridge, Mass.

485,537. Electric Arc Lamp. Edgar A. Edwards, Cincinnati, O.

485,555. Underground Electric Conduit and Trolley Bar for Electric Railways. John S. Moss, Martinsburg, W. Va.

The conduit is provided in place of a slot with jaws, which normally rest in contact, but which are adapted to be separated by the passage of the trolley arm, closing when the trolley arm has passed.

485,558. Electric Switch. James C. O'Neil, Cleveland, O.

485,559. Construction of Jails. D. K. Osborne.

The bars are composed of metallic tubes within which are arranged insulated cylindrical cores; the cores are connected to one side of an electric circuit, the metallic tubes being connected to the other side, whereby an alarm is given when the metallic tubes and the cylindrical cores are electrically connected.

485,567. Coin Controlled Stereoscope. John Ringen, St. Louis, Mo.

485,587. Socket for Incandescent Electric Lamps. John S. Potter, Newton, and David J. Cartwright, Boston, Mass.

485,591. Watchman's Electric Time Recorder. James A. Tilden, Hyde Park.

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"Gem" and "Rugby" Folding Beds, Brass and Wire Work.

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The rubber used in insulating our wires and cables is especially chemically prepared, and is guaranteed to be waterproof, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather and is not affected by heat. The insulation is protected from mechanical injury by one or more braids, and the whole slicked with Clark's Patent Compound, and special extra finish, which we have now adopted for all our solid wires as an extra weatherproof protection, and also preventing chafing and abrasion, which is water, acid, and to a very great extent fireproof. Our insulation will prove durable when all others fail. We are prepared to furnish Single Wires of all gauges and diameter of insulation for Telegraph and Electric Lights from stock. Cables made to order. We are now prepared to furnish our Clark Wire with a white outside finish for ceiling clost work as well as our standard color.

Clark Joint Gum should be used for making waterproof joints. This is put up in half-pound boxes, in strips about one foot long and five-eighths inch wide, and when wrapped about a joint and pressed firmly it makes a solid mass. **FOR RAILWAY** and **MOTOR** use, we make all sizes of stranded and flexible with Clark insulation.

WE GUARANTEE OUR INSULATION WHEREVER USED, AERIAL, UNDERGROUND OR SUBMARINE, and our net prices are as low, if not lower than any other first-class Insulated Wire. We shall be pleased to mail Catalogues with terms and discounts for quantities.

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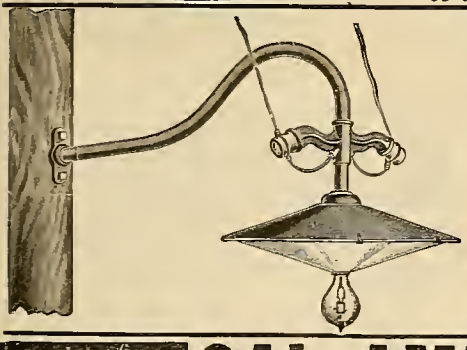

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The Electrical Construction Co.,

43 and 45 Franklin St., CHICAGO.

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One 35-light, 2,000 candle power, T.-H. Arc Dynamo with 35 double lamps, $1,700.00.
One 20 horse power, 220-volt Generator, $450 00.
One 15 horse power, 220-volt T.-H. Motor; complete, $350.00.
One 20-light, 10 ampere Sperry Arc, with 20 lamps, $800 00.
One 220 volt, 15 horse power, T.-H. Motor with Rheostats and Belts, $325.00.
One 10 horse power Excelsior Motor, $200.00.
All in A1 order and guaranteed as good as new. Terms cash.
Twenty other dynamos of various makes, all sizes, all prices. Good dynamos bought for cash.

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QUEEN'S PORTABLE E-L PHOTOMETER.

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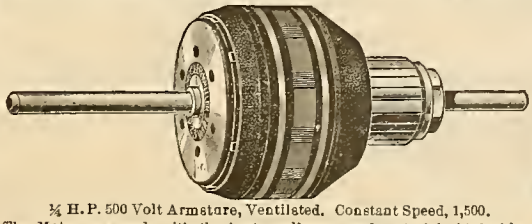

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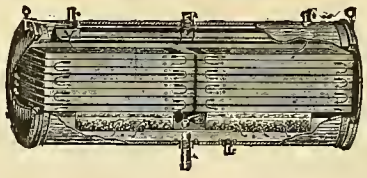

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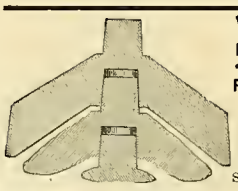

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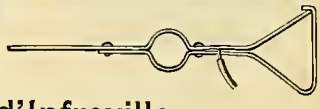

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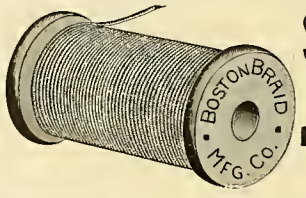

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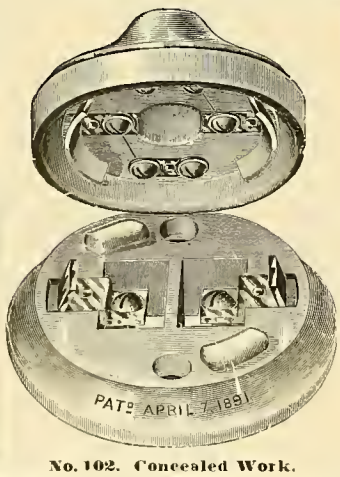

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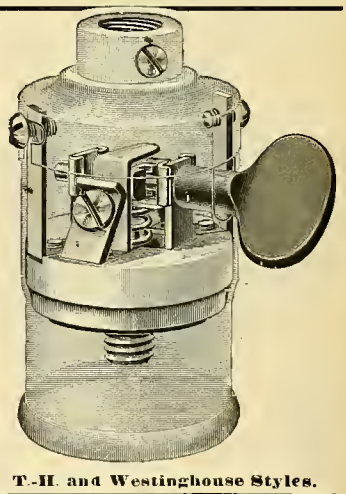

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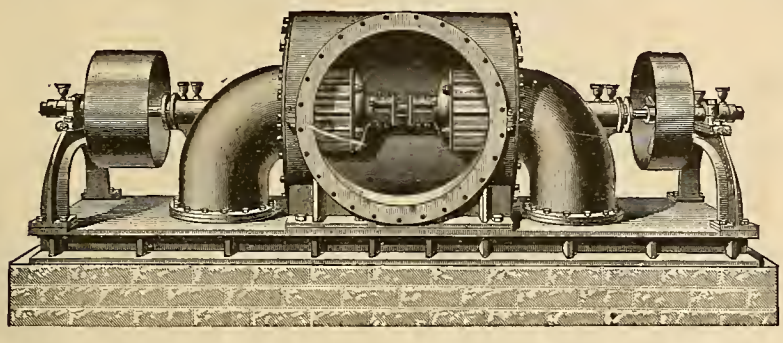

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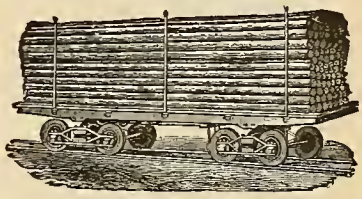

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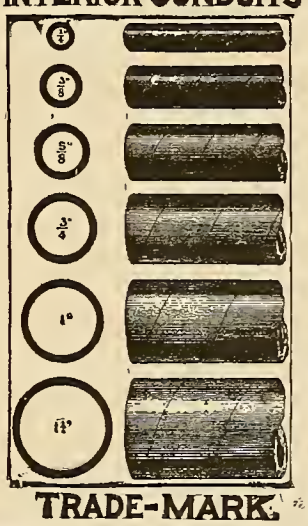

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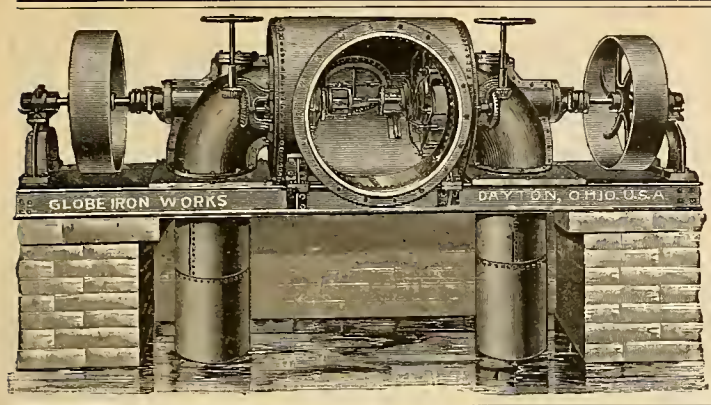

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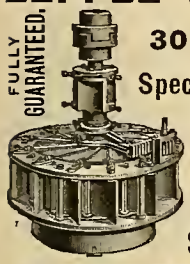

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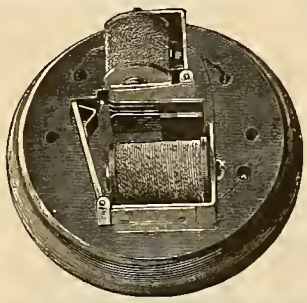

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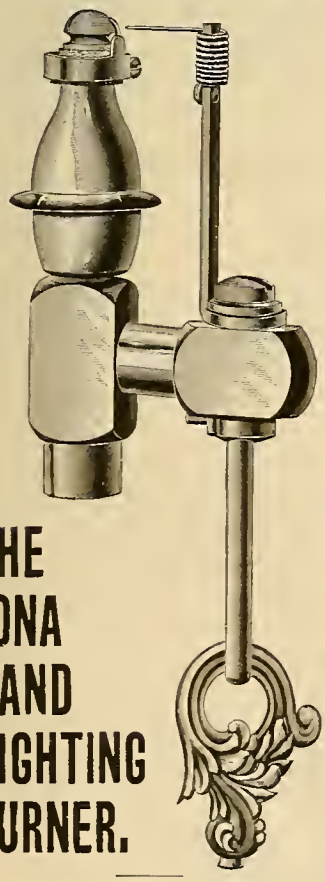

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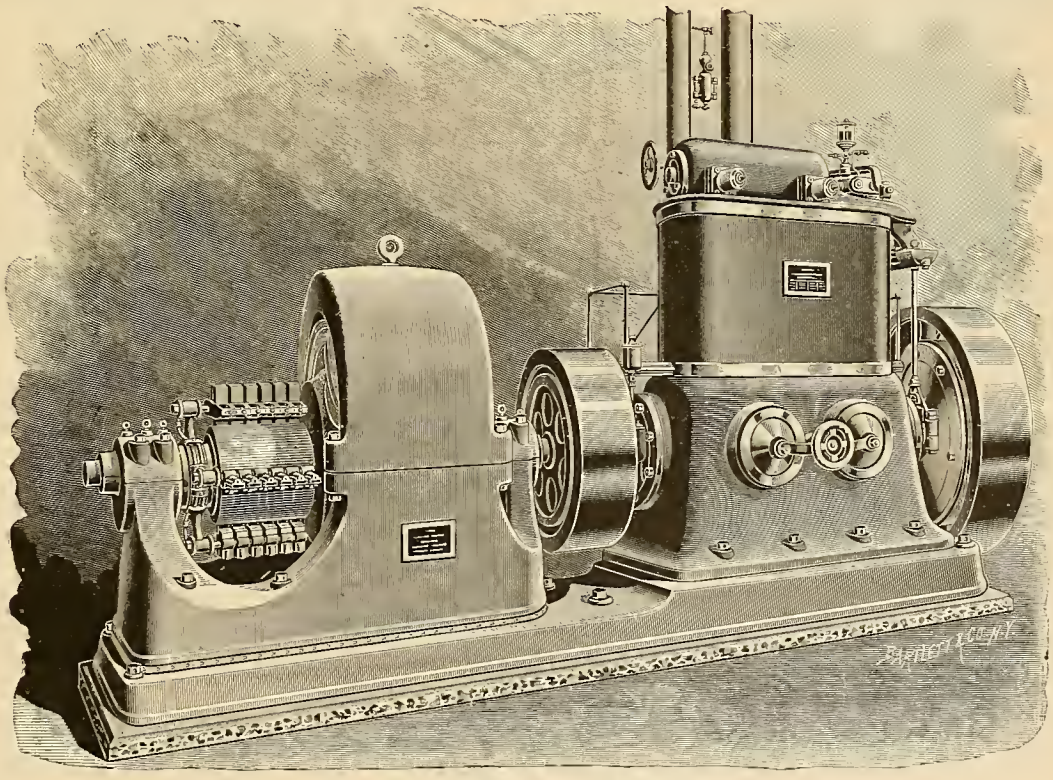

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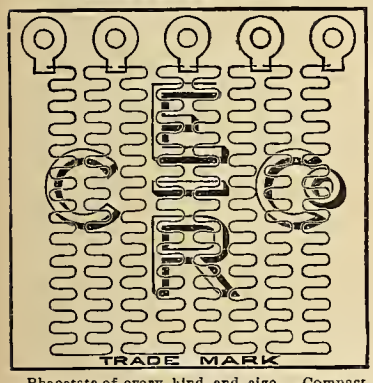

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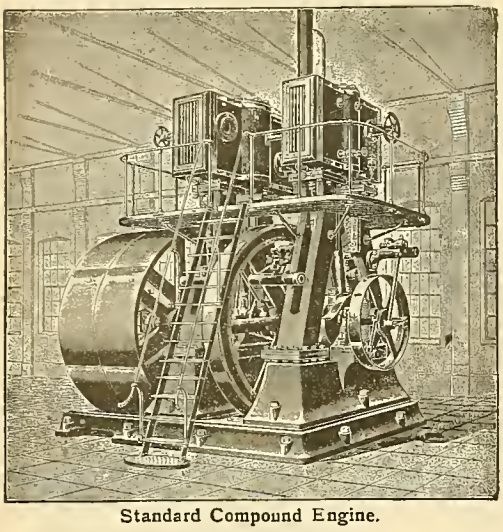

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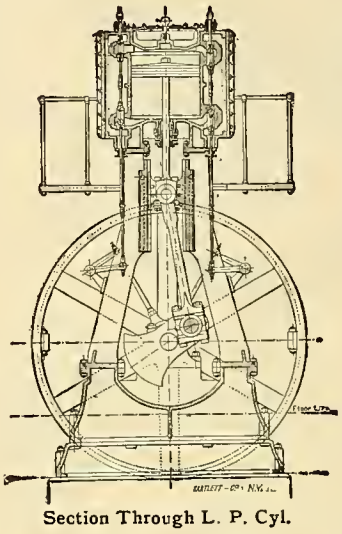

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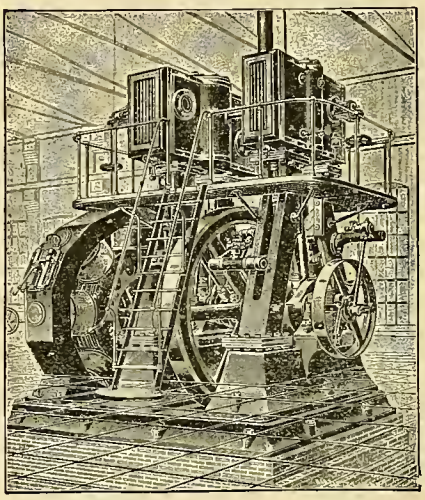

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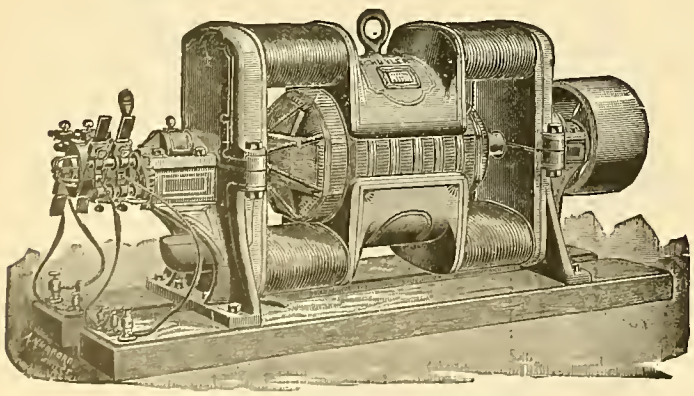

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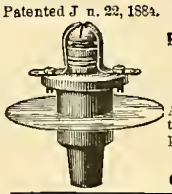

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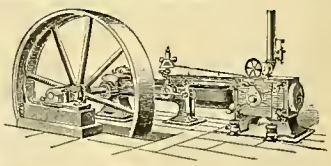

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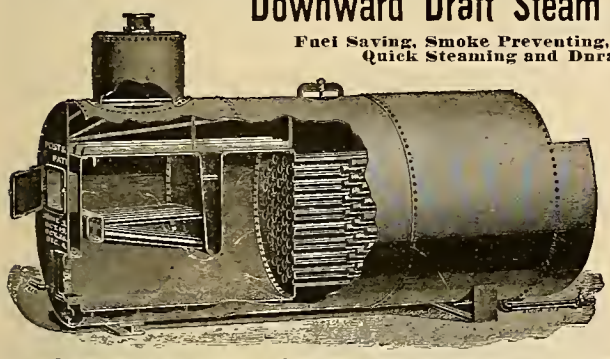

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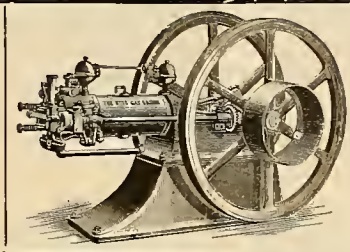

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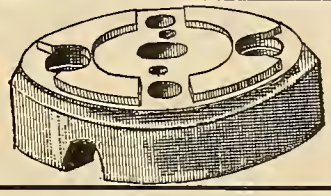

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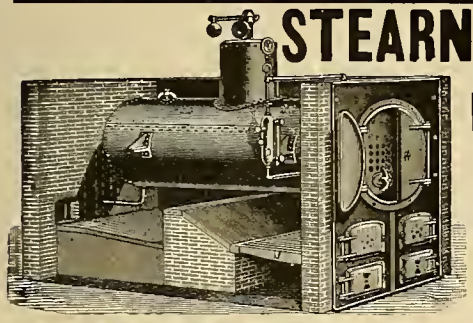

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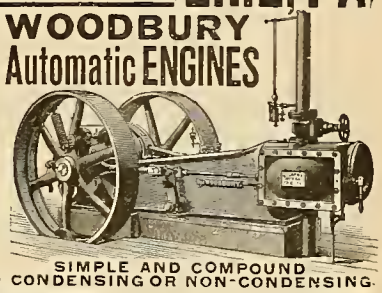

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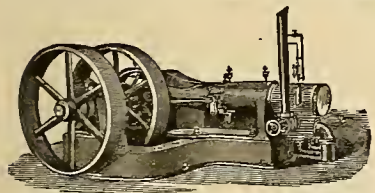

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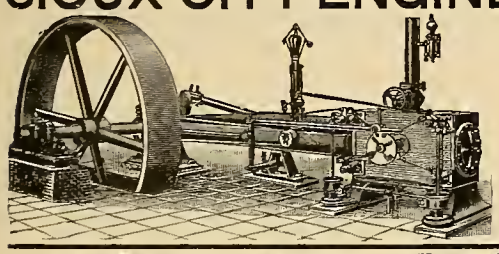

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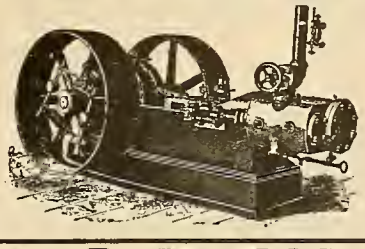

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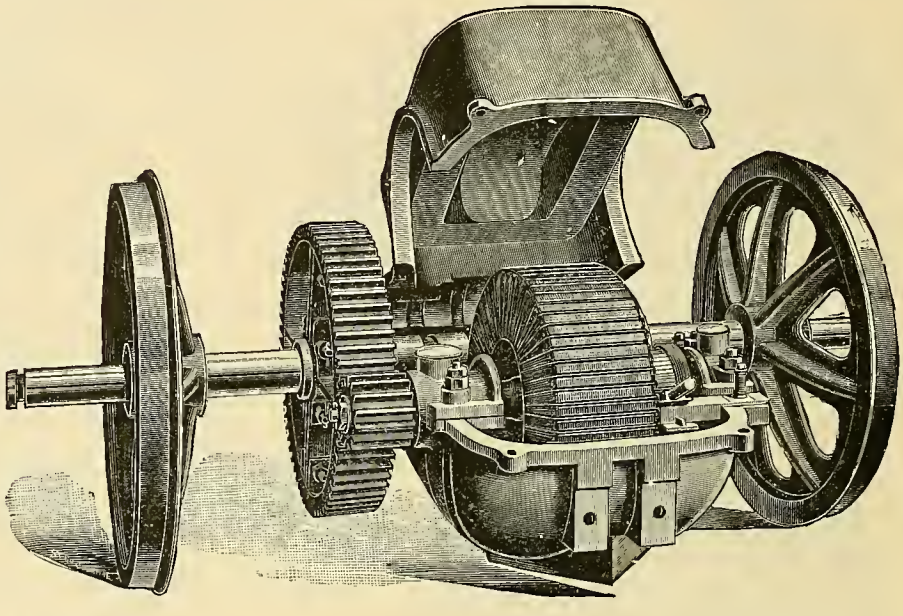

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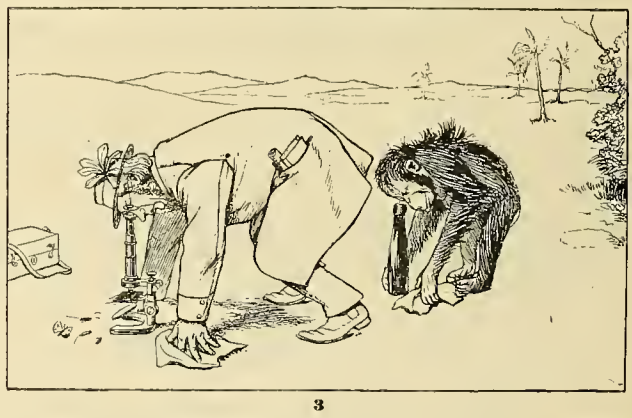

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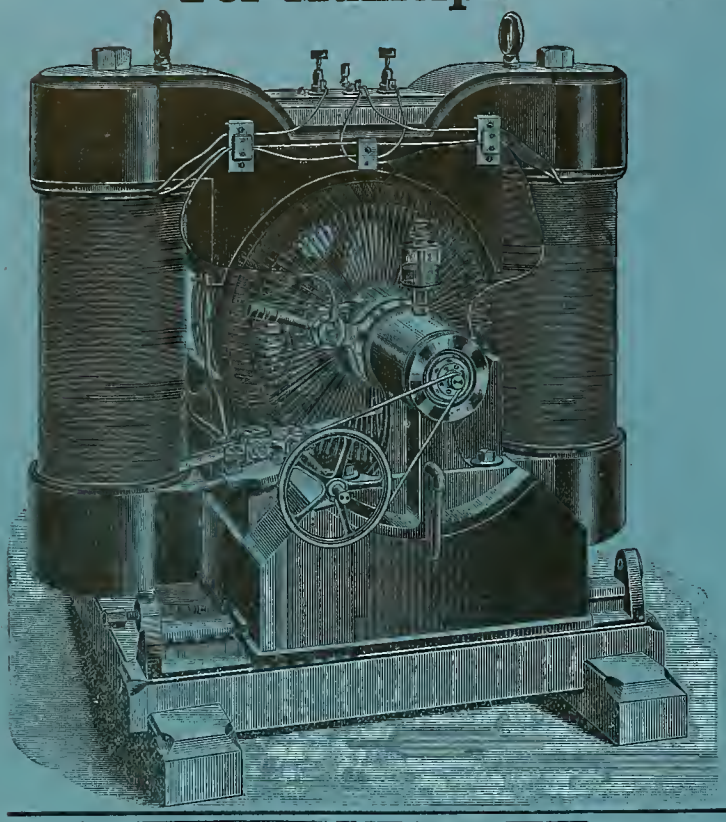

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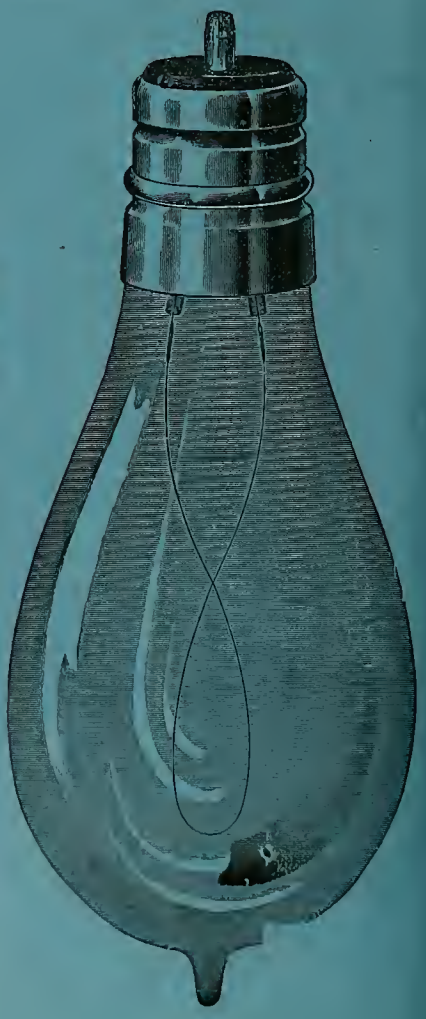

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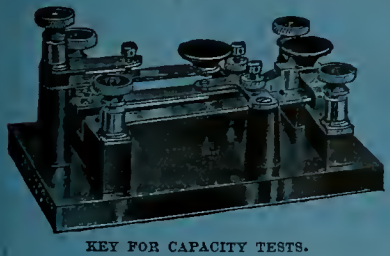

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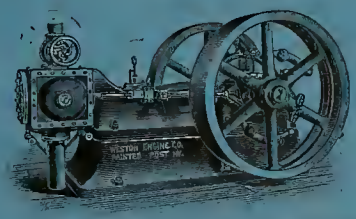

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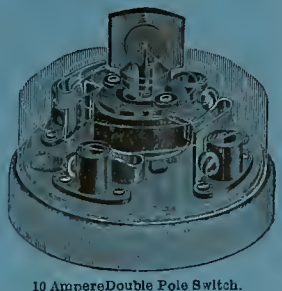

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INDEX AND CLASSIFICATION OF ADVERTISEMENTS.

ALPHABETICAL LIST.

American Battery Co..... ix
American Desk & Seating Co.. xiii
American Electrical Mfg. Co.. ix
American Engine Co..... xii
Andrews & Co., A. H..... —
Babcock & Wilcox Co., The.... i
Baggot, E..... xiv
Baker & Co..... xii
Ball Engine Co..... xix
Ball & Wood Co., The viii
Beacon Vacuum Pump & Elec. Co.i
Becker Mfg. Co., John..... xiii
Beggs, J. E., Mch. & Supply Co.xiv
Bernstein Electric Co..... xii
Blanchard, Albert..... —
Boston Braid Mfg. Co..... xiv
Bowers Bros..... xvii
Bridgeport Mach. Tool Wks.. —
Brookfield, Wm..... xii
Brush Electric Co xvii
Bryan, W. H..... xv
Bryant Electric Co..... xli
Buckeye Electric Co., The..... ix
Cabell, L. Breckinridge.....iv, xiv
Carpenter Enamel Rheostat Co.xvii
Central Electric Co..... v
Chicago Rawhide Mfg. Co.... —
Columbia Inc. Lamp Co..... —
Columbia Mfg. & Supply Co.. xiii
Crescent Ins. Wire & Cable Co. xiii
Crocker-Wheeler Electric Co.. xiii
Cushing, F. W..... vii
Cutter, Geo..... i
Cutter Electrical & Mfg. Co... —
Dayton Globe Iron Works Co.. xvi
Densmore Typewriter Co..... xii
Diamond Electric Mfg. Co.... xii
d'Infreville, G..... xiv
Dixon Crucible Co., Jos..... xv
Dudley & Co., W. W..... xiii
Duplex Electric Co., Ltd..... —
Eastern Electric Cable Co..... xiii
Eastman Kodak Co..... xiv
Edwards, W. S. Mfg. Co..... iv
Electric Appliance Co xii
Electric Cons. & Supply Co.. xv
Electric Engr'g & Supply Co.. iv
Electrical Eng. & Supply Co. The.—
Electric Secret Service Co.... xix
Electrician Pub. Co. .. xiv, xv, xix
Electrical Construction Co., The. xiii
Electrical Mfg. Co., The..... xi
Electrical Supply Co., The ... xxii
Elektron Mfg. Co..... xviii
Empire China Works xiv
Enterprise Electric Co..... xvii
Falls Rivet & Machine Co..... ix
Ferracute Machine Co..... xiv
Ford-Washburn Storelectro Co iv
For Sale Advs. .....xii, xiii, xiv
Fort Wayne Electric Co..... viii
General Electric Co.... ii, xx
Great Western Elec. Supply Co—
Greeley & Co., The E. S.....i
Gregory, Chas E..... xiii
Hart & Hegeman Mfg. Co..... i
Heisler Electric Co..... —
Hill Clutch Works..... xix
Hine Eliminator Co..... —
Holmes, Booth & Haydens.... x
Hood & Co., Wm..... xi
Hughes Bros. Mfg Co..... xiii
Illinois Electric Lamp Co..... x
India Rubber & G. P. Ins. Co. xxiii
Institute of Technology..... xvii
Interior Conduit & Insulation Co. xv
International Okonite Co..... i
Jewell Belting Co..... i
Johns Mfg. Co., H. W..... xi
Kartavert Mfg. Co..... xvli
Klipstein, A..... xiii
Knapp Electrical Works..... xxi
Lake, J H. & D., Co ..... —
Lake Erie Engineering Works. xviii
Lane & Bodley Co..... —
La Roche Electric Works.....xviii
Leclanche Battery Co., The .. x
Lefmann, Julius xv
Leffel, & Co., Jas..... xvi
Link Belt Machinery Co..... xiii
Loud, H. M. & Sons Lumber Co. xiv
Mather Electric Co..... iv
Midland Electrical Wks..... xii
Moore, Alfred F..... i
Morse & Co., A. M..... xiv
Munsell & Co., Eugene..... xii
National Carbon Co..... x
National Electric Mfg. Co.... —
National India Rubber Co.... —
New York Insulated Wire Co. xvii
N. Y. Safety Steam Power Co. xiv
New York & Ohio Co..... i
Otto Gas Engine Works..... —
Osborne Steam Engineering Co. xiii
Ostrander & Co., W. R..... xix
Page Belting Co..... —
Partrick & Carter Co..... —
Pearson & Co., W. B..... xvlii
Pelton Water Wheel Co..... x
Penn. Electric Engineering Co x
Perkins Elec. Switch Mfg. Co. —
Phoenix Glass Co..... xix
Porter-Leavitt Elec. Motor Co. xiii
Queen & Co..... xiii
Racine Hardware Mfg. Co.... —
Railway Equipment Co.....vi, ix
Redding Electric Co..... xvi
Ries Electric Specialty Co..... x
Roebling's Sons Co., J. A .... —
Rose Elec. Light Supply Co... xii
Samson Cordage Works. xii
Sawyer-Man Electric Co..... xxiv
Scott Electrical Mfg. Co..... xi
Schuyler Electric Co..... xi
Sechrist, Albert..... xvi
Shawmut Fuse Wire Co..... x
Shultz Belting Co..... xv
Siebert, G..... —
Siemens & Halske Electric Co. ix
Sioux City Elec. Supply Co...—
Sioux City Engine Works.... xix
Smith, A. T..... —
Smith, Thos. G. Jr..... —
Sperry Elec. Mining Mach. Co. xvii
Standard Electric Co..... xxiv
Standard Paint Co x
Stanley Electric Mfg. Co..... v
Stearns Mfg. Co..... xix
Steuben Lamp Works..... xiii
Sterling, W. C..... xv
Stilwell & Bierce Mfg. Co. xlv, xv
Sturm, Ernst..... xiv
Sunbeam Incand. Lamp Co.. xxiii
Taylor Engine Co..... —
Union Hardware Co..... xii
Utica Elec. Mfg. & Supply Co. x
Van Nuis C. S..... i
Vulcanized Fibre Co..... xv
Waddell-Entz Company..... xii
Wannopee Pottery Co..... xi
Washburn & Moen Mfg. Co.. iv
Western Electric Co.....xiv
Westinghouse, Church, Kerr & Co..... xvi
Westinghouse Elec. and Mfg Co..... vi
Weston Engine Co..... i
Worthington, Henry R..... xii

CLASSIFIED LIST.

Annunciators.
Central Electric Co.
Electrical Supply Co., The.
Knapp Electrical Works.
Ostrander & Co., W. R.
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Begge, J. E., Mchy. & Supply Co.
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Lefmann, Julius.
Mather Electric Co.
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Sioux City Engine Works.
Smith, Thos. G. Jr.
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Moore, Alfred F.
National India Rubber Co.
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Electrical Manufacturing Co., The.
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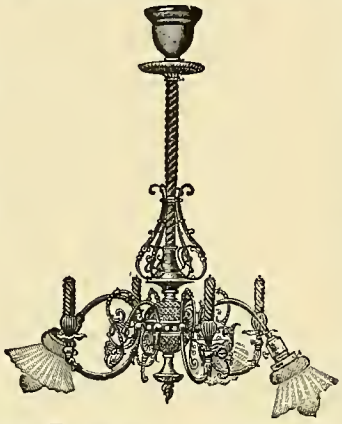

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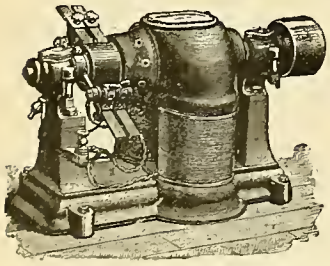

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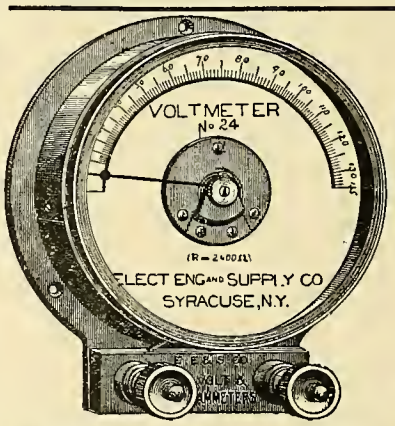

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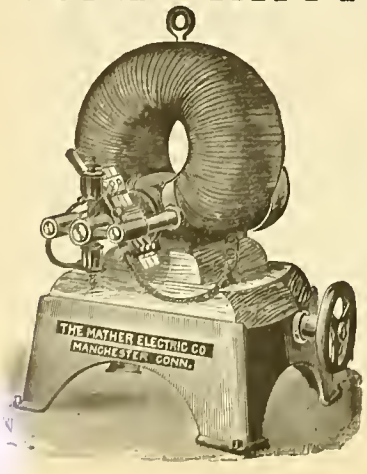

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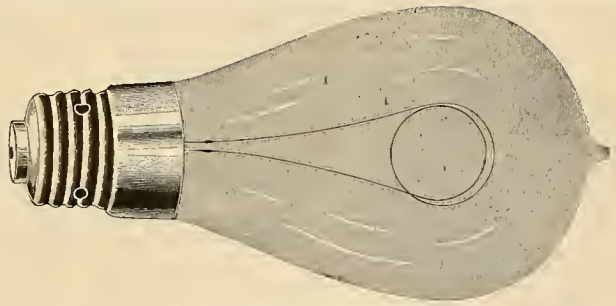

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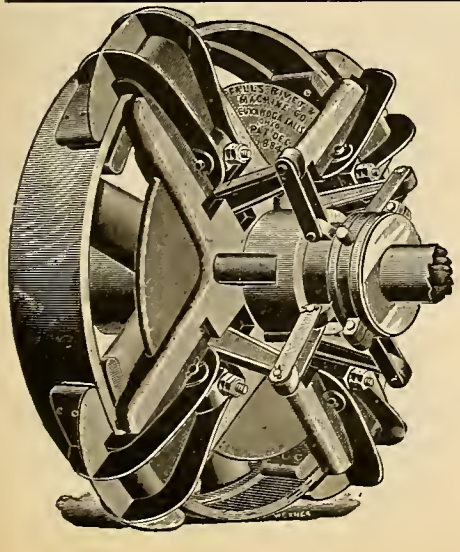

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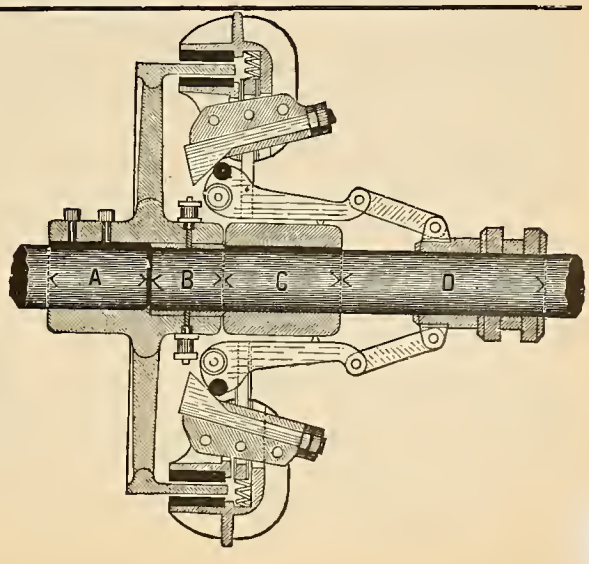

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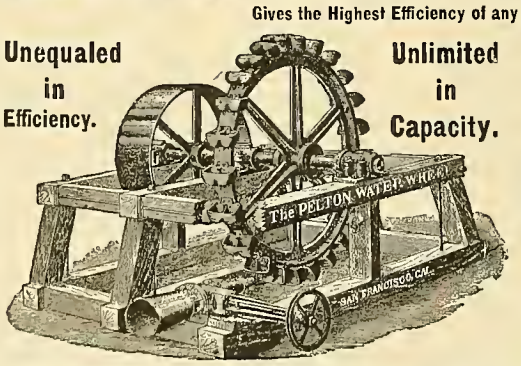

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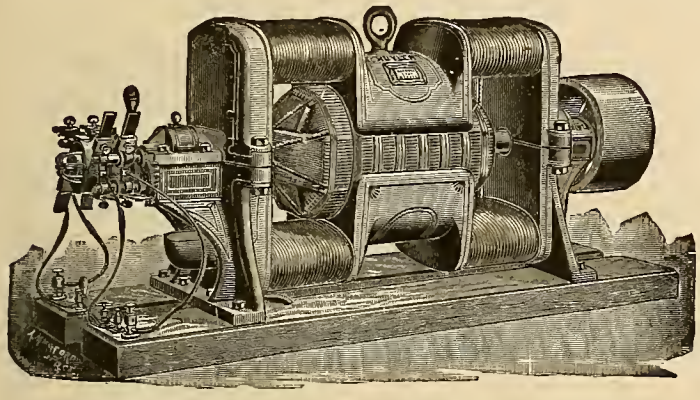

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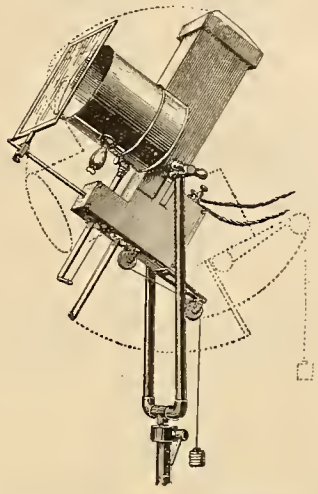

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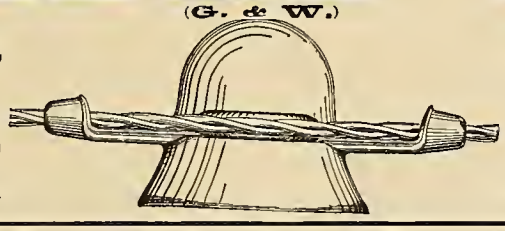

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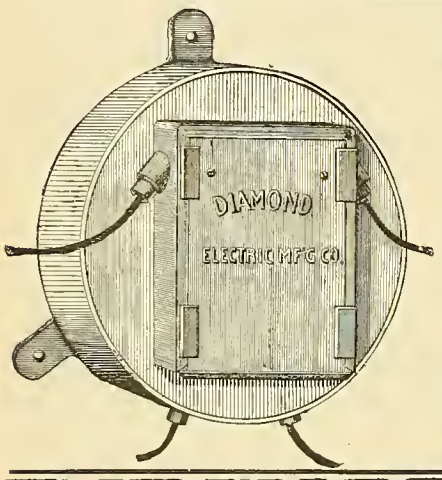

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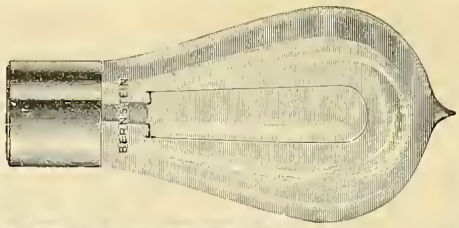

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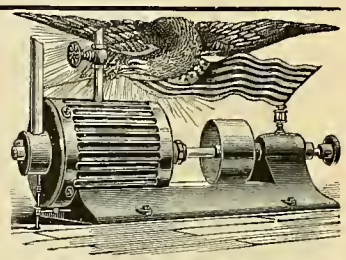

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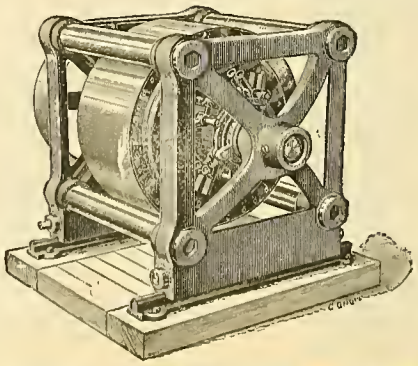

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Western Electrician.

EVERY SATURDAY.

Vol. XI. CHICAGO, NOVEMBER 19, 1892. No. 21

Governing Water Wheels in Railway Service.

In the WESTERN ELECTRICIAN of April 16th there was presented a description of a method of controlling the water wheels of the Ottawa, Ont., electric railway, that had been devised by T. Ahearn. The company operates eight miles of double and four miles of single track. The cars were put into service in the latter part of June last year. The equipment consists of sixteen cars of the vestibuled type, and the electric system employed is that of the Westinghouse Electric & Manufacturing company, single reduction motors of 20 horse power each being used on each car. The dynamo room is located at the famous Chaudiere Falls, where two 175 horse power turbine water wheels drive two old style 100 horse power Westinghouse compound dynamos, and a third machine is kept in reserve. The wheels are under 15 feet head of water, and the dynamos are belted to a main shaft driven by the turbines.

The difficulty in supplying steady current by water wheels was at first a matter of serious difficulty, as, owing to the frequent stopping of all or nearly all the cars at the same instant, the water wheels were liable to race. By an ingenious mechanical arrangement described in the article above referred to the water-wheel gates are raised and lowered instantly, and by the introduction of a novel electric device sufficient load is now kept on the dynamos at all times to keep down the speed of the water wheels.

Recently Mr. Ahearn applied this method in the new railway station that his company has erected not far from the old plant. Practically the arrangement of the governing apparatus is the same as that employed in the old station, but in details it varies considerably in that the current which in the old station is wasted by being passed through dead resistance is utilized in the new plant for heating purposes.

Speaking generally, the old device consisted of several coils of iron wire, connected in shunt to the trolley circuit, and so arranged that any current, from 12 to 72 amperes, might be made to flow through it. The wire was kept cool by being immersed in a tank of water, which was changed as it became warm.

At first five non-inductively wound coils, immersed in five barrels filled with water, were employed. The resistance did its work very efficiently, but when current was kept continuously in the coils the water in the barrels became overheated, and decomposition began. A large tank was then constructed with a capacity of 8,000 pounds of water, and in this receptacle five coils of iron wire were immersed. Into this tank a ½-inch stream of water was kept constantly running through fifty feet of hose. The long hose was employed so as to increase the resistance of the stream of water. The five coils of iron wire in the tank were connected through an ordinary Westinghouse car controller.

The arrangement of the improved governing apparatus in the new plant possesses a number of interesting features that are quite novel. Mr. Ahearn, as is now very generally known, is an enthusiastic advocate of electric heating, and in the new station of the electric railway company he has installed electric heaters of sufficient size to heat the entire building. A short time ago a representative of this journal was in Ottawa, and at that time the 50 volt alternating current had just been turned into the electric heating apparatus for the station. A recent communication brings the news that since the first test the 50 volt furnace in the new power house has been working perfectly, but instead of using the alternating current for heating purposes in the station Mr. Ahearn has constructed three series heaters to be in circuit with the coils immersed in water and work with current from the 400 horse power street railway generator.

Reference to the two accompanying illustrations, Figs. 1 and 2, and the diagram, Fig. 3, will aid in obtaining a clear understanding of the improvements made.

In Fig. 1 the interior of the new station is shown with the man at his post facing the voltmeter on the switchboard with the electrical controller at his right hand, the water wheel controlling lever directly in front of him, and the gate hand-wheel at his extreme left. The small view embodied in Fig 1 is a reproduction of a photograph of

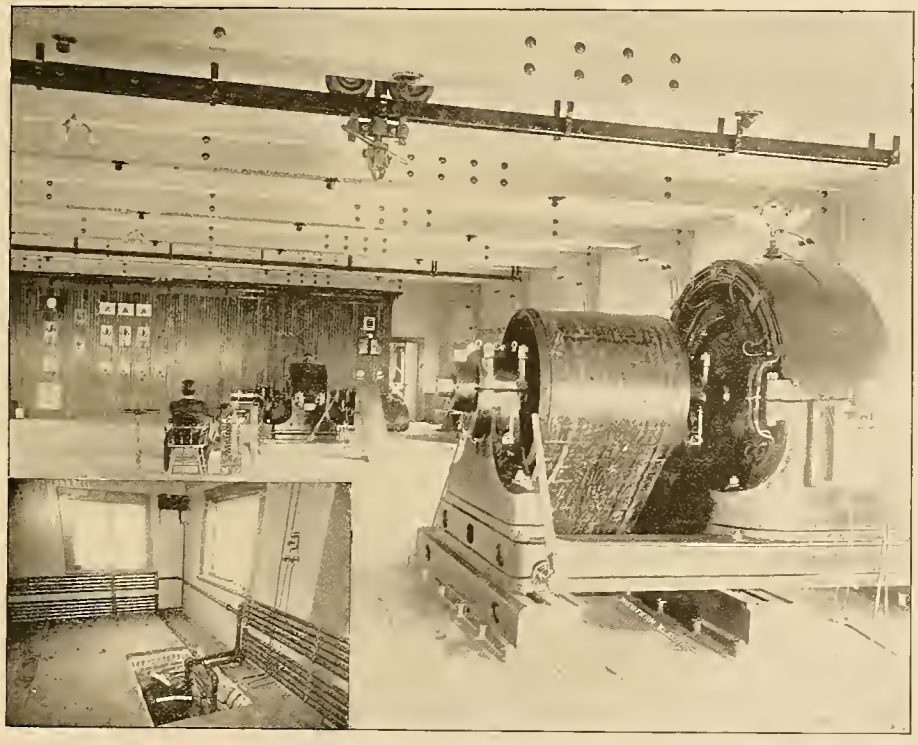


FIG. 1. GOVERNING WATER WHEELS IN RAILWAY SERVICE.

one of the heaters in this dynamo room. The corner shown, it may be explained, is the one that was to the left and back of the camera that took the larger picture. Fig. 2 shows the interior and exterior of the little house that was built especially to protect the water pit, containing the resistance coils. One of the coils, or more properly one of the racks, is shown withdrawn from the water.

The operation of this regulating apparatus is as follows: When the controller is on the first notch the three heaters in the station are in series with the resistance coils under water and a current of 30 amperes is flowing. The controller is, as shown in the photograph, at the right hand of the man at the wheel. If more current through the water is required, a movement to the second notch parallels the three heaters and one coil or rack under water. This reduction in resistance results of course in more current. Further movement to the third and fourth notches parallels those coils, which, prior to this movement, were in series, and when the fifth contact is made all the wire under water and the three heaters are in parallel; 450 amperes at 500 volts are thus diverted.

By a coincidence of not infrequent occurrence all or nearly all the cars may cut off current simultaneously, and when this occurs the controller is then employed until the gate lever has lowered the gate sufficiently to make its continued use no longer necessary. During this time the wheels are sufficiently loaded to prevent their racing. The man on duty watches the voltmeter and as the voltage drops he moves the lever to raise the gate until the needle stands at zero. If any unusual increase in pressure is indicated the controller at his right brings the coils into service and prevents the pressure from increasing dangerously. As the Ottawa company's power is cheap, as much drop in the mains as efficient work will permit is allowed. The voltmeter is connected with the center of distribution, a mile distant, so that regulation for the center of distribution is secured without regard to drop in the feeders.

The Right of States to Tax Telegraph Lines.

The Supreme Court of the United States in the Pensacola Telegraph company case (96 U. S. Rep., 1) decided that the telegraph was an instrument of commerce, and that telegraph companies were subject to the regulating power of congress in respect to their foreign and interstate business.

The court further declared that a telegraph company occupied the same relation to commerce as a carrier of messages that a railroad company did as a carrier of goods. Both companies were instruments of commerce, and their business was commerce itself. In another case (105 U. S. Rep., 460), proceeding upon the argument in the Pensacola case, the court referred to rights held by the telegraph company under the act of congress by which it became a "government agent"; and then, referring to the tax attempted to be levied on its messages by the state of Texas, says: "As such, so far as it operates on private messages sent out of the state, it is a regulation of foreign and interstate commerce, and beyond the power of the state. As to the government messages, it is a tax on the means employed by the government of the United States to exercise its constitutional powers, and therefore void. It was so decided in McCulloch v. Maryland, 4 Wheat. 316, and has never been doubted since." And thus in that case the telegraph company is put in exactly the same class with the United States Bank in McCulloch v. Maryland. With respect to the last named case, it was stated that there was in principle no difference between a stamp tax on the notes of the United States bank and a general tax upon its "franchise."

The validity of those statutes which give a federal character to telegraph companies which comply with their provisions was passed upon in the Pensacola case. That case was, in brief, as follows: In December, 1866, the legislature of Florida passed an act granting to the Pensacola Telegraph company "the sole and exclusive right and privilege" of maintaining lines of electric telegraph through certain parts of that state. There was nothing in the state constitution of Florida which prohibited its legislature from granting such exclusive privileges within its own jurisdiction. Afterwards a certain railroad company granted the right to erect a telegraph line along its right of way to the Western Union Telegraph company. The latter company had commenced the erection of the line when the Pensacola company commenced an action in the

United States Circuit Court to enjoin the work, on account of its alleged exclusive right under act of the legislature of Florida, with which the proposed line of the Western Union company competed. The action was dismissed in the circuit court, and an appeal was taken by the Pensacola company to the supreme court of the United States, where the judgment was affirmed. It was there decided that the act of July 24, 1866, "to aid in the construction of telegraph lines," etc., was a legitimate and proper exercise by congress of the power "to regulate commerce with foreign nations and among the several states," and "to establish post offices and post roads;" that the powers given to and accepted by the Western Union Telegraph company cannot be obstructed by state legislation, and that the act extends not only to such post roads as are on the public domain, but to "any of the military or post roads of the United States which have been, or may hereafter be, declared such by act of congress." The court says, among other things, as follows: "It is not necessary now to inquire whether congress may assume the telegraph as part of the postal system, and exclude all others from its use. The present case is satisfied if we find that congress has power, by appropriate legislation, to prevent the states from placing obstructions in the way of its usefulness." And the power of a state to tax its "franchise" to an unlimited extent would seem to be about as effective a means as could be imagined of "placing obstructions in the way of its usefulness." The question arose in the case of the telegraph company v. Texas, 105 U. S., 460. In that case the legislature of Texas had passed a statute providing that every telegraph company doing business in the state should pay a certain tax for every message sent by it; and the Western Union Telegraph company, having refused to pay taxes under that statute, basing its defense on the act of congress of July 24, 1866, judgment had been recovered against it in the state court for the amount of such taxes. But on a writ of error to the supreme court of the United States judgment was reversed.

An interstate railroad is a thing of more magnitude, and has greater financial and commercial value than an interstate line of wires and poles used for telegraphy. The transportation of troops and munitions of war is, no doubt, a thing of graver importance than the transmission of telegraph messages; but the latter has become also an absolute necessity to the proper administration of the national government, either in peace or war. If, therefore, the rights, privileges and powers conferred by congress on the railroad company constitute franchises which a state cannot tax, it seems impossible to escape the conclusion that the rights, privileges and powers thus conferred upon a telegraph company also constitute such a federal franchise.

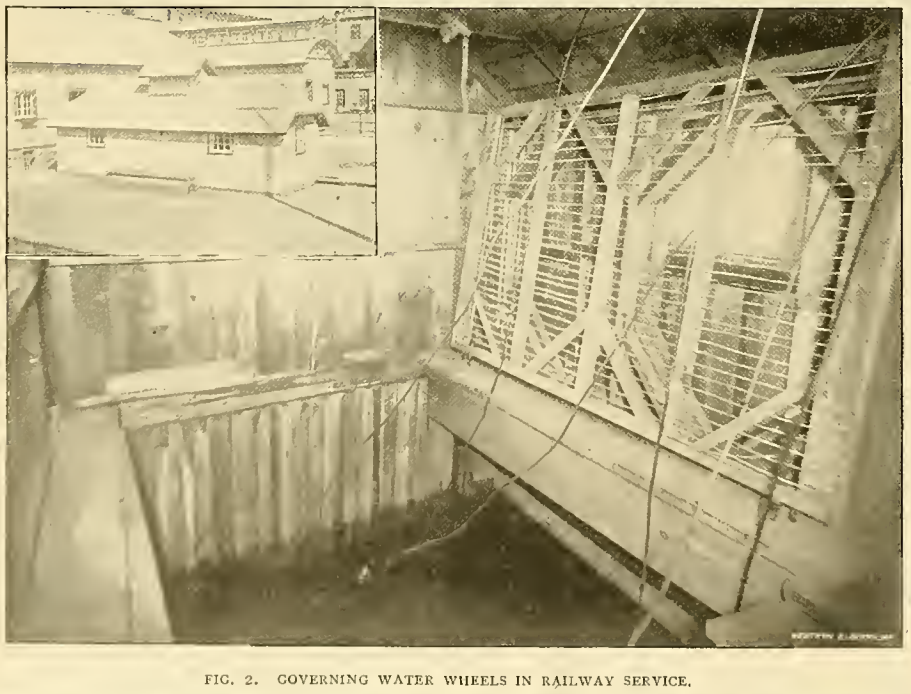


FIG. 2. GOVERNING WATER WHEELS IN RAILWAY SERVICE.

The Detroit & Suburban Railway company has been organized at Detroit, Mich., and has purchased the Jefferson street railway, the East Detroit and Gross Point road, the Gratiot and the Electric lines. The price paid was $400,000. The new company will issue $400,000 in bonds and will equip and improve the lines. The incorporators of the new company are the principal stockholders in the Citizens' Railway company.

Keep The World's Fair Open Evenings.

Interest in the early closing rule adopted by the national commissioners of the World's Fair continues to increase as the people begin to realize the meaning of this provision. The electrical fraternity is unanimous in its condemnation of the measure, and demands for its repeal continue to pour in from every part of the country. Already the subject has attracted so much attention that the daily papers have taken notice of it and in every instance the attitude of the WESTERN ELECTRICIAN is sustained. Following are a few abstracts of letters received at this office on the subject:

AMERICAN ENGINE COMPANY, Bound Brook, N. J.: We feel sure everybody in the country who expects to visit the exposition, and who is interested in the progress of electrical science will be disappointed. Thousands with limited means will undoubtedly be kept away.

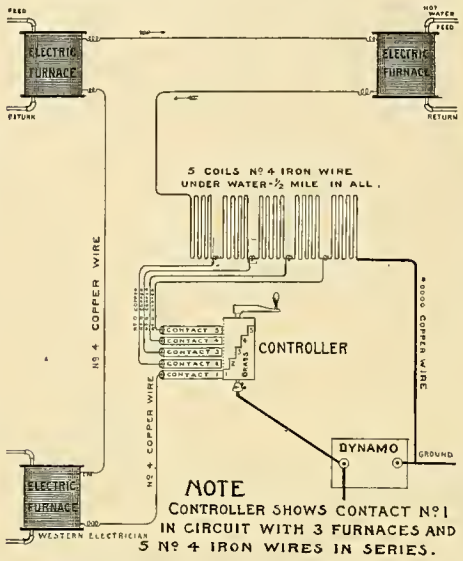


FIG. 3. GOVERNING WATER WHEELS IN RAILWAY SERVICE.

WESTON ENGINE COMPANY, Painted Post, N. Y.: We think this would be a great disappointment to the country at large, and it would be a fearful handicap upon the electrical features of the exposition, and most assuredly hope you may be able to get the National Commission to reconsider its decision.

W. L. CANDEE, Okonite Company, New York: I should think it would be advisable to keep the World's Fair open until 11 o'clock. There are a number of reasons why it should be done, among them to enable clerks to visit the fair and to give the electrical department a better opportunity to display methods of illumination.

THE STANDARD ELECTRIC SIGNAL COMPANY, Rochester, N. Y.: We wish to enter our protest against the seven o'clock closing rule, and respectfully request that you use all influence possible to the end having the exposition open evenings. This closing at the hour of seven o'clock would have a very serious effect upon the electrical exhibits at the exposition, and we trust that you will be successful in obtaining the necessary change.

UTICA ELECTRICAL MANUFACTURING & SUPPLY COMPANY, Utica, N. Y.: You can enter our vigorous protest against the decision of the World's Columbian Exposition to close up the fair every evening at seven o'clock. It is our candid opinion that this decision is a great injustice to the electrical industries; therefore be assured that any endeavor on your part to have this decision reconsidered will be heartily supported and appreciated by us.

CUTTER ELECTRICAL & MANUFACTURING COMPANY, Philadelphia, Pa.: We regret very much to learn that the National Commission of the World's Columbian Exposition has decided to close the fair every evening at 7 o'clock, and most sincerely hope that it will re-consider this point, as such early closing would, undoubtedly, dwarf the electrical exhibit, which will, no doubt, in the present state of the art, prove a very attractive feature of the fair.

ALFRED F. MOORE, Philadelphia: We beg to present our remonstrances in the strongest terms against closing the fair at 7 o'clock. The electrical features of the exposition will under these circumstances practically have been obtained under false pretenses, as no one in the electrical business, as far as I am aware, had supposed the buildings would be closed at such an hour. It is manifestly evident that an exhibition of electric light apparatus is seen to the best advantage at night.

CROCKER-WHEELER ELECTRIC COMPANY, New York: We are surprised and disappointed to learn that the National Commission for the World's Columbian Exposition has decided to close the Fair every evening at 7 o'clock. The electrical features of the Exposition will certainly lose much of their value. We trust that you will oppose this decision and use your utmost endeavors to persuade the commissioners to reconsider the matter and decide to keep the Fair open until 11 o'clock.

NOVELTY ELECTRIC COMPANY, Philadelphia: While we are not exhibitors, we have the interest and success of the electrical exhibit much at heart, and can but think in view of the expense entailed, and the great commercial importance of the electrical exhibit that such a decision would be unjust. In view of the fact that electric lighting can only be successfully shown after dark, we trust you will be able to bring sufficient pressure to bear through the columns of your paper to cause a reconsideration of this decision.

PENNSYLVANIA ELECTRIC ENGINEERING COMPANY, Philadelphia: We feel sure that we are voicing the sentiments of nearly all our friends and particularly those in the electrical business when we say that the electrical department of the World's Fair would be a sad failure without the opportunity to show to the world what can be done in the way of electric lighting which nine-tenths of the visitors will expect to see. Looking at the matter as electrical people we can simply say that it will be a great disappointment to us if you do not succeed in securing a reconsideration by the managers.

HELIOS ELECTRIC COMPANY of Philadelphia: If the national commissioners of the World's Columbian Exposition decide to close the fair every evening at seven o'clock this company will decline to make an exhibit. We had made arrangements for space, but the expense necessary to properly maintain our exhibit, would be too great for day service only. The benefits to be derived from making an exhibit, would not be of sufficient inducement for us, unless we could have a night exhibit. We sincerely trust that you may prevail upon the National Commissioners to keep the electrical exhibit open until at least 11 o'clock, as you suggest. We assure you that this matter will have our close attention.

AMERICAN ELECTRICAL WORKS, Providence, R. I: The disappointment that the commissioners decision will cause, will no doubt be widely extended, but upon no industry can it have the effect that it must upon our own. We cannot but think that the success of this department of the exposition is placed in a very hazardous position. So far as electric lighting is concerned it might now with good reason be abandoned. We believe that an industry occupying the position in the country, which our own does at this day, both in its commercial value and in point of interest to the general public, is certainly entitled to every advantage which can be given it in the coming exposition, and should not be hampered at the outset by a decision similar to the one referred to.

PETTINGELL-ANDREWS COMPANY, Boston: So far as other portions of the exhibition are concerned, we are not perhaps in a position to speak with any certain knowledg

of the effects of this decision, but in the case of the electrical exhibit we consider that it would prove very injurious to the interests of all concerned, and we hasten to enter our protest against such a course being pursued. The electrical interests of this country are now of such magnitude, and the growth is so rapid that it seems to us that this is a very important matter, and that the commission should take it into consideration in framing any rules for the closing of the exposition buildings. Very much of the success of the exhibit will unquestionably depend upon the demonstration made of the lighting capacity and of the working of the various appliances, and these can be observed to much greater advantage after dark than before. We trust that you will use all your influence to have this decision reconsidered, and the hour changed to something later—it seems to us that at least 9 or 10 o'clock is early enough.

B. J. Arnold, Chicago: I believe the exposition should be opened during the week from 8 o'clock in the morning until 9 o'clock at night. This would permit the large number of people, who are employed at moderate wages, to spend their evenings at the fair, thus seeing the exposition without being obliged to lose pay for the time they were absent from their work. The employers of these individuals would not be discommoded by the absence of their employes as they would be if the workmen had no opportunity to attend the fair evenings. This would give the spectators a chance to see the electrical effects of the exhibits to the best advantage, which, as we are all aware, appear better at night. These hours would require but one set of attendants, and ought not to entail any great additional expense upon the exhibitors or the Exposition company for employes. While some are disposed to eliminate the financial side of the case entirely from the question, the fact remains, nevertheless, that the Exposition company is expected to, at least, return to stockholders the money subscribed by them for stock, leaving the question of profit entirely out of consideration, but if the hours and the days for exhibit continue to be cut down, the outlook for the stockholders it seems to me, is not flattering.

Elias E. Ries, Baltimore: I would state in behalf of the Ries Electric Specialty company that we are decidedly opposed to any such action as that of the commissioners, which is not only an unlooked for occurrence, but one which we consider to be exceedingly prejudicial in its effects upon the electrical display, as well as upon the interests of the exhibitors and the enjoyment of the public generally. In fact, the proposition to close the electrical building at 7 o'clock is so absurd upon its face that we cannot bring ourselves to believe that it could have received serious consideration. We have secured space in the electricity building for a most brilliant and elaborate electrical display, which, we are reliably advised, will constitute one of the most prominent and attractive features of the exposition, both historically and electrically. This display has been designed especially for evening effects, and will cost thousands of dollars to produce. We certainly do not intend to undertake this exhibit if the fair is to be closed at 7 o'clock, nor do we think that other exhibitors of electrical apparatus will be likely to do credit to the exposition or to participate in it to any great extent if the objectionable rule should finally prevail. I would suggest that if it should be decided upon to close the Exposition at this early hour (for which step, however, there seems to be no adequate reason), that at least the electricity building should be permitted to remain open until a later hour. This will permit many of the electrical features and especially the illumination, to be seen at their best, and will enable all those in attendance at the exposition during the day to see the electrical display in the evening, thus affording visitors and others more time to inspect the exhibits in other departments that are not dependent upon and do not include artificial illumination as one of their leading features.

The petition referred to last week was quite extensively signed, and was forwarded to the executive committee of the Board of Directors. It contains the formal protest of a number of Chicago electrical concerns and representatives of Eastern companies against the 7 o'clock closing rule. Following is the text of the communication and the signatures accompanying the petition:

We, the undersigned, herewith enter our earnest protest against the rule recently adopted by the World's Fair commissioners closing the fair at 7 P. M., except on fete nights, for the following reasons:

First—It will deprive the manufacturers of electrical machinery of an opportunity for an exhibition of electric illumination, and therefore render an operative exhibit of machinery useless.

Second—It will lead to the abandonment of space by many applicants who will prefer to make no exhibition rather than an inoperative one.

Third—It will deprive many of the employes of the electric companies who are too busy to go to the fair in the day time an opportunity to see the great work.

Fourth—For many other substantial reasons the measure is a bad one, and it is the deliberate and sincere judgment of the undersigned that it be repealed.

Great Western Electric Supply company, J. C. Ruppert, secretary; G. E. Horne & Co., Bain Electric Manufacturing company, Force Bain; W. C. Vosburgh Manufacturing company, Geo. F. Fisher, manager; McIntosh Battery & Optical company, C. W. Bassett, president; Arnett Electrical Works, E. H. Arnett, president; Chicago Electric Service company, R. W. Day, secretary; Central Electric company, William H. McKinlock, president; General Electric company, B. E. Sunny western manager; George Cutter, American Electro Enamelite company, James S. Cummins, secretary; Badger Electric company (limited), P. H. Korst, secretary; Electrical Supply company, F. S. Terry, manager; United States Wire & Cable company, per F. G. Fuller; Western Dummy Railroad company, E. C. Ward, secretary; Standard Underground Cable company, F. E. Degenhart, manager; Standard Paint company, P. H. Hover, western manager; Pumpelly Storage Battery Manufacturing company, James K. Pumpelly, Brush Electric company, S. A. Douglas, district manager; Charles E. Gregory, Chas. S. Armstrong, Geo. S. Searing, Elmer A. Sperry, Elbert Ferguson, New York Insulated Wire company, George H. Meeker, manager; F. W. Cushing; Ball Electric Light company, E. O. Partridge, agent; William Hood; American Battery company, J. B. McDonald, president; National Electric Construction company, E. L. Abbott; Western Light & Power company, Max Eichberg, president; J. F. Wollensak; Mather Electric company, F. A. Baux, manager; Knapp Electrical Works, J. B. Wood, assistant manager; Chicago Arc Light & Power company, C. H. Wilmerding, general manager; Central Electric Light & Power company, W. H. Harding, manager; Fort Wayne Electric company, W. J. Buckley, manager; Short Electric Railway company, Frank R. Ford, agent; Electric Gas Lighting company, C. E. Lee, western manager; Union Electric Works, E. G. Fish, secretary; Chicago Electric Motor company, K. M. Richardson,

FIG. 1. ELECTRICITY AT THE WORLD'S FAIR.

Electricity at the World's Fair.

The electrical and mechanical engineering forces of the department of works at the World's Fair are now fairly installed in the new building especially erected for their use, just south of machinery hall. As will be seen in the view given in Fig. 1, the building is more useful than ornamental. It is a wooden structure, covered with staff, one story high, and possessing ground dimensions of 50 by 200 feet. It is given over entirely to the use of Mr. Sargent's department. In Fig. 1 the background is formed by the handsome machinery hall, and one of the domes of this building can be seen directly in the rear of the engineering building. The location is convenient, as much of the work of the engineering department relates to the plant in machinery hall. A plan of the building is shown in Fig. 2. The offices are designated by figures. Mr. Sargent's office is at 6, with a private room, 7. Room 5 is for the accounting department, and is also used as a reception room. R. H. Pierce, the assistant electrical engineer, is in room 3, while Mr. Neiler, second assistant electrical engineer, is installed in the adjoining office to the east, at 4. Room 1 is devoted to L. A. Scovil, superintendent of construction, and J. H. R. Ward, superintendent of operation, while room 2 forms the headquarters of Prof. Dodge, the inspector. The railed-off spaces are assigned as follows: *A*, electrical inspectors; *B*, electrical engineers; *C*,

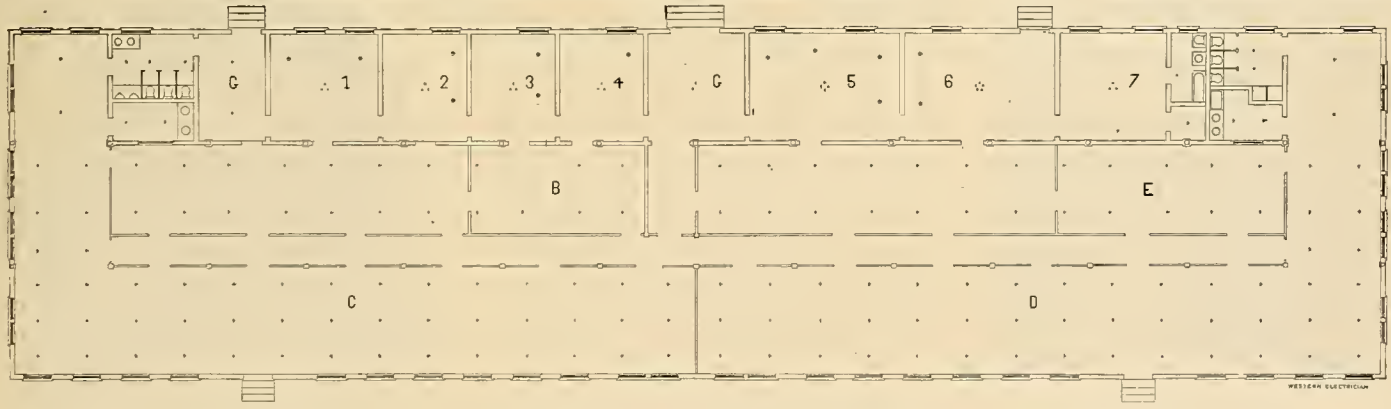


FIG. 2. ELECTRICITY AT THE WORLD'S FAIR.

electrical draughtsmen; *D*, mechanical draughtsmen; *E*, mechanical engineers; *F*, mechanical inspectors; *G G*, hallways. A loft with skylights arranged for the production of blue prints extends partly over the first floor. There are about 200 incandescent lamps in the building, the arrangement being shown in Fig. 2.

At a recent meeting of the Electrical Trade Section in England the chairman made reference to a proposal which W. H. Preece had made at a former meeting, that in view of the poor display which the electrical trade was about to make at the Chicago exhibition, it might be well to consider whether it would not be desirable for the sake of the reputation of English electrical engineering that a syndicate should be formed to furnish a suite of rooms at the exhibition, and to have them lighted by electricity in the manner common to English houses, and which he believed was superior to that adopted in the United States. Following up this suggestion, a circular had been sent out to the whole membership of the section, with a view of ascertaining what support would be forthcoming for the proposal, but not a single favorable response had been received. It might, therefore, the chairman thought, be taken as an evidence that the trade did not wish to be represented at the exhibition. He thought it a pity, however, that there should be any English exhibits at all if they were not to be of a representative character. The English technical press expresses very general regret at this action. One journal feels sure that "English electrical firms will have cause to regret the decision they have evidently arrived at, and which must still further encourage foreign competition, which is daily assuming more formidable proportions in this country."

There is just complaint at the delay in completing machinery hall. The contractor agreed to have the work done not later than July 15th. It isn't done yet. In consequence a great deal of annoyance and serious delay in the installation of the power plant have been occasioned. Although the contractor has been engaged for months in the construction of the building, he has failed to completely enclose the south side of the building, where the heat, power and light for the fair are to be furnished. While the work is partially done, it is so incomplete that engines and boilers have been run in the open air, and sometimes with the rain falling upon the machinery and operators. The foundations for the arc and incandescent dynamos and the driving engines are now being placed in position, but the work has been greatly delayed by the condition of the building. The delay has also caused great annoyance to the boiler manufacturers who have donated steam generating apparatus.

The plans for the wiring of the women's building have finally been settled and the actual work will soon be begun. Three thousand lamps will be put in. The fixtures will soon be placed in position in the administration building, and it is hoped that this building will soon be lighted by a portion of the Westinghouse permanent plant.

The two temporary lighting stations now operated at Jackson park have an average nightly load of 300 arc and 850 incandescents lamps.

The General Electric company has opened a temporary office in the horticultural building, from which the installation and arrangement of its exhibits is directed. Lieut. Spencer has charge of the work.

The instruments on the switchboards of the Westinghouse installation in machinery hall will be entirely enclosed in glass, without metal or wooden frames.

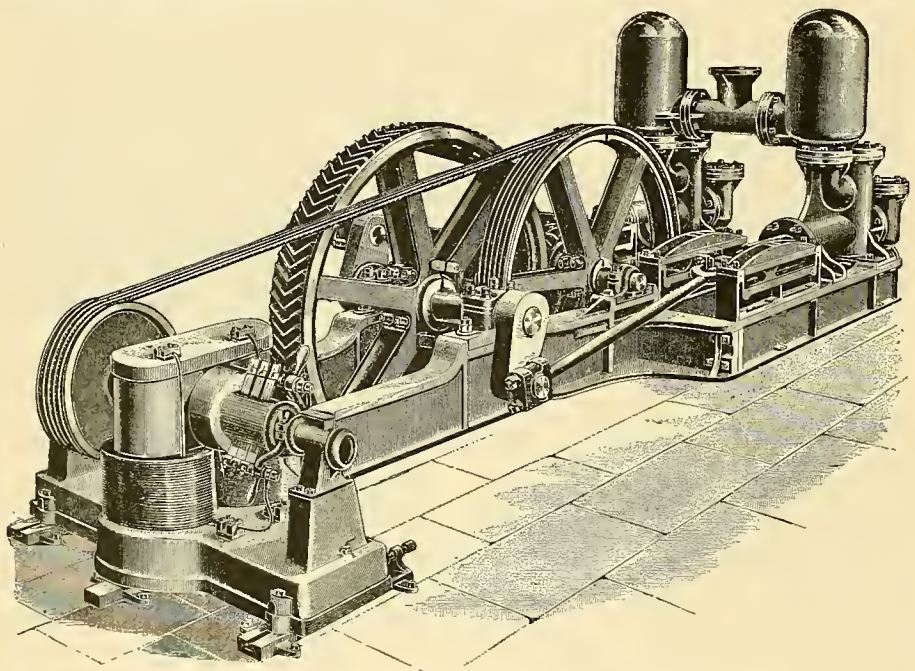
It is said that all of the Brush arc machines shown at the fair will be nickel-plated.

Carl Haller, the engineer of the imperial German commissioner for the World's Columbian Exposition, has arrived in Chicago and is looking after the engineering features of the German exhibit.

English Electric Pumping Plant.

The plant illustrated in the accompanying cut was constructed for the Jubilee colliery, Shaw, England, and was installed in November, 1890. It has since then been running continuously from 100 to 150 hours per week, except for four or five hours, on a few occasions, through the fuses, etc., burning out from various causes. It consists of a steam engine on the surface, working a dynamo which supplies current to a motor below, fixed in one of the roads, about 750 yards from the bottom of the shaft, which is 120 yards deep. This drives a pump delivering its water into the sump, and from thence is raised to the surface by the main steam pumps placed at the bottom of the shaft.

The steam engine is an old single cylinder condensing, much too large to work economically with the dynamo only. The following are the particulars of a test:



ENGLISH ELECTRIC PUMPING PLANT.

Steam engine: Cylinder, 28 inches diameter by 42 inches stroke, running at 54 revolutions per minute, and driving from a 15 foot fly wheel rope pulley on to a 4 foot pulley on a countershaft, with six 1½ inch ropes, and a 6 foot pulley on the countershaft drives a 2 foot 6 inches pully on the dynamo by six 1¼ inch ropes. The engine indicates 21.58 horse power with the brushes off the dynamo, and 62 horse power with ordinary load, which is equalto about 36 per cent. of the full load power given out by the engine.

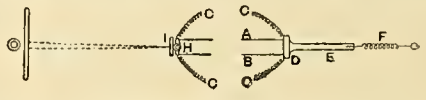
The dynamo is an "Oldham" series wound machine, giving a current of 48.5 amperes at 580 volts=28,230 watts, or 37.7 electrical horse power at 490 revolutions per minute when absorbing 40.1 horse power.

The cables are lead covered, and are carried down the shaft and at the bottom in strong wood casing, to protect them from mechanical injury, and along the road are laid in a trench below the surface at the side of the rails. Their resistance is .334 ohm, which at ordinary load as above=1.05 horse power loss.

The motor is in all respects similar to the dynamo, and when receiving 48 5 amperes at 567 volts, runs at 406 revolutions per minute, and gives out 35.53 horse power, and drives the pump with six 1¼ inch ropes from a 36 inch pulley on to one 7 feet in diameter on pump; on this shaft is a double shrouded helical steel pinion, with 18 teeth gearing into a wheel having 90 teeth on the crankshaft, which has two cranks, 15 inches throw; the rams of the pump are 9 inches diameter, and ran during the test at 35 revolutions per minue, indicating 24.3 horse power on the water cylinders, and delivered 577 gallons per minute against 142 feet vertical head. The illustration is from the *Electrical Review* of London.

Swinburne's Differential Voltmeter.

For the purpose of testing the drop in a hedgehog transformer run from a gas engine or unsteady steam engine, Mr. Swinburne of England has designed an ingenious instrument which enables accurate measurements to be made in spite of considerable variation of speed in the dynamo. A diagram of the instrument from London *Industries* is presented herewith. The object of the device is to measure a small change of voltage. If one voltmeter, only were used, it would follow all the fluctuations of speed and accurate readings



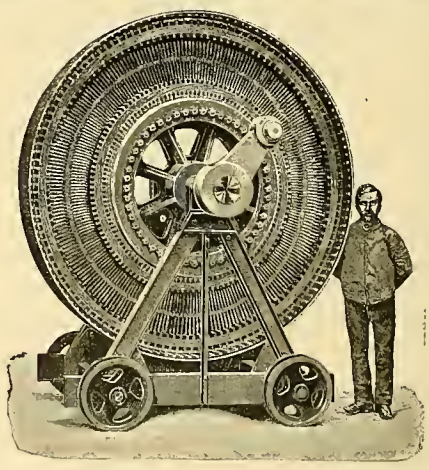
SWINBURNE'S DIFFERENTIAL VOLTMETER.

would be out of the question; a differential Cardew voltmeter is therefore employed. This is alluded to in the article as a hot-wire voltmeter.

To obtain a standard, the primary coil of a closed circuit transformer was used as resistance, and this was tapped at two places, between which there was a difference of potential of 100 volts at the average speed of the engine, but owing to fluctuations this voltage would not be steady. This voltage was measured by one of the wires of the differential voltmeter, the other being used for measuring the voltage of the hedgehog transformer under test. When the speed, for example, dropped a little, both parts of the differential voltmeter, would be equally affected, but any difference in the voltage of the two circuits would be indicated by a steady deflection of the instrument. In the diagram *A* and *B* are the two hot wires, and these are connected at one end to the block *D* of ivory, having long tail-piece *E*, kept taut by a spiral spring *F*. The other ends of these wires are attached to a short lever, *H*, which carries a mirror, *I*; flexible connections are provided between the wires *A* and *B* and the terminal *C*. The instrument is said to be very sensitive, reading to within a small fraction of 1 per cent. The drop of the transformer was thus accurately determined, although the speed of the engine was varying considerably.

A Large Armature.

The cut presented herewith represents a large Fritsche armature for direct driving, in which connectors are employed and armature strips proper that are radial. The armature conductors, according to London *Industries* are connected in series; the method of coupling can be understood from the illustration. It is stated that Mr. Fritsche was the first to investigate the laws of the numbers of turns necessary to produce series winding in multipolar dynamos. The connectors in the radial armatures are copper, and as the iron conductors are naturally large in comparison, it is easy to fit the connectors in neatly. Fritsche & Pischon of Berlin have been manufacturing these machines for some time, and have made all sizes from 5,000 watts up to slow speed direct coupled dynamos for central station work, giving 200 horse power each.



A LARGE ARMATURE.

The Consumers' Electric Light & Street Railroad company of Tampa, Fla., expects to build an electric light and power plant, and is now constructing a dam to develop 2,500 horse power water power.

A fire broke out in a lot of poles on the Municipal Electric Light company's premises at Montrose avenue and Gratiot street, St. Louis, recently. The department was called out, but the damage was small. The fire is supposed to have been caused by a lot of boys.

Utilizing Water Power in Washington for Generating Electricity.

One of the prettiest spots to be found in the state of Washington is at the very extremity of its great inland sea, where the De Schutes river, terminating its course through a series of waterfalls, forms the head of Puget Sound. For over a century, since the time of the first Astor settlement there the power of the Tumwater falls has been used for various purposes, but as yet the amount of water taken from the river has not appreciably diminished its flow nor detracted from its natural beauty. Aside from the picturesque view of the location, the place has a special interest for electricians, in that the city of Olympia derives its electric light and power from the second of the Tumwater falls, and that it is now proposed

FIG. 3. UTILIZING WATER POWER IN WASHINGTON FOR GENERATING ELECTRICITY.

to develop the entire power of the three falls and deliver current for all purposes to Olympia, only two and one-half miles distant.

The Tumwater falls first came into electrical prominence early during the present year, when an account of an interesting experiment in electrical transmission was published in the electrical papers. Two 50 kilowatt, 500 volt Edison railway generators were coupled up and their current sent to Olympia where it operated an 80 kilowatt motor which ran two smaller compound wound Edison incandescent dynamos, coupled up for the ordinary three-wire system of city distribution. It is believed that this was the first direct current transformer plant in America and it certainly worked to the satisfaction of the consumer. But the efficiency fell far below that of the alternating system and now the machines have found other uses in the station, and two 1,300 light Thomson-Houston alternators have supplanted the direct current transformer plant, which at best was but an experiment. The two 50 kilowatt 500 volt Edison generators now operate the new Olympia & Tumwater electric railway and the four dynamos just named, together with two 50 light Edison arc and one 50 light Thomson-Houston arc machines, constitute the dynamo electric machinery of the Olympia Light & Power company. It has two pairs of 25 inch Victor wheels, each developing 400 horse power. These are placed at each end of a line of shafting, which is provided

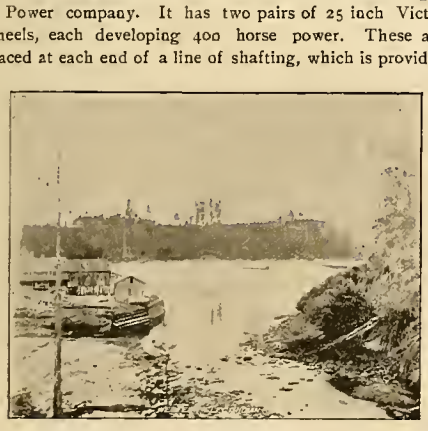


FIG. 1. UTILIZING WATER POWER IN WASHINGTON FOR GENERATING ELECTRICITY.

with two heavy fly wheels. No automatic regulators are used on these wheels, and even with the heavy fluctuations due to the street railway generators, the speed is practically constant. All the electrical equipments of the station are of the most recent types. There is no small station in Washington that excels it in arrangement, neatness, or general completeness in all details.

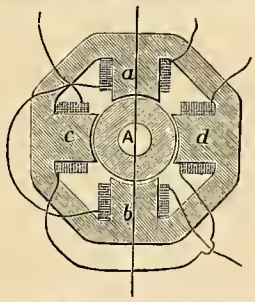
As stated, the Olympia station is located at the second, or middle Tumwater falls. These have a fall of 24 feet and the water is conveyed from the dam adjoining the station into its basement through a 52 inch round boiler iron flume. In addition to the two wheels named, a smaller Victor wheel of about 200 horse power has been placed in the basement of the station. This furnishes power to a flour mill, situated about one hundred yards above the station, through wire rope transmission. Except for a small box factory, no further utilization of the water of the De Schutes river is made at the middle falls. The upper falls make a turbulent descent of 26 feet, but they are not used in any way. The lower falls make a nearly abrupt descent of 32 feet, and it was here that the first Astor settlement on Puget Sound was located early in the present century. The old mills at the lower falls are in a very dilapidated condition, and one old wooden flume built 40 years ago has partially burst, throwing a goodly sized waterfall from its crevasses.

It will be noted that the total descent of the three Tumwater falls is 82 feet. These three falls all occur within a distance of a quarter of a mile, and it is now proposed by the Olympia Light & Water company to flume the water from the upper falls to a point below the lower falls, where a large station will be erected. The power so realized will be more than sufficient to supply the needs of Olympia for years to come.

The accompanying illustrations, reproduced from photographs taken by the correspondent of the WESTERN ELECTRICIAN, show the two lower falls of the De Schutes, and the Olympia station to advantage. Fig. 1, taken from the bridge shown in Fig. 2, is interesting as being the very head of Puget Sound, and in that in it, close by the shed nearest the water way, may be seen the ruins of an old brick chimney—all that remains of the first Astor settlement on Puget Sound. Fig. 2, taken from the Astor ruins referred to, shows the lower falls, with the broken flume and a portion of an old saw mill. Fig. 3, taken from the upper side of the bridge in Fig. 2, shows the station of the Olympia Light & Power company, with the company's flour mill just behind it. In Fig. 4 is given another view of the station in which may be seen the adjoining dam and waterfall.

Operation of the Tesla Alternating Motor.

Rankin Kennedy contributes to the London *Electrical Review* an article on "The Drehstrom Patents" that will



OPERATION OF THE TESLA ALTERNATING MOTOR.

be of interest to many readers in that it gives a good explanation of the actions of a multiphase motor. Mr. Kennedy says, concerning the claims of several inventors: "The whole question, no doubt, will be thrashed out in some law court, the issue being whether Tesla's patent is sweeping enough to rake in the improvements made during the last four years by those other inventors in the same field.

"As one who has worked out a drehstrom motor, which I consider to be a totally different invention from Tesla's, I may be permitted to give my views on the subject. In the first place, let us see what was Tesla's motor.

"It consisted essentially of two magnetic systems, one energized by one alternating current, the other energized by another alternating current, the two currents differing in phase by 90°, and these two magnetic systems acted on an armature having closed coils. The diagram is a simple illustration; *a b* forms one of the magnetic systems, *c d* the other. *A* is the armature.

"The action of such a motor is very simple, although its action has been obscured by the volumes of mathematical analysis and investigations made into it, and also by elaborate attempts to work out the rotary polar theory; its action is quite obviously simply the same as ordinary motors. The poles, *a b*, are at a maximum at the same instant that the poles, *c d*, are a minimum power, consequently the armature coils at that moment form a closed secondary circuit to the primary, *a b*, so that poles are induced in the armature by this secondary current, which are opposite in sign to *a b*, but lag in phase behind *a b*; the poles, being opposite on armature, are repelled by *a b*, and attracted round by *c d*, which poles begin to strengthen as *a b* weakens, till *c d* are at a maximum strength and *a b* at a minimum, when the same cycle begins again, thus producing rotation of the armature, without a commutator.

"Tesla also claims that if armature *A* were made into two armatures, placed side by side on the same shaft, and the poles *a b* acting on one of the armatures and *c d*, one of the pair of poles, being shifted along sideways to embrace one of the armatures acting on the other armature, both armature coils being connected electrically across, that construction would still be a Tesla motor; no doubt it would, but what becomes of the rotary polar theory?

"The writer of this article constructed and exhibited at the Edinburg exhibition a motor working with two Siemens drum armatures connected together to form closed circuits; these were acted on by two laminated magnets excited by two currents in quadrature. Such a construction comes

FIG. 2. UTILIZING WATER POWER IN WASHINGTON FOR GENERATING ELECTRICITY.

under Mr. Tesla's claims. Under the best conditions, however, this style of motor is a waster; it is not efficient, and does not start with a load, so that Tesla's claims don't concern it very much.

"Another form was made afterward, which proved considerably superior to Tesla's form. I described it in detail. Other inventors have made improvements, and the question at issue between them and Tesla is whether such constructions come under Tesla's patent right. The general question for electrical engineers is of more importance to your readers, and that is, are multiphase Tesla or drehstrom motors "any good anyhow?" The author's opinion is that they are no good—even the best of them yet designed. They have little or no great starting torque, and require enormous exciting currents. Their only field of usefulness can be in transmitting small powers on board ships or in mines.

"If ordinary high frequency is employed, such as is required for lighting purposes, then motors such as these, wherein the field magnets are excited by the alternating current, the exciting current becomes too large. If the frequency is low, then the mutual induction is too low, and the motor becomes too large for the power it gives out.

"Altogether the drehstrom motor has not so much to recommend it that would make it worth while fighting for it. Two and three-phase currents have more important ap-

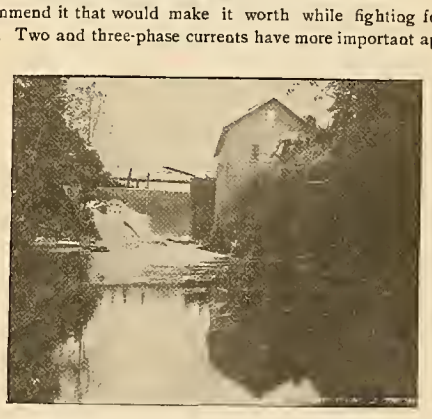


FIG. 4. UTILIZING WATER POWER IN WASHINGTON FOR GENERATING ELECTRICITY.

plications than for driving motors. For transmitting electrical energy to a distance at high pressure, and afterward converting it into low pressure, continuous current for distribution seems to be a more promising application.

"The alternating current motor, which has been a 'long-felt want,' is a small motor to work safely and efficiently on the present existing alternators, with no commutator, if possible; but with a commutator, if you like, provided no skilled attendance is required."

It is stated that the Russian government intends to buy up the telephone lines in its dominion.

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CORRESPONDENCE relating to electricity, or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

PAGE.

Governing Water Wheels in Railway Service. Illustrated...257, 258
The Right of States to Tax Telegraph Lines.....257, 258
Keep the World's Fair Open Evenings.....258, 259
Electricity at the World's Fair. Illustrated.....259, 260
English Electric Pumping Plant. Illustrated.....260
Swinburne's Differential Voltmeter. Illustrated.....260
A Large Armature. Illustrated.....260
Utilizing Water Power in Washington for Generating Electricity. Illustrated.....261
Operation of the Tesla Motor. Illustrated.....261
Editorial.....262
Pulsating Electric Rock Drill. Illustrated.....263
Electricity in Mill Work.....263
Henrion Lubricator. Illustrated.....263
Carbon Manufacture in Germany.....263
A Proposed Solution for the Electrical Hazard Problem. By George P. Low.....263, 264
Mrs. Becker in a Post Hole.....264
Measuring Instruments for Students. Illustrated.....265
Improved Cut-Outs. Illustrated.....265
New Cleat. Illustrated.....265

DEPARTMENTS.

Correspondence.....265, 266, 267
New Incorporations.....267
Electric Lighting.....267
Electric Railways.....267, 268
Telegraph.....268
Miscellaneous.....268
Trade News.....268
Business.....268
Electrical Patents.....268

IT is hardly possible that any further steps will be taken at this time by the government to develop the postal telegraph system, which has been a pet hobby with the present postmaster-general. Inasmuch as the new administration is opposed to centralization of power and governmental control of private enterprises, there is little hope that further time will be devoted to the consideration of this project.

THE remark is often made that electricity seems destined to "revolutionize the world." But few, except those who give special attention to the subject, realize how near the truth is this apparently exaggerated statement. The telegraph, for instance, is such a familiar agency and it has so rapidly become one of the necessities of life that the world is only now beginning fully to understand its value as an annihilator of distance. The *New York Herald* recently advocated abolishing our foreign ministry and suggested the substitution of the international telegraph for the present system. "Abolish our foreign ministry," says our contemporary, "send home the farcical diplomats from the courts where they are so ridiculous and ridiculed a feature. Henceforth let the United States of America do business from its own office in Washington and let the Atlantic cable be envoy extraordinary when this government has extraordinary business to transact with the other countries of the world. For the ordinary commercial business the consular offices are, or should be, made all sufficient." It takes a long time to "revolutionize," and perhaps the government may see fit to continue to maintain representatives in foreign lands and may not avail itself of the plan suggested. There is no doubt but that the Atlantic cable has proved itself a most useful agent, and the government has employed it to an extent that shows that it is a valuable factor in diplomatic work.

DURING the last two years the readers of the WESTERN ELECTRICIAN and other electrical journals have been treated to a great deal of matter referring to multiphase current motors. The high sounding name "drehstrom" and the network of mathematical formulæ that have usually accompanied explanations relating to it have doubtless made many hesitate in their attempt to obtain a clear general idea of the working of the motors employed in a multiphase current system. There are many, for instance, who would like to have a clear understanding of the Tesla two-phase motor. It was, therefore, with the view of helping what might be called the non-technical reader that the article on "The Operation of the Telsa Motor" was presented in another column. Mr. Kennedy, the writer of the article referred to, is not enthusiastic in his remarks on the Tesla motor's practicability, but his explanation of a two-phase motor is simple and easily understood.

TO devise an automatic governor for water-wheels furnishing power for electric stations is a problem that has never so much as now occupied the attention of engineers. When the load on the station varies gradually types of water-wheel controllers may be had that do their work in a fairly satisfactory manner. But in railway work, for instance, where the demand for current fluctuates greatly it is not such an easy matter to maintain the constant speed that conduces to a constant pressure. Descriptions of methods of governing such systems are, therefore, just now interesting reading, and for this reason the leading article in this issue of the WESTERN ELECTRICIAN will doubtless be appreciated. The method referred to is an elaboration of a previously devised arraogement in which the load on the electric railway system was steadied at periods of no load or very light load by throwing dead resistance by hand in shunt across the terminals of the generator. The resistances employed were coils of iron wire immersed in a tank of running water. In the new arrangement of the method, however, a novel feature was introduced. Instead of simply using the dead resistance a part of the shunted current which had been heretofore wasted is now passed through a number of electric heaters in the dynamo room, and thus utilized to heat the station. The electric heater is now advancing rapidly to the front and bids fair to take a place alongside the electric lamp and the motor, and this application of it in a saving capacity in a method that, strictly speaking, is an uneconomical one, is suggestive to say the least. The article is worthy of careful perusal by those interested in water driven central stations.

ANOTHER batch of interviews presented in this issue shows that interest in the subject of evening closing at the World's Fair is not abating among the members of the electrical fraternity. The daily press of Chicago and elsewhere has also shown its interest in the question, and the unanimous opinion is that the preposterous rule for closing the exposition at 7 o'clock should be repealed. A numerously signed petition to this effect, circulated among the electrical business houses of Chicago, will soon be presented to the executive committee of the directors, and it is earnestly hoped that the local board will not only refuse to adopt the rule but use its utmost endeavors to bring the commission to a similar way of thinking. There is a general impression, both inside and outside the circle of World's Fair authorities, that by the time the fair is opened some action will be taken to render the rule inoperative, and that the exposition will actually be open every week-day evening. The electrical people must not allow themselves to be lulled into a feeling of false security by this idea, however. At the present time the objectionable rule exists, and there is no definite assurance that it will be expunged from the list. So long as this condition of affairs exists the electrical fraternity must keep actively at work in the endeavor to secure a repeal. No stone should be left unturned. Nobody can be found to defend the action of the commission; but, on the contrary, a perfect storm of opposition has arisen from the electrical and allied interests, and there is no doubt that the general public would re-echo this sentiment if its wishes were made known. We cannot believe that the national commission will disregard this wide-spread desire for the sake of—what? Who can tell the reason? The public will be disgusted, the Exposition company will be deprived of a large portion of its revenue, and the electrical display will be greatly curtailed, many of the exhibits being entirely withdrawn, if evening closing prevails. Then let the electrical fraternity be active and constant in its opposition. With all at it and always at it, the rule will be repealed.

THE question of the right of states to tax telegraph lines has been under consideration in several states, and many conflicting opinions have been delivered. Now the question has been passed upon by the Supreme Court of the United States, and the telegraph company has gained a substantial victory. It has been decided that the telegraph is an instrument of commerce, and that telegraph companies in their foreign and interstate business are subject to the regulations of Congress, the same as railroad companies. Referring to the attempt of the state of Texas to levy tax upon telegraph messages, the court decided that "so far as it operates on private messages sent out of the state, it is a regulation of foreign and interstate commerce, and beyond the power of the state; as to the government messages, it is a tax on the means employed by the government of the United States to exercise its constitutional powers, and therefore void." In the case just referred to the Legislature of Texas had passed a statute providing that every telegraph company doing business in the state should pay a certain tax for every message sent by it; and the Western Union Telegraph company, having refused to pay taxes under that statute, basing its defense on the act of Congress of July 24, 1866, judgment had been recovered against it in the state court for the amount of such taxes. But on a writ of error to the Supreme Court of the United States judgment was reversed.

It is admitted that an interstate railroad is a thing of more magnitude, and has greater financial and commercial value than any interstate line of wires and poles used for telegraphy, and the transportation of troops and munitions of war is, no doubt, a thing of graver importance than the transmission of telegraph messages; but the latter has become also an absolute necessity to the proper administration of the national government, either in peace or war. If, therefore, the rights, privileges and powers conferred by congress on the railroad company constitute franchises which a state cannot tax, it seems impossible to escape the conclusion that the rights, privileges and powers thus conferred upon a telegraph company also constitute a federal franchise.

JUST at this time readers of electrical journals have had a surfeit of articles defending the overhead trolley system. We may be pardoned for calling attention, however, to a suggestion which a contemporary makes, and which, if acted upon by street railway men, would result in less accidents from electric cars. Speaking of the trolley in New York city, the *Mechanical News* of that city says: "The cars are heavy and the speed is high, but the brake furnished with these cars is the old one hand crank handle horse car brake. It is ridiculously inefficient. With a strong man on the platform, when the car is going at full speed, a stop cannot be made in much less than one hundred feet. The lighter brakemen have more difficulty in applying the brake and make still poorer stops. To make such stops as are common on the cable cars is actually impossible even in case of emergency. One of the brakeman's hands is in use manipulating the handle which controls the current, the other applies the brake. There is the usual amount of slack chain and this alone wastes time in a stop. Here is the secret of the danger from the electric car."

We agree with our contemporary in the main, for though all electric cars are not deficient in this respect the lack of an efficient brake has been without doubt in a great many cases the cause of serious accidents that through the ignorance of newspapers have been charged to a "deadly" current.

The electric car to answer the purpose for which it is intended, viz., rapid transit, must of necessity be driven at high speed, and cannot therefore be quickly stopped. Cable cars as the *News* says, when coasting down hill often attain speeds quite as high as the electric car, but their enormous brake power can be applied almost instantly and with but slight exertion as compared with that needed on the electric cars, and their stops can be made almost within a car's length. They can make stops so short that the passengers will slide upon their seats. This lack of brake-power is an unfortunate failing in the electric cars and until a power brake is applied to these cars, they will certainly be very dangerous. And it is fair to presume that until this is done the popular demand will be for the cars to run at a comparatively slow speed so as not to subject the people to danger at crossings.

Pulsating Electric Rock Drill.

Electricity possesses such manifest advantages as an agent for operating drills as compared with compressed air that its general adoption as a substitute for the latter in all places seems to be only a question of time. One of the most recent applications is shown in the accompaning illustrations. The makers, Rooper & Toger, of Northampton, England, first coupled the drill to the motor by means of a flexible shaft. This arrangement was found to be unsatisfactory, as it was cumbersome and the core of the shaft, when continuously used, gave way. The present form was therefore adopted, which, it is claimed, is easy to transport and fix and has a considerable range. As will be seen from Fig. 1, the drill is mounted upon a small carriage while a vertical pillar carries a cross carriage. By means of a screw jack at the top, the machine can be fixed in the heading; it is, of course, too high to be used for long wall working, but is suitable for tunneling and other work where there is a clear headway of about six feet. At the lower part of the pillar a loose sleeve is fitted in such a way that it can be raised or lowered by means of the ratchet brace and vertical screw; this sleeve is provided with a pair of trunnions which carry the cross carriage, which is thus capable of being swiveled through a considerable angle, as shown in Figs. 2 and 3, where it is supposed to be at work in a heading seven feet high by seven feet wide. The sleeve, of course, allows the cross carriage to be slewed in a horizontal plane through a large angle, as shown in Fig. 2. The cross carriage carries at one end a Bromfield-Ingersoll rock drill and at the other a Goolden mining motor with the commutator cased in so as to avoid danger from sparks; this precaution seems to be unnecessary in this case, as the apparatus can only be used in large headings, which are rarely unsafe.

Upon the spindle of the motor a toothed wheel is shown, and at first the drill spindle was driven by gearing. This, however, was found to be objectionable, and a pair of speed cones and belting were substituted. A worm upon this shaft drives a worm wheel, which actuates the drill itself through a special cam, and the feed is given upon the return stroke. The motor requires a current of 10 amperes at 100 volts, and runs at 1,800 revolutions per minute. The drill spindle runs at a speed of 115 to 120 revolutions per minute, the number of blows being 230 to 240 per minute, and the weight of each blow is about 360 pounds on the bit.

It is stated that the rate of drilling in hard slate rock has been found to be 1½ inches per minute for holes one inch in diameter, using a current of 10 amperes and 100 volts; but since these results the machine has been improved. At Greenwich the drill was recently exhibited,

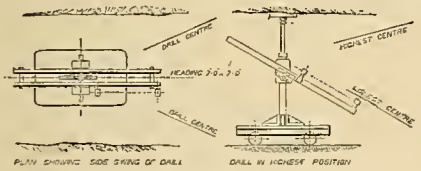


FIG. 1. PULSATING ELECTRIC ROCK DRILL.

drilling into a block of hard silicate concrete, made with flint stones and Thames sand. A drill 1½ inches in diameter was being used, and the maximum stroke was 6¼ inches. It drilled 9 inches deep in two and a half minutes, and 11 inches deep in three and a half minutes. The motor was then using 16 amperes at 100 volts, and running at about 1,820 revolutions. The special advantage of the arrangement appears to be that the weight of the drill is balanced by the weight of the motor, so that the cross carriage can be swiveled and clamped easily at any angle within the range of the apparatus. It appears probable that driving by belt would not be found suitable in moist places. The cuts are reproduced from the *Engineer* of London.

Electricity in Mill Work.

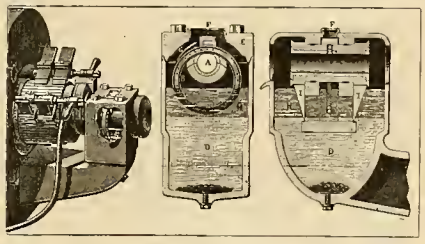
We are now really entering upon the electric power transmission era, says the *Commercial Bulletin* of Boston. Recent developments clearly show this. Electric power for mill work has long been talked of, but its realization and adoption now seem to be at hand. Its practicability and economy have before been demonstrated, but the drawback has been the cost of the apparatus. The advantage of subdividing the units of power in mill and factory by the use of electricity are virtues of the system which will recommend its use in place of steam, providing the first cost of apparatus be not too great. It is estimated it saves 30 per cent. in power over the present steam methods with its attending long lines of belting and shafting.

New England, as it rightly should with its great mill and factory interests, is taking the lead in the adoption of electricity for power transmission. A large woolen mill at Taftville is about to put in the largest electric power plant of the kind in the country. The Cataract Construction company, of Niagara Falls, of course, will have, without exception, the largest power plant in the world, but it will supply current for all purposes. The Taftville equipment, which will be strictly a mill plant, will in all have a capacity of 750 horse power in generators and transmit power from waterfalls three and a half miles distant. This will operate a large part of the mill machinery. In location, where water power is cheap and relatively handy, it can, through the agency of electricity, be made to run machinery cheaper than by any other method.

We predict that in a few years all good water powers in New England and elsewhere, that are now running to waste, will be harnessed by electricity to operate the wheels of industry. The fact, however, that electricity can, be subdivided, and therefore do away with considerable shafting and belting, often recommends its use even where steam has to be used to operate its generators. This has been demonstrated in both Brockton and Lynn. In the latter place it is proposed to equip about twelve factories with electric power throughout, the current to be furnished by the local central station. Such plants will need but little attention, and with numerous motors, operating independent of each other, power can be used as wanted. The supply of power will be regular and reliable, a duplication of generators being in readiness at the station from which power is taken.

Henrion Lubricator.

The automatic lubrication of a dynamo or motor bearing is ordinarily effected by means of a ring mounted on the shaft, which dips into oil. This means of lubrication is open to the objection, it is claimed, that the oil is



HENRION LUBRICATOR.

thrown from the ring by centrifugal force, and is not carried, therefore, to the point where it is needed. To overcome this objection, Fabius Henrion of Nancy, France, has designed the lubricator shown in the illustration. It consists of a copper ring *B*, mounted on a shaft *A*, and turning in oil *H*, which floats on water *D*. The oil in which the ring turns must first pass through the filters *I I*, and the impurities either adhere to the surface of the latter or fall to the bottom. The ring is pierced by a number of tiny holes, as the cut shows, which tend to keep the oil from flying off as a result of centrifugal force. The oil tends to gather at *G*, and is distributed gradually over the shaft. A writer in *La Nature*, from which the cut is reproduced, is authority for the statement that the device proves extremely efficient in actual use.

Carbon Manufacture in Germany.

The French vice-consel at Nuremberg, Leon Duplessis, has recently made a report on the electric carbon industry of that town, from which the following extracts are taken: The manufacture of electric light carbons occupies six large factories, belonging respectively to C. Conradty, Ch. Schmelzer, Carl Braun, J. G. Meier, Emile Mahla and Jules Fuchs. To these may, perhaps, be added a seventh, namely, that of Dr. Albert Lessing, though the latter does not produce carbons for electric lighting, but only battery carbons. The raw material employed in this manufacture is "retort graphite." As far as the vice-consul was able to discover, this material only is used when homogeneous carbons are required, but when cored carbons are to be made a softer substance is added. Before they are ready for use homogeneous carbons pass through twelve, and cored carbons through sixteen, different processes. The first operation is to break the graphite into small nuts. For this purpose a three-stamp mill is used. The stamps, in falling, crush the graphite placed over movable steel gratings that allow the broken material to pass between the bars. These bars are placed nearer to one another or farther apart, according to the size of the pieces required. Having passed this grating the pieces are collected by hand and passed through a sieve. The coarse particles are submitted to a vertical crushing, and the fine are passed on to a rolling mill. The vertical crushing is intended to reduce the pieces of graphite to about the size of semolino grains. The graphite thus treated is directed a second time into a sifting machine. Then follows more rolling. The sixth operation is to damp and mix the graphite obtained from the rolling mill, as well as the powder gathered in the sifting machines, with a binding substance. The mass delivered from this machine being too soft, it is necessary to render it plastic and capable of taking a shape, and with this object it is consigned to a sort of puddling machine which produces a species of paste. This paste is pressed through a machine fitted with dies. These produce coarse rods or other pencils, according to the diameter of the cylinders. The rods so prepared are introduced into steel hydraulic cylinders and submitted to a pressure of 25 atmospheres. Some of these hydraulic presses—the construction of which the Nuremberg manufacturers have only attained by successive steps—can deliver 500 meters of carbon per hour, or from 2,000 to 3,000 arc light carbons of average size. All these operations terminated, the carbons obtained are baked in a blast furnace, where the temperature occasionally attains as much as 2000° centigrade. When homogeneous carbons are withdrawn from the furnace they have only to be passed on to an automatic cuting machine. This machine is in direct communication with a ventilator which draws off the powdered carbon produced in cutting. The construction of machines employed in the manufacture of electric light carbons is also a Nuremberg specialty, and the house of Justus-Christian Braun has a monopoly of the business, and supplies machines in Europe and America. The cost of an outfit for a factory is put at 20,435 marks, irrespective of packing, transport, and custom charges.

A Proposed Solution for the Electrical Hazard Problem.

By George P. Low.

The record of the incandescent light as a fire producer, during recent years in particular, is not to be maligned, for, as has been shown, it is the safest of all artificial illuminants, but it has not attained that which it is capable of reaching, namely, an unblemished record. To do this, the natural tendency to buy the cheapest that will answer must be checked, and the fire underwriters alone have the power to do so. It is useless to plead with the owners of buildings, for many are always found who will turn a deaf ear, especially so when they realize that the carrying out of good advice would violate their sacred precept of patronizing only the lowest bidder. The only way to reach such men is to touch their pockets. Moral suasion availeth naught. An instance has been cited where the constant application of moral suasion for three months failed to secure the removal of a wooden ash barrel, but within five minutes after the receipt of a letter to the effect that if the hazard was not removed at once the rate on the premises would be materially increased, the barrel was not to be found.

With the exceptions of such localities as are in constant surveillance, I have found that but little or no progress is being made toward the desired end. Noteworthy exceptions occur here and there, but generally speaking the condition of electrical work is not satisfactory. It is not necessary to look far for the reasons. A glib tongued electrician, an electrically ignorant and easily gullible public, a let-the-contract-to-the-cheapest-bidder policy and, worse than all, the fact that it is possible under existing requirements to so wire a house that after its completion it is impossible to detect faulty or hazardous construction without tearing up floors or breaking plaster completes the whole story of present electrical troubles. Charlatan electricians know that the insurance inspector will not ordinarily put the occupants of a fine residence, for instance, to the annoyance of taking up carpets and floors, or to the expense of breaking frescoed walls. It would frequently be unreasonable if not impossible to demand it, and so the work is uninspected, except superficially, and a great hazard to a valuable property exists for which the

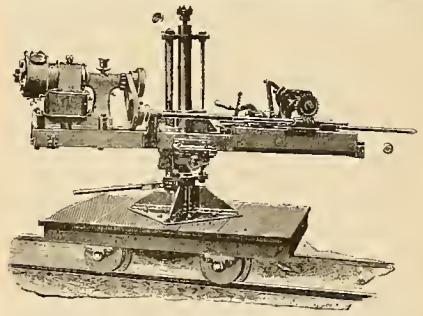


FIG. 2. PULSATING ELECTRIC ROCK DRILL.

insurers make no charge. To show that this is by no means an imaginary case, let me describe an instance which actually occurred. A well-known theater not many miles from San Francisco was wired for incandescent lights during a period when I was absent in Montana. Upon my return I found the wiring of the auditorium of the theater, etc., closed in by lath and plaster, but the wiring back of the stage, and in the offices in front of the building, was open and accessible. Upon careful examination I found that all wires in the open portion referred to were of proper sizes, and were of Grimshaw, which is one of the best insulations made. All circuits were supported in porcelain knobs and holes through timbers through which wires were drawn were bushed with interior conduit on hard rubber tubing. The circuits were properly subdivided, joints were well compounded, painted with P. & B., and in brief, the work was one of the best pieces of ordinary concealed wiring I had seen. From a desire not to discommode either the contractors or the owners of the building, I did not demand an uncovering of the circuits in the auditorium. Upon superficial examination, I found the outlet wires to be of Grimshaw, and I noted that each hole through which the outlet wires passed out through the iron lathing was bushed with a specially made piece of hard rubber tubing threaded at the ends and held in place by fiber nuts. This was certainly good construction. The proper number of lamps was in each circuit, and the only thing which could not be determined was the quality of insulation used behind the plaster, and the manner in which joints were made. I was assured by the electrician who held the contract for the work that every foot of incandescent wire in the building, including that behind the walls of the auditorium, was of Grimshaw, and that all joints were of the kind I had seen. A written assurance

1. Read before the California Electrical Society, November 7, 1892.

that the work was per requirements was also given, and the work was accepted. Some time afterward, however, the theater was torn out for reconstruction, leaving only the four walls and roof standing, and of 9,757 feet of incandescent wire taken from the building, 2,520 feet were of Grimshaw, an acceptable insulation, while 6,670 feet were of weatherproof wire, a grade of insulation that is condemned for ordinary concealed work, from the Atlantic to the Pacific.

The evidence of guilt was ample, all wire concealed behind lath and plaster in inaccessible places was of weatherproof insulation with short pieces of Grimshaw spliced on at terminals and outlets. Had not the building been reconstructed the fraud would never have been discovered; or had it burned the cause of the fire would doubtless have been attributed to mice or entered up as unknown. Yet this electrical imposter is still in business and, if more recent experiences amount to anything, he would still be up to his old tricks if he were not carefully watched. Is it not possible that such practices can be controlled? If I will tell you how to do it, will you, as underwriters, act on the suggestion, if it be a reasonable one?

With the experience which has now been had with electrical work, it is believed by the foremost electricians that each and every feature that can present a fire hazard is fully understood, and that a competent safeguard for every such fire hazard has now been not only devised but is in actual and successful operation in hundreds of installations. The details of safe construction under the different uses to which electric light or power is used are almost as varied and fully as peculiar as are the fire-hazards attending various occupancies or manufacturing risks, and the impossibility of laying down a general law is apparent. Let us, therefore, take a special case, such as an office building, and analyze the conditions it presents. In this instance, the normal condition of the building is dry and if any considerable leakage or dampness occurs it is quickly noticed and promptly remedied. Despite this most favorable condition it is nevertheless true that the wire used must be of an absolutely water and moisture proof insulation. Were it not such it is easily seen that dampness, so slight as to escape observation, might form a pathway for the escape of current from one conductor to another, which would form a hazard that the use of a water-proof insulation would have averted. More than this, a water-proof insulation generally possesses every merit of a non-water-proof one, beside being covered with a material that insulates the wire far more perfectly. It is for these reasons that water-proof insulation should be used for concealed inside wiring. To detect one class of insulation from the other is very simple. If a wire is covered with thick rubber, or with a solid material resembling rubber, and then wrapped with a tape or covered with a woven braid, then the wire is of the class known as solid rubber insulations. Such an insulation is water-proof. If, however, the insulation of a wire consist of fibrous material only, with no covering of solid rubber, or equivalent solid (not fibrous) material, then it is of the class known as weather-proof insulation—a wire originally designed for outside use on pole lines. This wire is not permanently waterproof and must not, therefore, be used for concealed work for the reason that it is not proof against the greatest electrical danger, namely, water. As to the workmanship and manner of running wires, the conscientious workman will so place them that if the wires were bare there would be no escape of current from any wire to another wire or to any other metal work, piping, dampness or ground connection. All wires must be rigidly run and well separated from each other, from all metal work, gas, water, or other piping, and from every possibility of moisture. The insulation will then be relied upon as little as is possible, and the greatest safety will be secured. If concealed wiring is placed in accordance with the practice outlined, as is now done in San Francisco and immediate vicinity, where it is subject to constant inspection, the wiring will be perfectly safe, but it is not possible to inspect each and every building on the Pacific coast just before the lathing is placed, and all kinds of wiring, good, bad, indifferent and even highly hazardous, are buried out of sight and inaccessible, the electrical contractor gets his money for his job, and that is the end of the matter until a time when the services of an insurance adjuster are called in.

It must be evident, therefore, that next in importance to the question of insulation and workmanship is the matter of accessibility of the wires, and, indeed, I have frequently thought that insulation is a secondary consideration when compared to accessibility. Even a year or so ago it was a matter of doubt whether it was possible to wire a building so that all circuits could be exposed for inspection or subjected to examination throughout their entire length without disfiguring the building or impairing the utility of the plant. The problem has now been solved, and if it is distinctly understood that all concealed circuits must be so placed that they may be uncovered or withdrawn from inspection at any time, or a discrimination in rates will be made; then, and not until then, will perfect safety be assured. Taking advantage of the inspector's absence will then be rendered impossible and equally impossible will it be to practice any imposition of any nature in regard to electric light work.

It is but right and proper that insurance interests should believe that in the incandescent electric light and in low potential electric power may be realized light and power from sources that will prevent no fire-hazard. Electric heating and cooking are rapidly becoming more prominent, and they, too, may be accomplished without entailing a fire-hazard. These are all possibilities and ones which can only be achieved through the fire underwriter themselves, if not in encouraging their use, in at least requiring that when used they shall be properly placed, or a severe penalty shall be imposed. Underwriters may look upon these applications of electricity not as evils to be restricted, but as benefits to be fostered; but to reap the benefits of them as hazardousless commodities certain restrictions, such as accessibility, should be insisted upon. Generally speaking, that they are evils is not to be denied, but it is equally true that they are not needlessly so.

It has been charged that insurance organizations are culpable, to a certain extent, for a great deal of poor wiring that is placed, for the reason that the safety rules promulgated are so explicit that any school boy, after studying them, imagines himself competent to wire a building and starts out into business. Without affirming or denying the statement it is certain that there is no profession in which there are so many incompetent and irresponsible amateurs posing as capable practitioners as in electricity. Its mysteries present a fascination; a battery is constructed; a simple bell circuit is run; then a toy electric motor is made; the youthful tyro is considered a prodigy, and being at that age when he is neither man nor boy but a know-it-all, he hangs out his shingle as an "electrical engineer," determined to perform wonders. And he generally does so, for wonderful indeed are his works. I once learned of a case where joints in incandescent leads, after being indifferently twisted together, were covered over with nothing but sealing wax, and to an objection entered the self-satisfied retort came; "Well, it holds 'em together, don't it?" and "It's an insulator, ain't it?" This man was caught in the act of covering joints with sealing wax, yet he pretended to be familiar with safety requirements. Perhaps he was more or less so, and he may have honestly believed the work to be safe. He said that he had worked in different places on the coast. Probably he had left a trail of inaccessible sealing wax joints in his wake, and some day it may be remarked as peculiar coincidences that "every house that man had anything to do with burned down."

Again, it is not only the amateur who is grossly negligent. Amateurs and locksmiths and sawfilers who have taken up electrical work as a little side issue to their business go hand in hand as kindred evils. The wretched blunders they make are blunders of ignorance, blended with indifference, but bad as they are, they are excusable when compared to the wilful violation of safety rules, as practiced by electricians who know better, such, for instance, as the man who wired the theater with a weatherproof wire, splicing Grimshaw on to the ends at outlets, or to the individual who makes the joints here exhibited, and boastfully advertises that he has been in the electrical business more than twelve years. He said he did not believe that the house from which these joints were taken would ever be lighted by electricity, so he didn't take much pains with the work, but it was lighted—fortunately after the careful electrician of the local company had torn up carpets and reconstructed the circuits. Equally untrustworthy is the man who, in wiring a shoe dealer's house, insisted that he was justified in setting the safety requirements aside and concealing waterproof wire for the reason that the owner, who had had considerable experience with rubber shoe ware, wanted a weatherproof wire used, because in his opinion rubber will dry rot quickly. Undoubtedly shoe dealers' opinions, when applied as expert information on rubber insulations, are similarly afflicted.

The four instances given, all actual occurrences, show a few of the evils an electrical inspector encounters. Fortunately they are not everyday cases, but they teach the same lesson, and from them the same moral may be learned. The lesson is: many electricians, whether amateurs or otherwise, will wire a building in any manner, so long as it will be accepted and paid for by the owner. This done, they feel no further responsibility for their work, and they think that by the time the premises are lighted, if ever, they will perhaps be many miles away. I have heard more than one electrical imposter use the very inelegant expression: "There's a new crop of suckers born every day." The property owners, architects and builders are the ones who are imposed upon, and it is they who are considered legitimate prey.

But what of moral? Simply this: Require all interior circuits to be so placed that they may be exposed for inspection at any and at all times. Imposition, so far as a fire hazard is concerned, is not practiced in localities under constant surveillance, but elsewhere there is practically no restriction in the matter of wiring for the reason that no certain conclusion can be reached from examining only the ends of a wire that is buried and inaccessible. Let all wiring be made accessible, let periodical inspection be made, if it is impossible to obtain continuous ones, and then will the possibility of perfectly safe light, heat and power be realized.

How this condition of accessibility may be attained is a question I do not feel called upon to answer, or I would be liable to criticism as encroaching upon the legitimate field of electrical engineers. Suffice it to say, that it it now thoroughly practicable, as may be demonstrated by the examination of hundreds of installations, and if the rendering of all circuits accessible is made compulsory there will be no lack of ways or means for carrying out the new requirements.

A belief is growing among fire underwriters that the recent remarkable increase in the number of fires from unknown causes is due to the development of electric lighting. Circumstantially the evidence is against the electric light, and no one can fully understand why it is so unless he has a personal familiarity with the quality of wiring that is concealed behind lath and plaster throughout the country. The number of fires from unknown causes has increased almost in the same ratio as the growth of incandescent lighting, and, as stated with many, the conclusion derived therefrom has formed a conviction. In the absence of explicit information it is impossible to combat this conviction, hence, being undisputed, it cannot but stand. That it is to be deplored is true; but rather than do the electric light industry a gross injustice it is better to sift the condition to the bottom and reach the true state of affairs, namely, that the hazardousness of electric light is due, not to the use of the light, but to the abuse of it. Abused by whom? Why, the electrical impostors, of course, who, taking advantage of a national error foist their worse than worthless construction upon the public at ruinously low figures, and the legitimate trade either is forced out of business or is compelled to stoop to the same class of work. Though this is distressing it is not an exaggerated statement of the condition of electrical affairs in many localities, and when things are as stated, let me ask, is it reasonable to hope for safe work? To maintain an electrical inspector in each locality would be an unjust and unreasonable tax upon the fire insurance companies, who on this coast do not derive a single penny as compensation for the existence of the electrical hazard. Many efforts have been made to have cities themselves adopt electrical ordinances and enforce safety requirements by municipal inspection. In several cases such ordinances have been passed, but each has remained practically a dead letter. Neither moral suasion nor threats remedy the general situation, and now, after a constant application for three years, to the finding of a solution of the difficulty, it is recommended that the course defined be pursued. To insist upon universal accessibility of all electric light, heating or power wires, will possibly cure the evil. It is a remedy of wonderful simplicity and undoubted efficacy.

There is yet another potent reason for insisting upon accessibility. In "accessible" systems wires receive not only the protection of their insulating covering, but they are always free from the effects of moisture, lime, rats; atmospheric changes, and such other influences as may exist. They are, moreover, almost from the fact of being accessible, so placed as to be rendered fireproof. These properties alone entitle the suggestion to unusual consideration.

Again, it would be interesting indeed to invite opinions from electrical people concerning the advisibility of enforcing this proposition. I dare say that every legitimate concern would give it heartiest support, while dissenting opinions would be had from only electrical impostors or the other "half-baked" electricians whose ignorance renders their opinions unworthy of consideration.

I beg you not to overlook the fact that, as far as statistics are to be relied upon, it is shown that electricity is by far the safest known artificial illuminant. But that is not sufficient. To derive absolutely safe light, heat and power is the aim, and this can be accomplished through the medium of electricity, without further experimenting. Eliminate every possibility of unprincipled competition in electrical work, adopt and rigidly enforce requirements demanding the universal and constant accessibility of all circuits to authorized inspectors, and electrical impostors, together with the present unfortunate condition of affairs, due only to their machinations, will be no more.

Mrs. Becker in a Post Hole.

Considerable excitement was created at the corner of Tenth and Market streets recently, according to the *Commercial* of Louisville, Ky., by a woman voluntarily jumping in a hole that was being dug to receive an electric light pole. The woman in question is Mrs. Becker, the widow of G. W. Becker, who conducted a large grocery and produce business at that place until his death, which occurred some time ago. Since her husband's death Mrs. Becker has been overseeing the business herself. The electric light company has been erecting poles along Market street, and it so happened that one was to be placed directly in front of Mrs. Becker's place of business, thereby taking up a considerable portion of the narrow pavement. When the lady became aware that the company intended erecting a pole at that place she informed the men in charge of the operation that they positively could not put a pole there. The foremen of the gang of workmen presented a permit from the mayor authorizing the erection of the poles. This did not satisfy Mrs. Becker, and she repaired to her room thinking that she had conquered.

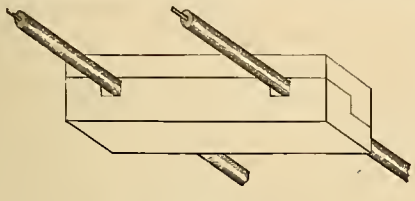
About 2 o'clock in the afternoon she happened to go into the street and saw a large hole that the men were making larger, the dirt being piled high on each side and partially obstructing the sidewalk. Mrs. Becker became very angry at the sight of her pavement being torn up, and running up to the laborers, made them get out of the hole that they had dug. After they stood on the pavement, Mrs. Becker herself jumped in the hole and defied the laborers to dig farther. The men were rather in a "fix," as they expressed it, and sat down to await developments or until Mrs. Becker had become fatigued with her ludicrous position. The lady had plenty of nerve, however, and an hour passed with nothing being done save the severe "tongue-lashing" that was being administered to the men by Mrs. Becker. Matters stood thus for some time, and the foreman became uneasy and started for the mayor's office to get a special permit to place a pole at that particular spot or obtain authority to force the lady to leave. In the meantime a crowd of curious people had gathered. In a short time the foreman, armed with the necessary papers, returned to the scene of action and placed them in the hands of Officer McCue. The officer read the permit to Mrs. Becker, who, with many protestations and expressions of anger, climbed out from her ungraceful position. The workmen then finished their work without interruption.

In the Thomson-Houston factory at Lynn there is a mutual benefit association with 754 members.

The Thomson-Houston Carbon company is rebuilding its factory at Fremont, Ohio, that was destroyed by fire last February. The company was in favor of building elsewhere than in Fremont, but the citizens of that town collected some $35,000 among themselves and offered the sum as a bonus to the Thomson Houston company not to move its plant out of town, so the offer was accepted, and already the new factory is more than half completed. It will be about one half larger than the old one. The building will be of brick and iron with a slate roof, the dimensions being 336 by 70 feet. About 330 hands will be employed.

Measuring Instruments for Students.

The accompanying cuts illustrates new measuring instruments especially adapted for use in schools, which have been placed on the market by Queen & Co., Philadelphia. Fig. 1 illustrates a D'Arsonval galvanometer intended to be against the wall place of a laboratory. It has a graduated scale with pointer and also a mirror. This instrument is dead beat, and is well adapted for general work where quick measurements are desired. Fig. 2 represents a universal tangent galvanometer which is especially designed for determining current in absolute measure, and for showing the effects of variation in the different quantities contained in the tangent galvanometer equation. It has two mahogany rings, built up of a number of pieces to prevent warping. One ring is wound so as to rotate freely on a vertical axis, with a pointer and scale graduated to degrees for use in sine measurements. The compass box slides along the horizontal graduated bar, so that the needle may be placed in the plane of either



NEW CLEAT.

coil, as a tangent galvanometer; midway between them, as in a Helmholtz-Gaugain galvanometer, or at any point upon the axis outside the planes of both coils, as in the Weidemann type. In the electrometer shown in Fig. 3 the quadrants are fastened to a circular block of hard rubber, two of them being made of one piece of metal bent so as to have a level surface on top, to which the brass suspension tube and one binding post are attached. The aluminum needle, provided with mirror for reading deflections and vanes for damping the system is suspended from an adjustable torsion head, thus connecting it with one pair of quadrants. In this way the Leyden jar arrangement otherwise necessary for maintaining the needle at a high potential is avoided. Fig. 4 represents a coulomb electrometer, in which the suspension tube is free to rotate. At the bottom a pointer moves over a scale graduated on top of the glass case. A mirror is placed in the bottom of the case to avoid parallax. Fig. 5 represents a convenient form of a magnetometer for laboratory work. Observations may be taken either directly by aid of pointer deflections or by the telescope and scale method, a mirror being attached to the magnet system. The earth inductor, Fig. 6, is arranged for exact measurements. Fig. 7 shows a voltmeter suggested by Professor Ryan of Cornell University. It possesses important features, such as freedom of electrodes from angles and sharp corners, easy

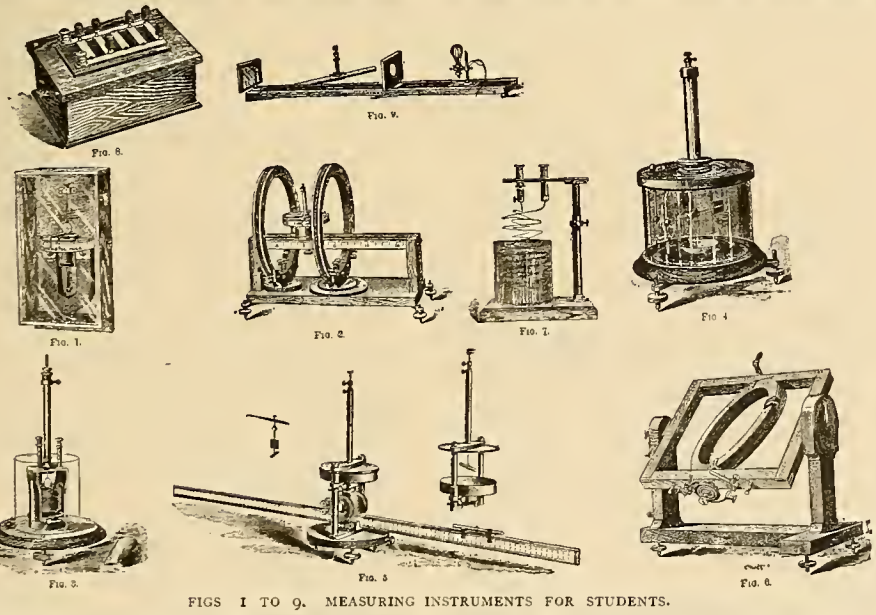


FIG. 8.
FIG. 9.
FIG. 1.
FIG. 2.
FIG. 3.
FIG. 4
FIG. 5
FIG. 6.

FIGS 1 TO 9. MEASURING INSTRUMENTS FOR STUDENTS.

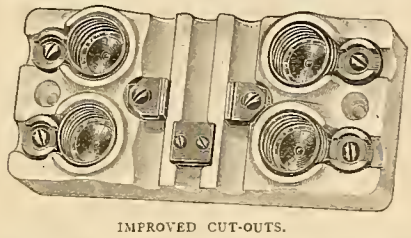
removal of the electrodes, facility for cleansing and greater homogenicity of deposit. The electrodes may be lowered or raised to give corresponding changes of resistance.

Fig. 8 is a subdivided condenser of one microfarad capacity.

Fig. 9 shows a Rumford dispersion photometer, similar to that described in Professor Ayrton's "Practical Electricity." It has a range of measurements up to 1,000 candles.

Improved Cut-outs.

The accompanying illustrations show improved pieces of wiring apparatus, which the General Electric company has just brought out. They are made of hard white, thoroughly vitrified porcelain, impervious to moisture, and impassable to the electric current. The plug cut-outs are de-

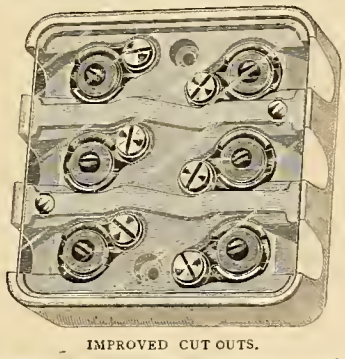


IMPROVED CUT-OUTS.

signed to protect a circuit having a maximum current of thirty amperes at 125 volts. The fuse is carried in a small glass plug, cased and covered with brass, which is screwed into a brass screw socket in the body of the cut-out. Should the fuse blow, the defective plug can be instantaneously replaced without tools of any kind. The porcelain of which these cut-outs are manufactured is itself made by the General Electric company at its porcelain factory at Schenectady.

New Cleat.

The accompanying cut shows a new safety adjustable china cleat that is manufactured by the E. G. Bernard company of Troy, N. Y. The company states that the electric insurance experts of the United States, at their recent meeting in New York, decided against the further use of wooden cleats, and the one in question was devised



IMPROVED CUT OUTS.

to meet their requirements when they shall be made public.

In this cleat both parts, top and bottom, are exactly alike, thus preventing trouble or mistake in packing and saving time in putting up. The cross section is so designed as to strengthen the cleat. It only requires one screw and four small lugs to hold it securely in position when once it is put up, so that perfect alignment is secured. It is adjustable, and is made both glazed and unglazed. The cleat is made of superior imported clay and is thoroughly vitrified and strong. The Western Electric company, the E. S. Greeley company and Alexander, Barney & Chapin of New York carry a stock of these cleats.

An electric railway between Yarmouth and Portland, Me., is proposed.

CORRESPONDENCE.

New York Notes.

NEW YORK, November 12.—To say that New York was excited during the election would be putting it mildly. The city was wild, and when the returns began to come in Tuesday night the enthusiasm of the Democrats knew no bounds. The *New York Herald* employed a search light on Madison Square Garden tower to signal the news to the people. The light was discernible for twenty miles and told the story accurately and rapidly, and the spectators below showed their appreciation in cheers. Down in a little box on the sidewalk in front of the *Herald* branch office, at Fifth avenue and Twenty-third street, three nimble fingered young men were transcribing telegraphic returns on pieces of glass which exactly fitted the stereopticon on the floor above. The transfer required about ten seconds. Then the slides were put in the stereopticons and the news flashed forth. The same process was employed at the main office at Broadway and Ann street, in the new building at Broadway and Thirty-sixth street and in the branch office at One Hundred and Twenty-sixth street and Seventh avenue, Harlem. At all of these bulletins enormous crowds congregated, and each announcement was greeted with mighty shouts. It is estimated that fully 3,500 people occupied the streets in the vicinity of Seventh avenue and One Hundred and Twenty-sixth street, where there was a stereopticon of 800 candle power by which the returns were announced.

While writing of electricity in politics it will not be amiss to call attention to a Wall street rumor relative to the Western Union company and the government. Recently reports have circulated to the effect that the hundred-million mark would be a convenient one for a deal with the government. The actual cost of the company's outfit is popularly estimated at about $40,000,000. The success of the Democracy on Tuesday, however, is likely to count as a black eye to any such project as that talked about. Officers of the company have all along protested that they have known nothing of any plan to sell out to the United States, and when president Norvin Green was asked about a report that the result of the election had spoiled the deal, he said that there was no foundation for street gossip about such a transfer.

The directors of the Western Union company met Thursday and proceeded to carry out the plan of increasing the capitalization of the company. They declareda script dividend of 10 per cent. payable December 3d. Their action was taken under the authority granted at the recent meeting of the stockholders, when it was voted to increase the capital a round to hundred millions. The directors decided to distribute 10 per cent. of the increase as dividen ds to the stockholders and to place the rest of it in the treasury as a reserve with which to improve the system and erect new lines. The balance will be put the market as soon as Western Union stock reaches par, for under the law it can not be sold below par.

Another victim will have to die by electricity before long. Thomas Pallister, formerly a telegraph lineman, who was convicted in the General Sessions of murder in the first degree in stabbing and killing Adam Kane, a probationary policeman, at Grand and Sullivan streets, on the night of May 30th, has been sentenced to be killed by electricity in state prison during the week beginning Monday December 12th. Pallister heard the sentence unmoved.

There are people who believe that New York is one of the poorest lighted cities in the United States. Commissioner Gilroy is of this opinion and at Thursday's meeting of the gas commission he so expressed himself. He stated that in his opinion electric lights should be used hereafter instead of gas wherever it was possible, and evidently the commission as a body agreed with him. In conformity with this view, it passed a resolution providing that streets supplied with subways are to be lighted with electricity hereafter, when it can be done at the regular rates. Proposals will be advertised for at once, and the bids for both electric and gas lighting opened by the commissioner of public works on December 8th. In submitting the new list for electric lighting Commissioner Gilroy explained that the appropriation for lighting in the provisional estimate made no provision for the electric lighting of the districts now proposed, as it was based on last year's estimates.

The rapid transit plans are at last completed, and to-day the Commission resolved to proceed with the advertising of the franchise for sale, beginning next Wednesday. Many difficulties were encountered by the engineers in dealing with the sewer problem, and this has been the chief cause of delay in the work of the commission. Several changes had to be made in the plans as originally prepared, but they relate only to the plan for cutting and re-

constructiog the sewers aloog the line. The most troublesome of these was the Whitehall street sewer, which drains into the river at South Ferry. This will have to be removed and a new sewer constructed nearer to the surface of the street, and draining in the opposite direction into the North river. The difficulty at Houston street, where the Broadway Cable Railroad company has a shive pit over twenty feet deep was overcome in a very ingenious way. Three of the tracks are to go under it, and one, the up-track on the accommodation line, the one on the extreme right going north, will go around it. There is to be a station at Bleecker street, and the two down tracks will dip rapidly down from it by a steep grade to get clear of the shive pit. The up track of the express line will continue on a lower and easier grade until it reaches the common level at the next station. Unless there has been a great deal of secret negotiation or quiet organization of which the public has no information, it is believed that there is no syndicate or organization yet formed to undertake the construction of the road unless the Melville C. Smith syndicate, the old New York Arcade Railway company, is prepared to do so. The construction of the road would seem to lie between that company and the Rapid Transit commission for the city at large. N. F. O.

Milwaukee, Wis.

MILWAUKEE, November 12.—General Manager McLeod, of the Wisconsin Telephone company, recently invited the members of the Wisconsin Electric club to visit and make a thorough inspection of the new telephone exchange. The visitors were made familiar with every nook and corner of the plant, from the terminal room in the basement to the switch-board on the fourth floor, and obtained much valuable information of a technical character. Upon returning to the lower floor, they found a substantial luncheon awaiting them in the lobby. The members of the club extended a vote of thanks to the telephone company.

Last Monday Gustav Froehlich, chief engineer of the Badger Illuminating company, died from the effects of a scalding which he had received several days before. His injuries were caused by the explosion of a steam pipe leading from the boiler to the engine room at the company's plant. The verdict of the coroner's jury was that death was due to his own carelessness. Froehlich left a wife and two small children.

A bonus of $10,000 has been raised by the property owners of North Greenfield to secure an extension of the Milwaukee and Wauwatosa motor railway, and work on the line will be commenced very soon. The extension will cost about $25,000. A tunnel is to be constructed under the St. Paul railway tracks near the fair grounds. The terminus will be within two blocks of the North Greenfield depot.

Scores of handsome new cars have been received by the Villard company and are in use on every line in the city operated by that company. More cars are being supplied with motors, and by next spring, when the company will take possession of the West Side system, none but fine new cars will be in use.

The Milwaukee Street Railway company has commenced the work of building its Sixth and Clybourne street line. This line will connect on Sixth street with the Grand avenue line and then continue along Sixth to Clybourne and west on Clybourne to Eleventh, where a connection will be made with the piece of track now operated there. The line mentioned is at present operated with horses, a fact that causes a great deal of complaint, and the management is therefore desirous of completing the line as soon as possible. Nothing will be done about extending the Clybourne street line to the Soldiers' Home until next spring.

It is said that a few of the interested property owners do not look with favor upon the proposition that they give enough land to permit the widening of Kinnickinnic avenue as provided in the franchise granted to the Villard syndicate. Nothing will be done either about widening the road or building the electric line until next spring.

In the Circuit Court Charles F. Pfister has recovered judgment upon his note for $125,000 against the Milwaukee Electric Railway company, with interest from July 21, 1890, making a total of $145,050, beside the costs of the action. The Pfister interest still controls the stock of the company and will probably remain in possession of the road after the receiver's sale. From Pfister the line will eventually go into the hands of the Villard syndicate, which will then embrace all the street car systems of the city.

The common council of Fond du Lac has awarded a contract for lighting that city for the next five years to W. G. DeCelle, of St. Paul, western agent of the Westinghouse Electric company, who recently purchased the street railway there and is now changing it into an electric line. The contract price is $84 per lamp per year, Philadelphia schedule.

A. B. Meyers, the general manager of the Milwaukee and Wauwatosa motor line, announces that the question of equipping the system with electricity will not be decided until spring. The management desires, he says, to see how the suburban electric lines now in in operation stand the test of winter.

The common council is considering ordinances to increase the salaries of the superintendents of the fire alarm telegraph system and the police alarm telegraph system, the former from $1,800 to $2,000 and the latter from $1,500 to $1,800. The matter is in the hands of the two department committees and the finance committee.

Angus Hubbard, formerly of Milwaukee, now of New York, who has charge of the long distance telephone lines, was in the city the other day. He spoke with satisfaction of the results achieved with the line recently opened between Chicago and New York. The line is used very much now, he said, and calling upon New York, either from Chicago or Milwaukee, is no longer a novel experience. No further extensions are contemplated, he said, for the near future, but Prof. Bell intimates the probability of a line from New York to San Francisco. Some lateral lines are being built at present. For six months, Mr. Hibbard said, the company has been trying to get into Cleveland with a line extending into southwestern Pennsylvania, but the Cleveland authorities decline to give a franchise, and the terminus of the line is just outside that city.

Election news was transmitted between Milwaukee and New York on the long distance line Tuesday night. Several Milwaukee telephones with metallic circuits were connected with the long distance line.

Lorenz Knoblich, an old resident of the city, was run over at the corner of Third and Cherry streets, by an electric car, last Tuesday evening, and killed.

C.

New England News.

BOSTON, November 12.—At the annual meeting of the stockholders of the West End Street Railway company last Thursday the following named directors were elected for the ensuing year: Henry M. Whitney, G. T. W. Braman, Prentiss Cummings, Eustace C. Fitz, Walter Hunnewell, Samuel Little, Theophilus Parsons, Nathaniel Thayer, Isaac T. Burr, Joseph S. Fay, Jr., Henry D. Hyde, E. D. Jordan, William Powell Mason, Dexter N. Richards, Walter S. Swan. In his address President Whitney reviewed the financial condition of the enterprise, and outlined the policy for the ensuing year. He said that nearly all the lines of the company had been rebuilt and equipped for electricity, and the construction account would hereafter decrease to very small proportions. Renewals would constitute about the only charges to the account. The company was exchanging its heavy running motors for noiseless machines and expected to have the work completed in January. The cost would not exceed $100,000, which would be charged to operating. The cost to the company for taking care of its motors was 1¾ cents per mile run, as against 3½ paid the Thomson-Houston company. In reply to a question in regard to the present development of the storage battery system, Mr. Whitney said that little advance had been made toward an entirely practical method. It was being tried in several places, but at a loss.

In the directors' report, which was submitted at the meeting it was shown that the total earnings of the road were $6,317,205 and the expenses $4,477,783, leaving a net earning of $1,839,422. The report further shows that the distribution of the earnings and expenses between the horse and electric systems for the year was as follows:

	Horse.	Electric.	Total.
Earnings	$2,953,894	$3,363,310	$6,317,205
Expenses	2,459,155	2,019,627	4,447,783
Net	$495,739	$1,343,683	$1,839,422

At the close of the year, the report says, about two-thirds of the mileage, namely, 1,000,000 miles per month, was being operated by the electric system. It is hoped that by January 1st about 200 cars will be added, bringing the electric mileage up to 16,000,000 miles per year. It is expected that the power houses will be practically completed by that time and a sufficient number of large dynamos installed to supply all demands for power. The company now owns 702 horse box cars, 577 electric cars (455 long and 122 short), 524 open horse cars and 451 open electric cars (47 long and 404 short), 3 754 horses and 247,832 miles of track. It ran 17,498,660 miles during the year, carried 126,210,781 passengers and made 2,259,858 round trips with its cars. The net addition to the company's real estate for the year has aggregated $692,249.69, while the horse car account has been reduced $339,688. The electric car account has increased $98,777.90, and the charges for the electric line equipments have amounted to $376,389.59. The net increase in the power station equipment has been $952,-359.60.

Treasurer Goodspeed, in his report, gives the balance sheet of the company. This shows the assets and liabilities of the company in comparison with last year as below:

ASSETS.

	1892.	1891.	Inc.
Construction	$5,920,586	$5,516,994	$ 403,592
Real Estate	7,312,904	6,650,564	692,340
Equipment	556,317	458,139	98,228
Horses	505,036	910,664	*407,628
Cars	919,130	1 258,818	*339,688
Electric cars	3,238,228	1,396,929	1,841,209
Electric equipment	973,438	597,018	376,420
Car horse and shoe equipment	99,990	....	99,990
Power station equipment	1,441,042	488,682	952,360
Cash assets	1,607,971	2,704,052	*1,096,081
Total	$22,603,240	$19,981,982	$2,621,258

LIABILITIES.

	1892.	1891.	Inc.
Common stock	$9,085,000	$7,147,100	$1,947,900
Preferred stock	6,400,000	6,400,000	....
Stock subscriptions	....	12,250	*12,250
Funded debt	4,265,000	4,272,000	*7,000
Notes and accounts	2,516,955	1,945,971	570,984
Profit and loss surplus	336,285	214,661	121,624
Total	$22,603,240	$19,981,982	$2,621,258

*Decrease.

The directors consider this an excellent showing, and the stockholders expressed their satisfaction over the reports and indorsed the management.

The Highland Electric company has been organized at Portland, Me.

Preston H. Carr, formerly with the Thomson-Houston company, has accepted a position as chief in charge of the installation of the new electrical plants of the New England Engineering company at Waterbury.

H. D. Rodgers, for three years assistant to H. G. Reist, of the Thomson-Houston works, has entered the service of the Eddy Electric company.

Rubber manufacturers of New England, who have gotten their business into such shape that they can isolate the different parts of their plants and be able to run one department while another is shut down, are getting interested in electric motors as the ideal power for their purpose.

The Massachusetts State Assembly of the Knights of Labor has taken under consideration the needs of the present system of street car propulsion and suggests that each car be equipped with a number of pairs of rubber gloves with which the employes may handle live wires. The assembly also decided to petition the next legislature for such laws as will compel electric roads to adopt this measure, and to have a first-class electric gong attached to each car.

An exhibition of a new system of street car propulsion by electricity was given in Salem recently. It is the invention of E. H. Brown and is an underground or closed conduit system. A center track, with 8 foot iron rails, carries beneath it the feed wire. Beneath each iron rail is a plate in a hermetically sealed box attached to the feed wire. Two electro magnets beneath the car on passing over this raise the plate and complete the connection, thus causing the railabove to become alivethe current pass ing through the motor and the return being through the rails. The system worked satisfactorily upon the model shown.

A scheme is being developed to utilize the falls of the Androscoggin river above Brunswick, Me., to generate electricity to drive motors in Bath. The falls will furnish 6,200 horse power.

The Washburn & Moen company, of Worcester, will light their new mill by electricity. They will use the Westinghouse system and will operate 600 lights.

The union by electric road of Haverhill, Amesbury and Merrimac, Mass., was celebrated by a grand reception. Streets were decorated and there was a general holiday in three places. This road practically makes the three thriving towns one community.

A project is being considered for the consolidation of all the electric roads in the Connecticut valley. The idea is to build a section of track to join Chicopee and Holyoke and then extend the line up the river to Northampton. The suburbs would be reached by branches, and such towns as Wakefield and Thompsonville would be connected from Springfield. South Hadley could be reached from Holyoke and Amherst and Easthampton from Northampton, with a proposed line to Williamsburg if needed. Only about 15 miles of new track would be required and the estimated cost of the whole enterprise is $300,000. There is strong ground for believing that the Springfield and Holyoke street railways will unite shortly.

The new Britain, Conn., Tramway road has been pur-

chased by capitalists who propose to equip it with electricity.

The Edison Electric Illuminating company, of Boston, has its new dynamos in the Atlantic avenue station connected with the street mains. It now has two engines and four dynamos running, operating about 600 lights.

Springfield, Mass., had its first electric fatality recently. Peter Berthianme, a lineman for the United Electric Light company, was killed while making a cutout at the top of a high pole. He grasped both ends of a live wire and received 2,000 volts. As he fell he cleared the wires, but caught on a pin and hung there head downward for half an hour before he could be reached.

The new electric plant of the Clark thread mill at Westerly, R. I., is in operation.

Swan & Lane, electrical engineers of Boston, superintended the wiring of the Augusta, Me., opera house. They also have the contract for a 300 light Jenney plant for the Mt. Battie woolen mill of Camden, Me.

The new factory for the Hopedale Electric company, of Milford, Mass., is to be of wood, extra large framing, set on granite piers, and is to be 180 feet long, 100 fee wide and two stories high.

New England people are much interested in the new long distance telephone connections between the east and the west. The establishment of the line for commercial purposes between New York and Chicago has been closely watched. During the progress of the work President Bein, of the New England Telephone and Telegraph company has conversed with the different points reached through the New York office. At the recent experimental test he talked with the Chicago terminus, each word being distinctly heard, notwithstanding the fact that the Boston and New York offices are connected by an old No. 12 wire, while a No. 8 of very superior quality runs between New York and Chicago.

Dedham, Mass., has voted to allow the trolley system.

An electric road from Bradford, Mass., to run through Groveland and Georgetown to West Newbury will soon be put through if a charter can be obtained. At the latter place it will connect with the People's railroad and will thus make a through line from Bradford to the sea.

A cotton manufacturer near Norwich, Conn., is to build an electric line from the railroad station to his mills, a distance of 1¼ miles, for the purpose of handling the freight cars that he now has to take care of by horses. To do this an electric locomotive of large capacity will be bought.

J. C. E.

Northwestern Notations.

MINNEAPOLIS, November 12.—L. J. Cook of Tacoma is experimenting with an electric street railway which he claims will be operated at a speed of 200 miles per hour. He has a track on the water front in the form of an ellipse. Posts twelve feet high have a track on top and on the sides. The cars hang from the track at the top. They get partial support and receive motive power through large wheels resting on the rails.

A. B. Robbins has asked the court for an injunction restraining the Northern Car company from disposing of five promissory notes for $5,000 which he gave in payment for $25,000 worth of stock. He claims the notes were given on condition that the company rebuild its factory at Robbinsdale, where he had large land interests that would be enhanced.

An electric light repairer named Johnson was knocked senseless while trimming a lamp in a Superior clothing store.

The report of the Minneapolis building inspector for the ten months of 1892 showed that permits had been taken out for electric wiring to cost $143 934.

The Citizens' Electric company at Rat Portage has started up its new dynamo, giving the station a capacity of 2,000 lights. The company is rushed with the work of putting in lights. The contractor who first put up the station was so slow that the company took the work in its own hands, and the contractor is trying to collect the balance on contract which he claims he is entitled to.

The putting in of the electric light plant at Fairmount, Minn., has been delayed by the non arrival of the poles.

The Electric Light company at Grafton, N. D., proposes to enlarge its quarters so as to get more room to operate arc machinery.

The new electric light station at Northfield, Minn., is nearly completed.

The impression prevails at Grand Forks, N. D., that the electric railway scheme has fallen through.

The East Sioux City & Morning Side Electric Light, Heating & Waterworks company, which proposes to make extensive improvements in the eastern part of the city, will be incorporated by E. C. Peters, John J. Roche, James A. Jackson, F. M. Ferris, D. T. Hedges and T. Evans.

A couple of Grand Forks; N. D., doctors boast the biggest electric battery in the Northwest, having 60 cells and a capacity of 90 volts.

The jury in the suit of B. J. Benson against the Minneapolis Street Railway company for $25,000 damages has disagreed.

The Lakeside electric car line at Duluth is expected to be ready for operation December 1st.

The citizens of Butte, Mont., are highly pleased with the working of their electric system. The lines cover completely the city and the outlying mining districts.

It is not very probable that the proposed electric line up the 3E hill East End, Duluth, will be built very soon. The grade is very heavy.

H. C. C.

PERSONAL.

Secretary A. H. Pease of the Hart & Hegeman company of Hartford, Conn., is receiving congratulations on the arrival of an heir.

M. J. Sullivan, publisher of the *Street Railway Gazette*, Chicago, who has been suffering from a painful illness, is about again, much to the delight of his friends.

B. J. Arnold, consulting engineer of the General Electric company, Chicago, recently met with a bereavement in the death of his father. Mr. Arnold's many friends are extending their sympathy.

J. A. McLure, who has been until recently superintendent of construction for the Short Electric company, Cleveland, O., has accepted a position in the engineering department of the Siemens & Halske company. Mr. McLure is an experienced engineer, and no doubt will prove a valuable acquisition to the new company.

NEW INCORPORATIONS.

Crodus Electric company, Milwaukee, Wis., capital stock; $70,000; manufacturing electric works; Thos. K. Ewing, Milwaukee, Wis.

Crown Electric Manufacturing company, Elgin, Ill.; capital stock, $25,000; manufacturing electrical and metal goods; J. H. Williams, Elgin, Ill.

Holly Electric Light Power company, Holly, Mich.; capital stock, $10,000; furnishing light and power by electricity; C. F. Collier, Holly, Mich.

Vibrating Electric Gold Trap company, Denver, Colo.; capital stock, $400,000; manufacturing, leasing or renting machinery for extracting or saving metals from ores, etc.

Canton Electrical company, Canton, Ohio; capital stock, $10,000; manufacturing and dealing in electrical machines and appliances, etc.; F. E Case, Canton, Ohio.

Elwell Sliding Blind company, Berwick, Me.; capital stock, $200,000; to manufacture and deal in mechanical, electrical and other devices; Harry V. Moore, Berwick, Me.

Newark & Granville Electric Light company, Newark, O.; capital stock $15,000; furnishing electric light, heat and power in Newark and Granville; William E. Miller, Newark, Ohio.

Marietta Electric Light, Heat & Power company, Marietta, O.; capital stock, $30,000; producing and supplying electric light, heat and power, constructing street railways, etc.; W. G. Way, Marietta, O.

Creston Gas & Electric company, Creston, Iowa; capital stock, $100,000; to acquire, control and operate gas and to manufacture gas for illuminating purposes; Jones & Hovey, Independence, Iowa.

Gillett Electric company, Red Bank, N. J.; capital stock, $250,000; to manufacture and construct mechanical and electrical machinery, instruments, appliances and apparatus; Thos. Davis, Jr., Red Bank, N. J.

Taylor, Goodhue & Ames, Chicago, Ill.; capital stock, $50,000; to manufacture, buy and sell appliances for electrical and general merchandise purposes; Taylor, Goodhue & Ames, 827 Monadnock block, Chicago, Ill.

Missoula General Electric company (incorporated in Montana), St. Paul, Minn.; capital stock, $200,000; general electric business, with plants in Missoula county, Mont.; H. W. Turner, agent, Helena, Mont.

W. H. Gordon company, Chicago, Ill.; capital stock, $10,000; manufacture, patent, construct and sell all kinds of machinery, electrical equipments, etc., etc.; Francis W. Parker, 1007 Opera House building, Chicago, Ill.

General Electric company of Yucatan (incorporated in West Virginia), New York, N. Y.; capital stock, $1,000,000; furnishing electric light and power in the state of Yucatan, Mex.; D. M. Mensante, 36 Broadway, New York, N. Y.

Clear Lake & Russian River Railway & Navigation company, Lakeport, Cal.; capital stock, $500,000; to construct, operate and lease electric or steam railway in Lake and Mendocino counties, length 20 miles; William Biggerstaff, Lakeport, Cal.

Lyman, Fuller & Pest company, Baltimore, Md.; capital stock, $10,000; to buy and sell lands. to loan money, to build turnpike and plank roads and operate same and owning and operating railways moved by horse or electricity ontside the limits of Baltimore.

Mutual Register Company, Jersey City, N. J.; capital stock, $50,000; manufacturing, selling, using and leasing electrical and other machines for the purpose of registering tickets or other memoranda, and keeping a record of the same; Cardozo Bros., 96 Broadway, New York N. Y.

Berkeley Springs Water Works & Improvement company, Berkeley Springs, W. Va.; capital stock, $50,000; erecting and running water works and electric light plants, acquiring rights, privileges and franchises for supplying persons, firms and corporations with water and light; J. Hammond Siler, Berkeley Springs, W. Va.

ELECTRIC LIGHTING.

The city of Washington, Ind., has contracted for 108 arc lights.

The erection of an electric light plant at Jellico, Tenn., is talked of.

Search-lights operated by a threshing engine formed a portion of a recent political parade in Youngstown, O.

The citizens of West Point, Ga., will vote upon a proposition to issue $20,000 of bonds for waterworks and electric light plant.

The electric light company of Decatur, Ill., will erect a power house at the corner of North Edward and West Cerro Gordo streets.

At present there is an extraordinary activity in the fitting up of electric lighting installations in the shops and private houses of Madrid, Spain.

A tunnel 200 feet long is being constructed by the Redlands, Cal., Electric Light & Power company, in which to convey water to the power house.

The Holly, Mich., Electric Light & Power company has been granted a ten year franchise for operating an electric light plant. It will light the streets of the town.

The Oconomowoc, Wis., council has passed a resolution authorizing the mayor to make a contract with the Oconomowoc Electric Lighting company to light the city by electricity for a period of ten years.

Officers of the General Electric company say they have moved for an injunction restraining the Sawyer-Man company from manufacturing incandescent lamps, says the *Wall Street Journal* in a recent issue. They have already secured an injunction against the United States Electric Light company. The policy of the General Electric company with respect to competitors has not been outlined further than a determination to compel them to vacate the field as ordered by the court. Questions for damage for infringement are considered secondary. The company's officers are not inclined to discuss the new Westinghouse lamp, owing to the limited data available relative to its construction. However, they say that it must differ in more particulars than that of a 'glass stopper" in order not to be an infringement.

Two electricians, writing to an English electrical journal, claim to have produced electric "sky signs." They tell the story as follows: On Thursday night, October 6, 1892, from the grounds of the camp of the "Buffalo Bill's Wild West," we succeeded in placing the luminous letters "B U F" on the clouds, which letters were seen by hundreds of people, and from a good number of whom we received congratulations on having accomplished this surprising scientific feat. From that date to the present time we have frequently repeated the experiment, and have placed Colonel Cody's portrait, not only on the clouds, but also on artificially made clouds, and on a secondary beam of light as a background. These experiments have been witnessed by hundreds of people, and were carried on under the auspices of Colonel Cody (Buffalo Bill) and Edward Curtice, whose invention we were engaged in developing.

ELECTRIC RAILWAYS.

The construction of an electric railroad in Jackson, Tenn., is probable.

A company has been organized to build an electric railway at Guthrie, Oklahoma.

A power house 170 by 50 feet is being constructed for the new electric street railway at Newport, Ky.

Delaware, O., has an electric street railway system. Brill cars and Westinghouse generators and motors are used.

The Tramway company of Denver has been granted a permit to build its new electric line on Platte street.

The Carbondale Traction company has obtained a franchise for constructing and operating an electric railway at Archbald, Pa.

The Prospect Heights Street Car company is seeking to obtain a franchise to build and operate a street railway at Averyville, Ill.

The 'L" road company has taken steps to condemn property for the right of way to extend the Armourdale electric line in Kansas City.

The power house of the Beatrice, Neb., Rapid Transit company was destroyed by fire recently. The loss was $8,000, partly covered by insurance.

At Denver, Colo., the city council has granted the Metropolitan railway company extensive right of way for double track electric railway purposes.

The Wyandotte Street Railway company of Kansas City, Mo., is to be granted a restricted franchise to operate an electric street railway on Wyandotte street.

The Atlanta, Ga., and East Lake electric railway, for which franchise has been granted, will, it is stated, be built

by Henry Lanier and his New York associates. The road may be operated by the storage battery system.

The electric light commissioners of Lansing, Mich., have offered the company owning the electric light plant in that city $55,000. The equipment is said to have cost $50,000, and if the offer is refused the city may erect a new plant.

At Atlanta, Ga., the Metropolitan Railway company's holdings have been sold at receiver's sales to H. H. Atkinson, representing the Old Colony Trust company at Boston, which held the bonds. The price paid was $121,000.

TELEGRAPH.

It is said that the recent issue of additinnal stock by the Western Union company is for the purpose of buying the telegraph lines of Canada.

General Greely has given some new information as to the facility and speed with which temporary field lines may be constructed and operated, mentioning the fact that a corps working for the international boundary commission set up, operated and took down a telegraph line thirty-five miles long in three days.

MISCELLANEOUS.

The Gaynor Electric company has been given judgment for $3,066.67 against the city of Lincoln, Neb.

The General Electric company is said to be contemplating the distribution among its stockholders of $2,500,000 of treasury securities.

The Mather Electric company lost a 100 horse power generator in the Milwaukee fire. The machine was in the Northwestern freight house, awaiting delivery.

The London *Daily Telegraph* recently had a long article on electrical omnibuses, and announced that Radcliffe Ward's 'buses may be expected to be running in London within a fortnight.

The number of students of electrical subjects entered at Cornell University has increased from 28 in 1884 to 230 in 1892, and in several other institutions the proportionate increase is even greater.

Gustave Trouve has just finished a commission for an electric fountain at Craig-y-Nos, the Welsh mountain home of Madame Patti-Nicolini. The basin of the fountain is 20 feet in diameter, and the jets are illuminated by four 200 candle power incandescent lamps. The light is projected on the jets by means of four parabolic reflectors under the glass-covered chambers, from which the water springs. The tints are given to the light by interposing colored glasses arranged on two superposed disks, concentric or otherwise, which are turned in the same or opposite directions with equal or unequal velocities by means of a small water wheel. By this means the play of color on the water can be diversified like that of the kaleidoscope. Each of the lamps consume six amperes at 110 volts. There is also a brilliant search light on the tower at Craig-y-Nos, which is brilliant enough to be seen fourteen miles away. Craig-y-Nos has now the right to be called a veritable electrical palace.

TRADE NEWS.

The National Electric Construction company, of Eau Claire, Wis., has opened a branch office at 620 Atlantic avenue, Boston, with H. F. Holland as general manager.

The Love Traction company has opened a temporary office at 1939 Fourteenth street, Washington, D. C., with Messrs. Wheeler and Love in charge. These gentlemen are building a line six miles in length to connect with a suburban trolley system that could not get a franchise to bring overhead wires down town. Several other contracts have been signed, making about 30 miles of this system that will be in operation within six months from date.

The Waddell-Entz company, New York, reports a very brisk business. During the past two months it has shipped a number of motors and direct driven slow speed generators for electric lighting and power service to several manufacturing concerns in Buffalo, N. Y. This company recently installed two ventilating sets on the United States naval practice vessel Bancroft, now at Elizabethport, N J.

A conspicuous object of interest to people walking or driving along Michigan avenue in the vicinity of Twelfth street, Chicago, is a huge reel mounted on a flat car standing on the Illinois Central tracks. This reel is 7½ feet in diameter and 6 feet wide, and upon it is wound 4½ miles of armored submarine Kerite cable, made especially for the city of Chicago, in one piece, and is to be placed in the tunnel 90 feet under the bed of Lake Michigan to supply current to the new waterworks crib.

Boiler incrustrations are not only a source of incouvenience and danger, but of expense to the steam user. To prevent or remove them has been the object of numberless mechanical and chemical devices. There are many mechanical methods of ridding waters of impurities, but for the vast majority of boilers a simple scale preventive added to the water will answer perfectly. It is stated, though, that by the use of Fluoride boilers may always be kept clean, the generation of steam is not impeded, fuel consumption is reduced, and interruption to service avoided. The call for this purifier has increased so rapidly that arrangements are now being made to extend the business in the near future. The American Fluoride company of New York has its main office at 126 Liberty street and its western office at 73 and 75 West Jackson street, Chicago.

The Siemens & Halske Electric company of America has established an office in Cincinnati to have charge of a territory known as the central district, with Markle & Harnish, managers. This department will cover Michigan, Ohio, Indiana, Kentucky, Tennessee, North and South Carolina, Georgia, Florida and Alabama. John R. Markle is well known to the trade through his connection with the Markle Engineering company and other business enterprises during recent years in Detroit. Mr. Markle was also one of the early representatives of the Edison company in the West, the claim being made that he sold the first isolated plant in Chicago and installed it in the old Norton mill at the Madison street bridge. He also claims to have sold and installed the first plant in Michigan—at Luddington. Mr. Harnish has been, until a recent date, president of the Peninsular Electric company, of Grand Rapids, Mich. These gentlemen are both capable and experienced business men, and will undoubtedly prove worthy representatives of this new competitor for the electric business of this country.

BUSINESS.

The New York Insulated Wire company, New York, reports an increasing demand for Grimshaw white core wire. A large proportion of the recent shipments was for western concerns.

William Stanley, Jr., of the Stanley Electric company, Pittsfield, Mass., has just completed the plans for a residence to be built upon the property recently purchased on Dawes avenue. The house will cost about $20,000.

The Franklin Electric company, New York, expects to move into its own factory before the end of six months, and it has recently increased its working force. Prof. F. K. Irving of the company has just completed a new electrical theatrical novelty.

The Ries Electric Specialty company of Baltimore, Md., is sending to the trade a pamphlet entitled "The Ries Regulating Socket, the Missing Link in Electric Lighting." This little book gives answers to the questions one would naturally ask about the Ries socket.

A. M. Morse & Co., contracting engineers, Commercial building, St. Louis, Mo., have closed contracts during the past month for a number of Buckeye engines, boilers and complete power outfits for central plants at Monticello, Ind., Spring Valley, Ill., Fulton, Mo., Springfield, Mo., and Kansas City, Mo.

The Electric Appliance company, Chicago, has just closed arrangements with the Whitney Electrical Instrument company of Boston, to handle its test instruments in the West. The Whitney company has already established a reputation. The Electric Appliance company will carry a large and complete stock for the West.

The Electrical Supply company, Chicago, has received a letter from James I. Ayer, general manager of the Municipal Electric Lighting & Power company, St. Louis, in which he says that the "Shield brand wire recently purchased has a tough and well-made insulation, which I believe will prove entirely satisfactory. It is of a superior quality, and much better than many of the various brands commonly classed or grouped as 'weather-proof' to distinguish them from rubber covered."

Chas. F. Beach, Jr., 35 Wall street, New York, railway and corporation attorney, has recently issued a very comprehensive little pamphlet entitled "Railway Federation, the Proposed Railway Trust," which has received many complimentary notices for its concise and terse manner of treating the subject. Mr. Beach is very busily engaged in matters pertaining to street railway properties. He has also recently made a special department ine his office for the negotiation and sale of issues of street railway bonds.

The house of Waterhouse Bros., Hartford, Conn., manufacturers of arc lamps, is now to be known as Waterhouse, Gamble & Co., with James N. Gamble of Cincinnati, well known through his connection with the Proctor & Gamble company, and Wm. T. Partridge of New York in the firm. This company has extensive works in Hartford which afford it good facilities for manufacturing interchangeable arc lamps for either incandescent or arc circuits. The company will have offices in New York at 45 Broadway.

The Massachusetts Electrical Engineering company, through its western representative, Philip Harvey, has secured the contract to design the plant of the recently incorporated Oconomowoc Electric Light company. It is the intention of the company to make this station one of the most complete in the state. It will not only light Oconomowoc, but will furnish lights for the neighboring residences and summer resorts. This is only one of the contracts that Mr. Harvey is engineering, and the outlook of this company for business in the West is most encouraging.

ELECTRICAL PATENTS.

Issued November 8, 1892.

485,615. Manufacture of Carbon Filaments. Thomas A. Edison, Llewellyn Park, N. J.

The method consists in suspending filaments of carbonizable material in a closed chamber out of contact therewith, suspending weights upon the filaments, and heating the chamber to a carbonizing heat.

485,616. Manufacture of Carbon Filaments. Thomas A. Edison, Llewellyn Park, N. J.

485,617. Incandescent Lamp Filament. Thomas A. Edison, Llewellyn Park, N. J.

485,618. Apparatus for and Process of Refining Copper by Electricity. Franklin Farrell, Ansonia, Conn.

The impure copper plates are wholly submerged in an electrolytic bath, a free circulation of the bath being provided around and in contact with the top, bottom and sides of the plates; a current of electricity is passed through the plates in series, thus forming, by electro-deposition, plates of refined metal, the bearing surfaces of the refined plates being formed upon and supported by the devices which support the impure plates.

485,619. Rheostatic Controller for Electric Motors. Jonathan P. B. Fiske, Lynn, Mass.

The electric motor is reversed by establishing a shunt circuit around its field magnet and armature, reversing their relative connections while such shunt circuit exists and then interrupting the shunt circuit.

485,620. Electric Motor Controller. Jonathan P. B. Fiske, Lynn, Mass.

The controller consists of a resistance, a permanently closed continuous circuit including in series the resistance and the field magnet and armature of the motor, and a rheostatic switch having connections to said resistance and motor.

485,643. Switch-board for Electric Light Circuits. John J. Moore and Catharine M. Henry, administratrix of Dorwin A. Henry, deceased, New York, N. Y.

485,645. Electric Lock. James D. McAulis and Harvey E Fleming, Beaver Falls, Pa.

485,647. System of Lighting Railway Cars and Platforms. Danton H. Nichols, Boston, and Charles L. Cotton, and Charles A. Cotton, Dedham, Mass.

485,658. Electric Transmission of Power. Edwin W. Rice, Jr., Lynn, Mass.

Two sets of mains are provided, one to supply current to a constant current motor, which brings an alternating current motor up to the proper speed, the alternating current motor being supplied from a separate set of mains. When the alternating current motor has been brought up to speed the constant current motor is disconnected from the constant current mains and acts as a dynamo driven by the alternating motor to excite the fields of the alternating current motor.

485,659. Electric Transmission of Power. Edwin W. Rice, Jr., Lynn, Mass.

The invention is a modification of the foregoing, in which switching devices are provided so that one set of mains may be used to supply both motors.

485,668. Electric Railway Switch. Charles A. Stone and Edwin S. Webster, Boston, Mass.

Means are provided for electrically controlling the track switches directly from the moving car.

485,669. Continuous Current Transformer. Elihu Thomson, Swampscot, Mass.

The field magnet is supported upon a stationary shelf within the armature, which is of the Gramme ring type and supported upon a sleeve adapted to be rotated.

485,682. Incandescent Electric Lamp. Augustus Carey, Lake Pleasant, Mass.

Couplings between the leading in wires and the carbon filament are made by crimping a tube soldered to the filament and shipped over the end of the leading in wire.

485,728. Electric Railway Signal. Adoniram J. Wilson, Port Chester, N. Y.

485,739. Thermostat and Alarm. Gustav Fischer, Chemnitz, Germany.

485,744. Electric Arc Lamp. George Kirkegaard, Bronklyn, N. Y.

485,764. Typewriting Machine. Frank A. Heiss, Port Jervis, N. Y.

485,767. Electric Perforating Pen. Aaron D Lewis, Canton, Mo.

485,826. Voltmeter. Eugene R. Carichoff, Richmond, Ky.

Two wires of high resistance are held parallel to one another throughout a portion of their length, and twisted together beyond these portions; a pointer is connected with them at the parallel portion and is adapted to be moved by the untwisting of the wires due to expansion.

485,841. Method of Magnetically Separating Ores. Thomas A. Edison, Llewellyn Park, N. J.

The method is adapted for treating ores containing magnetic oxide of iron and magnetic pyrites. The ore is first concentrated and then passed through a magnetic separator of such strength that, due to the difference in magnetic properties of the oxide of iron and pyrites, the oxide of iron particles will be separated out.

485,842. Method of Magnetic Ore Separation. Thomas A. Edison, Llewellyn Park, N. J.

485,859. Telephony. William Bruening, East Orange, N. J.

The apparatus consists of a closed hollow vessel containing a fluid and provided with dashers, which are held movably in contact with the fluid, one of the dashers being provided with a spring and each of the others with a diaphragm.

485,876. Telephone. James W. McDonough, New York, N. Y.

A vibratory plate has electric conductors arranged parallel to one another over the whole surface of the plate, the conductors being vibratory to impart a vibratory action to the plate.

485,895. Electric Arc Lamp. James R. Steers, New York, N. Y.

Each carbon is attached to a rack by means of which the carbons may be automatically fed toward one another to maintain the arc in a fixed position.

485,919. Manufacture of Mandrels for Electrolytic Deposit of Tubes. Francis E. Elmore, Leeds, England.

The mandrels are coated with easily fusible material and simultaneously polished.

485,950. Automatic Electric Scale. Paul J. Kuhbacher, Ashland, Ky.

486,029. Electric Forge. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass.

486,051. Telegraph Sounder. James Maret, Mount Vernon, Ky., and William L. De Graff, Homer, Mich.

486,054. Water Indicator for Boilers. William H. Rodgers, Bay Side, N. Y.

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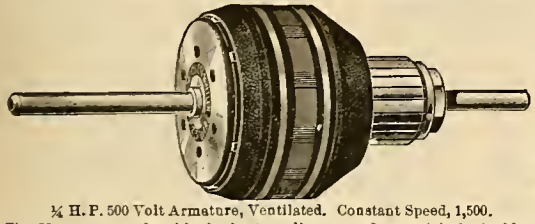

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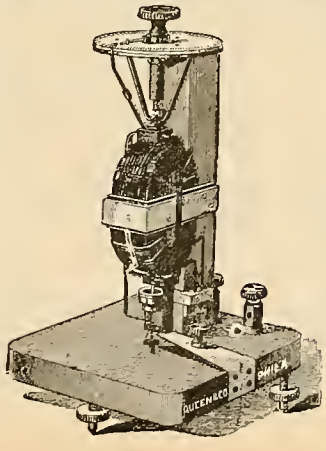

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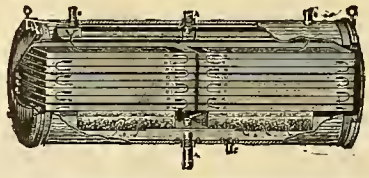

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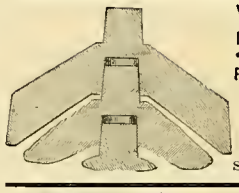

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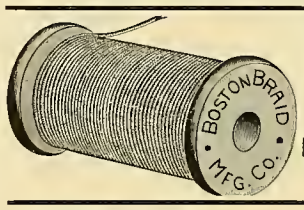

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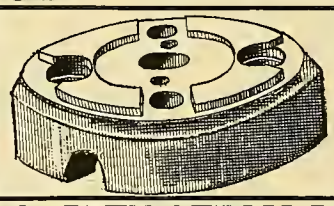

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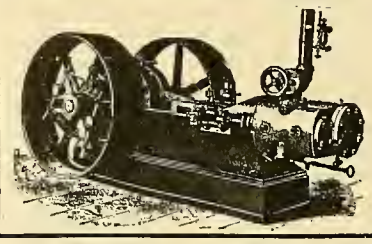

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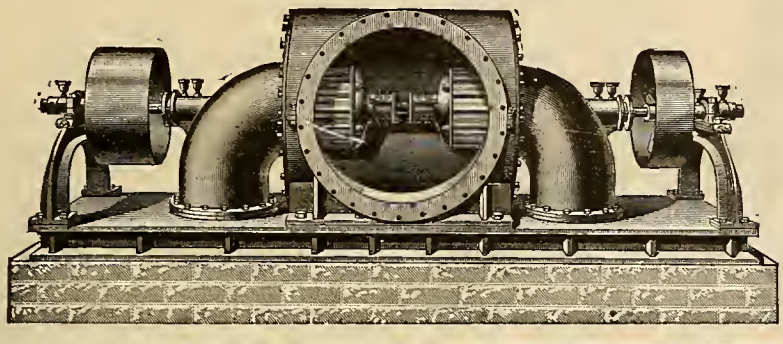

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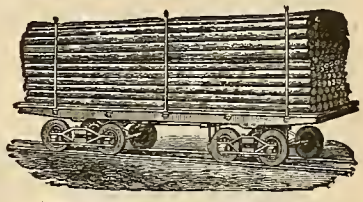

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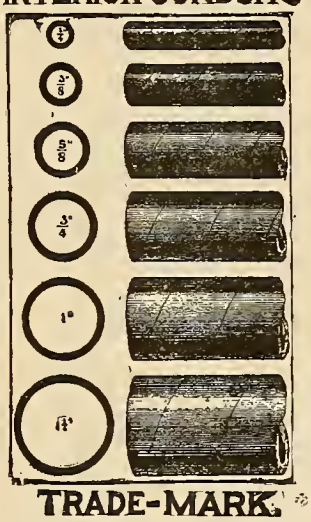

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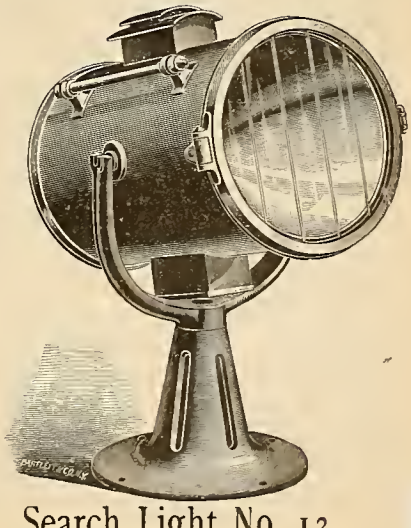
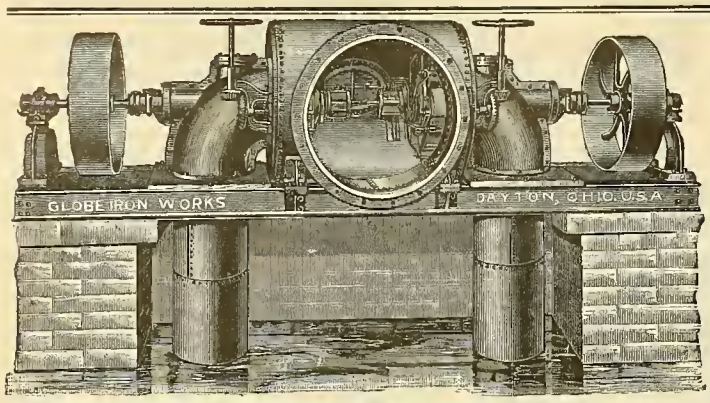


Search Light No. 13.



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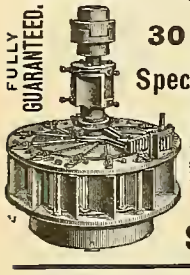

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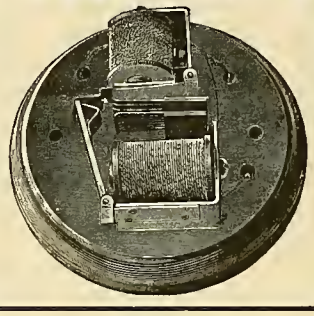

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Daily Sales of Westinghouse Engines
DURING THE MONTH OF OCTOBER, 1892.

Date.				H. P.	
1.	Phil. and Reading Terminal R. R.,	12th order,	Philadelphia, Pa.,	85	Comp.
1.	" "	13th "	" "	85	"
1.	" "	14th "	" "	85	"
1.	" "	15th "	" "	85	"
1.	" "	16th "	" "	85	"
1.	Pittsburgh Chronicle-Telegraph,	3d "	Pittsburgh, Pa.,	60	Stan.
3.	West Mich. Furniture Co.,		Holland, Mich.,	25	Jun.
3.	H. Mueller Plumbing Co.,		Decatur, Ill.,	25	"
4.	F. J. Parsons & Co.,		Nineveh Junc., N.Y.,	15	"
4.	Cochrane Chem. Co.,	3d "	Boston, Mass.,	35	Stan.
5.	Crescent Steel Co.,	6th "	Pittsburg, Pa.,	75	Jun.
5.	Pennsylvania Tube Works,		" "	75	"
5.	Dawson El. Lt. and P. Co.,	1st "	Dawson, Pa.,	75	"
5.	" "	2d "	" "	75	"
5.	" "	3d "	" "	35	"
5.	Nicaragua Eng'g Co.,		Managua, Nic.,	10	"
5.	Adam Blumer,		Monroe, Wis.,	25	Stan.
5.	Bridgeport Copper Co.,	6th (Kodak.)	Bridgeport, Conn.,	100	Comp.
5.	Westinghouse El. & Mfg. Co.,	35th order,	Pittsburgh, Pa.,	330	"
5.	" "	36th "	" "	130	"
7.	Wm. Clark Thread Co.,		Westerly, R. I.,	10	Stan.
7.	United Gas Imp. Co.,	25th "	Philadelphia, Pa.,	75	"
7.	H. J. Russell,		Tekoa, Wash.,	50	Jun.
7.	Evanston El. Ill. Co.,	5th "	Evanston, Ill.,	100	Comp
7.	J. E. Reinecker,		Chemnitz, Ger.,	85	"
7.	Yuan Boyer,		Yguniade, Spain,	45	"
7.	Yg. Y. Bertrao,		San Felice,	65	"
7.	Jose Solderlla Casas,		Balsareny,	85	"
7.	Jose Tobra,		Castellar,	200	"
8.	Rourke, Straub & Co.,		Knoxville, Tenn.,	35	Jun.
10.	Pittsburgh Reduction Co.,	5th "	Kensington Pa.,	330	Comp.
10.	" "	6th "	" "	330	"
10.	Detroit Citizens' St. Railway Co.,		Detroit, Mich.,	260	"
11.	Montgomery St. R'y.		Montgomery, Ala.,	130	"
11.	Columbian Exposition,	5th "	Chicago, Ill.,	130	"
11.	" "	6th "	" "	130	"
11.	Odd Fellows Hall,	1st "	Philadelphia, Pa.,	85	"
11.	" "	2d "	" "	85	"
11.	" "	3d "	" "	85	"
11.	First Nat. Bk. B'dg.,	1st "	Pittsburgh, Pa.,	45	Stan.
11.	" "	2d "	" "	45	"
13.	Tacony Iron and Metal Co.	1st "	Tacony, Pa.,	25	"
14.	S. D. Warren & Co.,	26th "	Yarmouthville, Me.,	85	Comp.
14.	W. G. Wildermanth,		Pomeroy, Ohio,	5	Jun.
14.	F. Glazier & Son,	2d "	So. Glastonbury, Ct.,	25	"
15.	Union Hardware Co.,		Torrington, Ct.,	160	Comp.
17.	Johnstown Pass. Railway Co, (kodak.)		Johnstown, Pa.,	330	"
17.	Rust & Mason,	2d "	Forest Mills, Minn.,	65	"
17.	Shaw Stocking Co.,		Lowell, Mass.,	10	Jun.
17.	Kalamazoo Paper Co.,	2d "	Kalamazoo, Mich.,	75	"
17.	Unknown,	order,	Moscow, Russia,	35	Jun.
17.	"		" "	25	"
17.	Unknown,		" "	15	"
17.	"		" "	35	Stan.
17.	"		" "	25	"
17.	"		" "	15	"
18.	O. B. Shallenberger,		Rochester, Pa.,	15	"
18.	Irvin Van Wie,	9th "	Syracuse, N. Y.,	15	"
18.	R. D. Nuttall & Co.,	2d "	Allegheny, Pa.,	15	Jun.
20.	Fontaine Crossing Co.,	8th "	Detroit, Mich.,	5	"
20.	Roberto Law,	4th "	Monterey, Mexico.	5	Stan.
22.	Standard Oil Co.,	3d "	Bayonne, N. J.,	35	"
22.	Hoyle, Harrison & Kaye,		Philadelphia, Pa.,	25	"
22.	Alex. McLaren,		Osceola, Ont.,	50	Jun.
24.	E. B. Hillman & Co.,		Kahoka, Mo.,	50	"
25.	Spreckels Sug. Ref'y.,	64th "	Philadelphia, Pa.,	75	Stan.
25.	" " "	65th "	" "	100	"
25.	" " "	66th "	" "	100	"
25.	" " "	67th "	" "	100	"
25.	" " "	68th "	" "	100	"
25.	Otis Falls Pulp Co.,	2d "	Otis Falls, Me.,	5	"
25.	Charleston Gas and Electric Co.,	2d "	Charleston, W. Va.,	330	Comp.
25.	Rob't Mitchell Furn. Co.,		Cincinnati, Ohio,	50	Jun.
26.	Long & Marvin,		Glenville, Minn.,	35	"
26.	William Knight,		Chicago, Ill.,	35	Stan.
26.	Tacony Iron and Metal Co.,	2d "	Tacony, Pa.,	10	"
26.	Justice, Bateman & Co.,	2d "	Philadelphia, Pa.,	15	"
27.	Moore, Arms & Thompson,		Bellows Falls, Vt.,	75	"
28.	Balt. Elec. Refin. Co.,	51h (kodak)	Baltimore, Md.,	100	Comp.
29.	Balt. Traction Co.,	(kodak)	" "	260	"
29.	Penoles Mining Co.,		Mapimi, Mex.,	10	Jun.
29.	Ott, Mergenthaler & Co.		Baltimore, Md.,	50	"
31.	Globe Furniture Co.,		Northville, Mich.,	75	"
31.	Cohannett Mills,		Taunton, Mass.,	5	Stan.
31.	Gaiety Bijou Theatre,		Boston, Mass.,	5	"
31.	Niag. Falls Paper Co.,		Niagara Falls, N.Y.,	35	"
31.	Waters-Pierce Oil Co.,		St. Louis, Mo.,	50	Jun.
31.	Colum. Exposition,	7th order,	Chicago, Ill.,	330	Comp.
31.	" "	8th "	" "	330	"
31.	Unknown,		St. Louis, Mo.,	50	Jun.
31.	Westinghouse Machine Co.	19th "	Pittsburgh, Pa.,	25	"
31.	Kahn, Lang & Co.,		Epinal, France,	65	Comp.
31.	Monongahela Furnaces,	1st "	McKeesport, Pa.,	5	Stan.
31.	" "	2d "	" "	5	"
31.	Carnegie Steel Co.,	16th "	Pittsburgh, Pa.,	5	"
31.	Allegheny Co. Lt. Co.,	54th "	" "	5	"
31.	" "	55th "	" "	5	"
31.	Otis Falls Pulp Co.,	3d "	Otis Falls, Me.,	5	"

SUMMARY.

33 Compound Engines,	aggregating	6185 H. P.
35 Standard "	"	1180 "
30 Junior "	"	1160 "
TOTAL, 98 ENGINES,	aggregating	7525 H. P.

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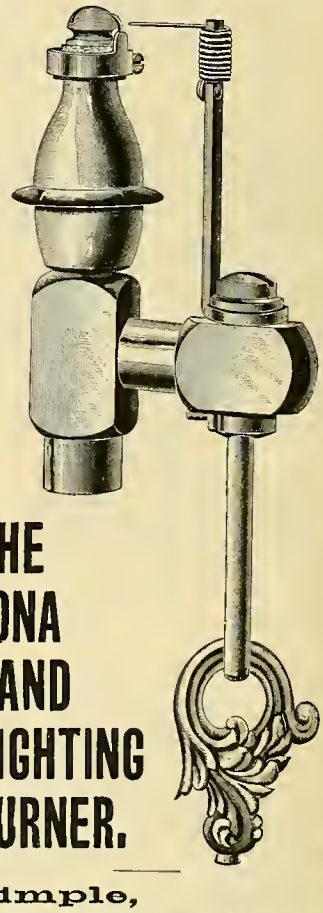

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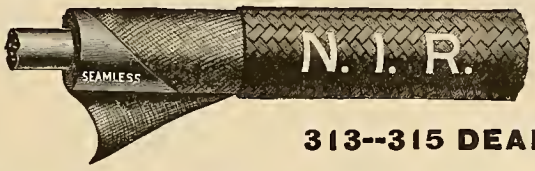

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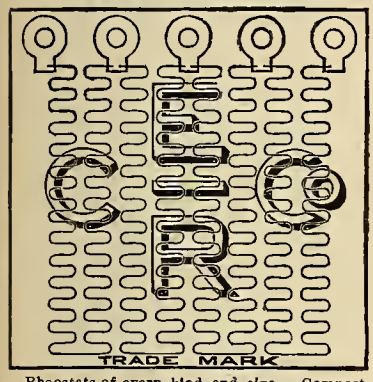

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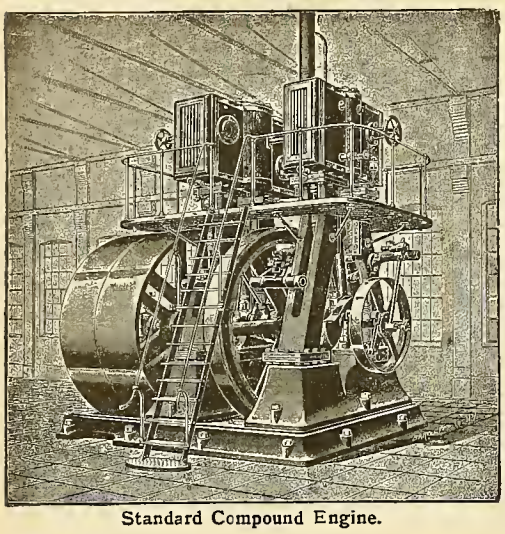

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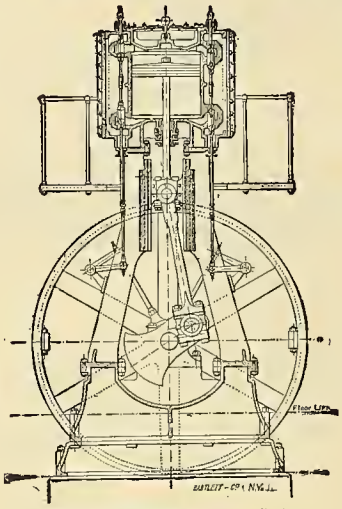

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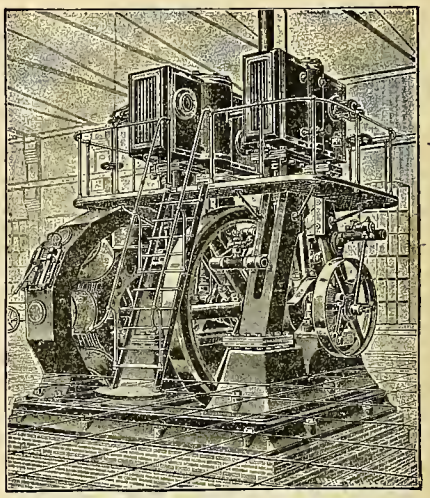

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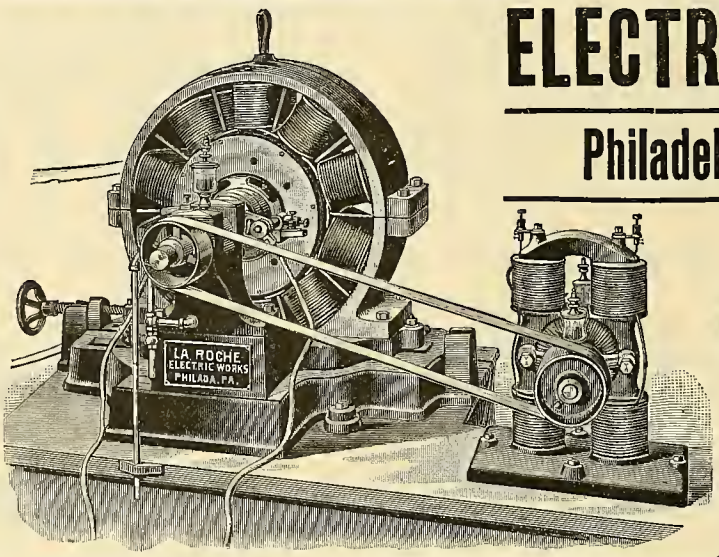

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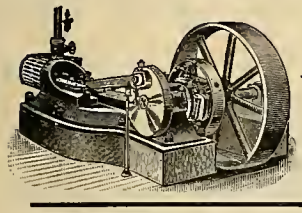

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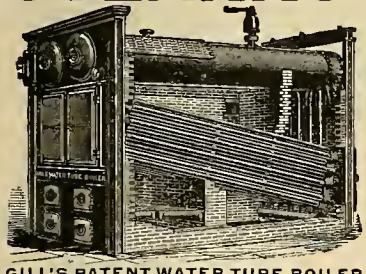

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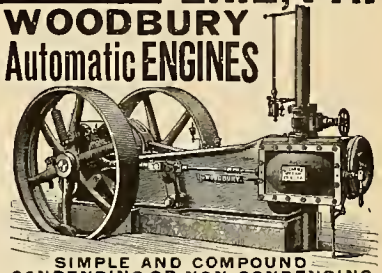

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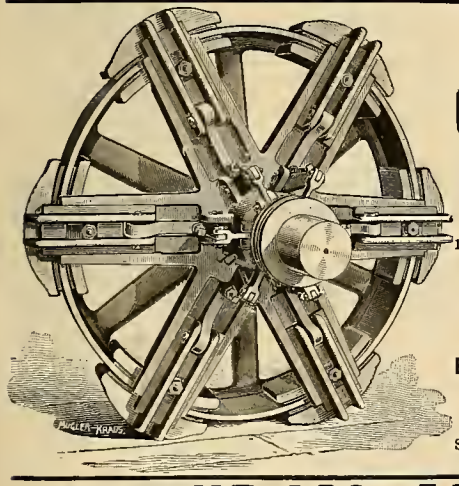

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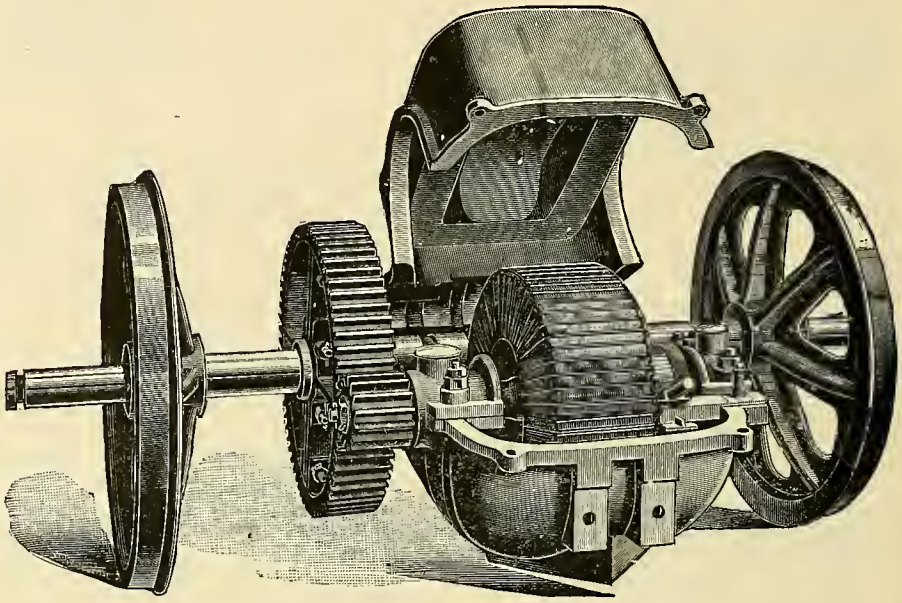
The W. P. Iron-Clad Motor

Has undergone the most stringent tests possible, and has fulfilled the most rigid requirements of Street Railway Service.



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For Alternating Currents, for the States of

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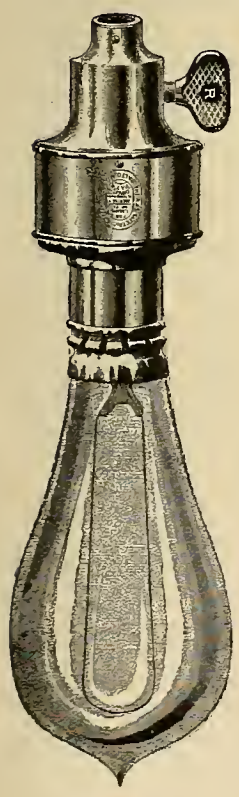

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Further particulars and prices upon application.

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The manufacturers of Shield Brand have never felt the necessity of bolstering up the reputation of their wire by claiming that it was "just as good as 'some other.'"

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3

4

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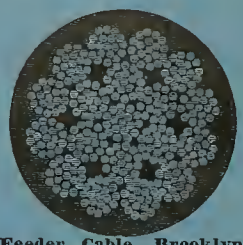
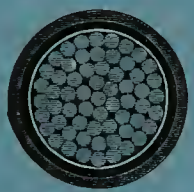
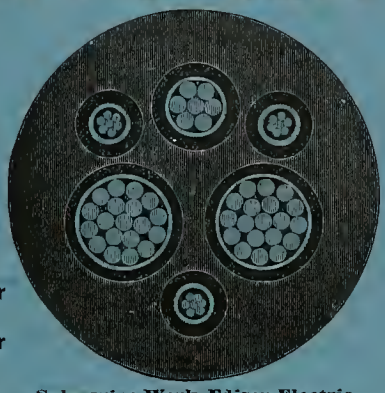

Feeder Cable, Brooklyn Edison Electric Light Co.

Underground Core, N. J. Central R. R.


Feeder Core, Broadway Theater.


Submarine Work, Edison Electric Light Co., Easton, Pa.

Naval Core, United States s. s. "Chicago."

Portable Cable, Broadway Theater.

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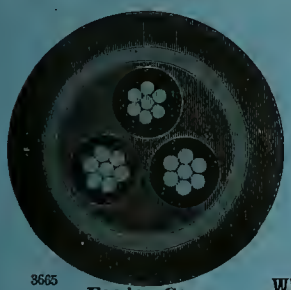
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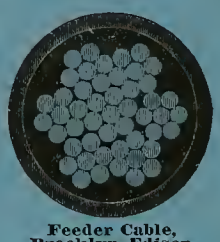
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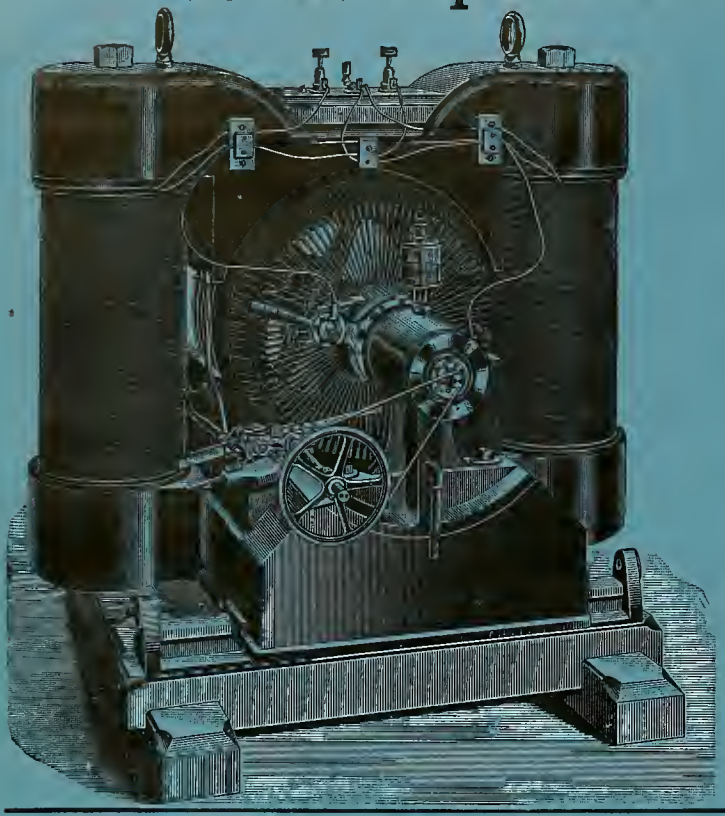

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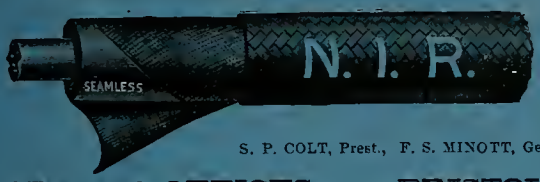

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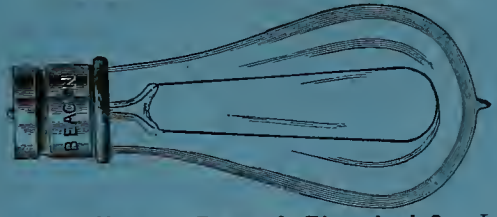

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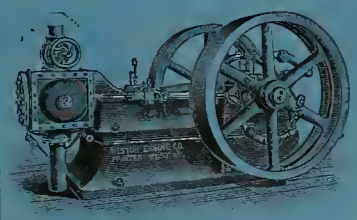

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INDEX AND CLASSIFICATION OF ADVERTISEMENTS.

ALPHABETICAL LIST.

American Battery Co..... ix
American Electrical Mfg. Co..——
American Electrical Works.... xiii
American Engine Co..... xii
Andrews & Co., A. H..... xiv
Babcock & Wilcox Co., The.... i
Baggot, E..... xiv
Baker & Co..... xii
Ball Engine Co..... xix
Ball & Wood Co., The i
Beacon Vacuum Pump & Elec. Co.i
Becker Mfg. Co., John.....——
Beggs, J. E., Mch. & Supply Co. xv
Bernstein Electric Co.....iv, xiii
Blauchard, Albert... xix
Boston Braid Mfg. Co.....xviii
Bowers Bros..... xvii
Bridgeport Mach. Tool Wks.. xii
Brookfield, Wm..... xii
Brush Electric Co xvii
Bryan, W. H.. xiii
Bryant Electric Co.....——
Buckeye Electric Co , The..... ix
Cabell, L Breckinridge.....iv, xiv
Carpenter Enamel Rheostat Co.xvii
Central Electric Co..... v
Chicago Rawhide Mfg.Co.... iv
Columbia Inc Lamp Co..... i
Crescent Ins. Wire & Cable Co. xiii
Crocker-Wheeler Electric Co.. xiii
Cushing, F. W..... vii
Cutter, Geo ..... ——
Cutter Electrical & Mfg. Co... ix
Dayton Globe Iron Works Co.. xvi
Densmore Typewriter Co..... ——
Diamond Electric Mfg. Co.... ——
d'Infreville, G..... xiv
Dixon Crucible Co., Jos..... xv
Dudley & Co., W. W..... xiii
Duplex Electric Co., Ltd..... xii
Eastern Electric Cable Co..... xiii
Eastman Kodak Co..... xiv
Edwards, W.S. Mfg. Co..... ——
Electric Appliance Co xii
Electric Cons. & Supply Co.. xv
Electric Engr'g & Supply Co.. iv
Electrical Eng & Supply Co.The. v
Electric Secret Service Co.... xix
Electrician Pub. Co. ..xi, xiv, xviii
Electrical Construction Co. The.xiii
Electrical Mfg. Co , The xi
Electrical Supply Co., The ... xxii
Elektron Mfg. Co..... ——
Empire China Works..... xix
Enterprise Electric Co..... xvii
Falls Rivet & Machine Co..... ix
Ferracute Machine Co..... ——
Ford-Washburn Store'ectro Co ——
For Sale Advs. .....xii, xiii, xv
Fort Wayne Electric Co..... viii
General Electric Co.... ii, xx
Great Western Elec. Supply Co..ix
Greeley & Co., The E. S.....I
Gregory, Chas E..... xiii
Hart & Hegeman Mfg. Co.....——
Heisler Electric Co..... viii
Hill Clutch Works..... ——
Hine Elliminator Co.... xii
Holmes, Booth & Haydens.... xiv
Hood & Co., Wm..... xi
Hughes Bros. Mfg Co..... xii
India Rubber & G. P. Ins. Co. xxiii
Institute of Technology..... xvii
Interior Conduit & Insulation Co. xv
International Okonite Co..... i
Jewell Belting Co..... i
Johns Mfg. Co., H. W..... ——
Kartavert Mfg. Co... xvii
Klipstein, A..... xiii
Knapp Electrical Works..... xxi
Lake, J H. & D., Co ..... ——
Lake Erie Engineering Works.xviii
Lane & Bodley Co..... x
La Roche Electric Works..... ——
Leclanche Battery Co., The ..xviii
Lefmann, Julius xv
Leffel, & Co., Jas xvi
Link Belt Machinery Co..... xv
Loud, H. M. & Sons Lumber Co. xiv
Mass. Chemical Co..... x
Mather Electric Co iv
Midland Electrical Wks..... ——
Moore, Alfred F..... i
Morse & Co., A. M..... .. xii
Munsell & Co., Eugene..... xii
National Electric Mfg. Co.... v
National India Rubber Co.... i
New York Insulated Wire Co. xvii
N. Y. Safety Steam Power Co.. xix
New York & Ohio Co..... I
Otto Gas Engine Works..... xix
Osborne Steam Engineering Co. xii
Ostrander & Co., W. R..... xix
Page Belting Co..... ——
Partrick & Carter Co..... ——
Pearson & Co., W. B.....xviii
Pelton Water Wheel Co xiv
Penn. Electric Engineering Co x
Perkins Elec. Switch Mfg. Co. x
Phoenix Glass Co..... ——
Porter-Leavitt Elec. Motor Co. ——
Queen & Co..... xiii
Racine Hardware Mfg. Co.... xii
Railway Equipment Co.....vi, ix
Redding Electric Co..... xv
Ries Electric Specialty Co..... x
Roebling's Sons Co., J. A iv
Rose Elec. Light Supply Co...——
Samson Cordage Works. xii
Sawyer-Man Electric Co..... xxiv
Scott Electrical Mfg. Co..... viii
Schuyler Electric Co..... xviii
Sechrist, Albert..... xvi
Shawmut Fuse Wire Co..... xv
Shultz Belting Co..... ——
Siebert, G..... xii
Siemens & Halske Electric Co.—
Sioux City Elec. Supply Co...xviii
Sioux City Engine Works.... xix
Smith, A. T..... x
Smith, Thos. G. Jr..... xv
Sperry Elec. Mining Mach. Co. xvii
Standard Electric Co..... xxiv
Standard Paint Co x
Stanley Electric Mfg. Co..... ——
Stearns Mfg. Co..... xix
Steuben Lamp Works..... xiii
Sterling, W. C..... xv
Stilwell & Bierce Mfg. Co. xiv, xv
Sunbeam Incand. Lamp Co.. xxiii
Taylor Engine Co..... xix
Union Hardware Co..... xiii
Utica Elec. Mfg. & Supply Co. x
Van Nuis C. S..... ——
Vulcanized Fibre Co..... xv
Waddell-Entz Company..... xii
Wannopee Pottery Co..... x
Washburn & Moen Mfg. Co.. ——
Western Electric Co..... x
Westinghouse, Church, Kerr & Co..... xvi
Westinghouse Elec. and Mfg Co..... xi
Weston Engine Co..... i
Worthington, Henry R..... ——

CLASSIFIED LIST.

Annunciators.
Central Electric Co.
Electrical Supply Co., The.
Knapp Electrical Works.
Ostrander & Co., W. R.
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Arc Lamps.
Beggs, J. E., Mchy. & Supply Co.
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American Battery Co.
Electrical Supply Co., The.
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Diamond Electric Mfg. Co.
Duplex Electric Co., Ltd.
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General Electric Co.
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Heisler Electric Co.
La Roche Electric Works.
Mather Electric Co.
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Waddell-Entz Company.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

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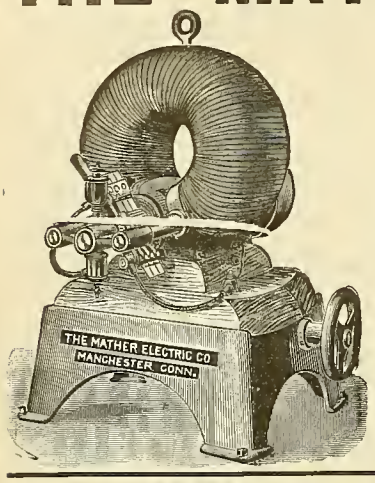

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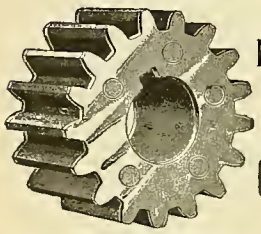

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I have in my hands two adjoining gold properties of about 1,250 acres each, aggregating nearly 2,500 acres, easily accessible, in the United States of Colombia, South America, with ore of the most extraordinary richness, some of which carries as much as three thousand dollars ($3,000) in gold to the ton, and all being of high grade.

These mines are of ancient discovery, and were worked with great profit for a long period, being only abandoned on account of political troubles before and after the War of liberation.

These troubles have been happily settled for over a quarter of a century, and the Colombian Republic is based upon the theory of and similar to our own government, with civil and religious liberty and equal rights to all, and is as stable as any government in the world.

These mines are so richly endowed with auriferous material, from the easily-worked sand, gravel, and dirt (carrying virgin dust and nuggets), to the fissure veins of free milling quartz, that when properly equipped a profit of ten thousand dollars ($10,000) a day, or over three million dollars ($3,000,000) annually is a very low and conservative estimate.

There is an abundance of timber and unfailing water power, with a genial and healthy climate.

It is proposed to organize this property on a basis of five million dollars ($5,000,000), upon which there can be dividends earned of 60 per cent. or more, and the parties furnishing the original capital, in small or large sums, for this organization, which will be about twenty-five thousand dollars ($25,000), will be let in on a basis of two and a half cents (2½c.) on the dollar, with the privilege of purchasing pro rata at five cents (5c.) on the dollar, a sufficient amount to give them a controlling interest if they so desire.

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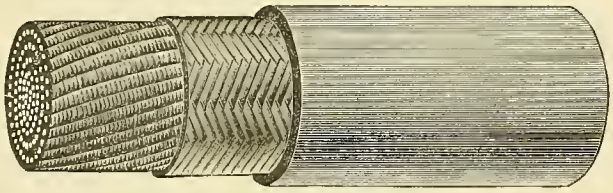

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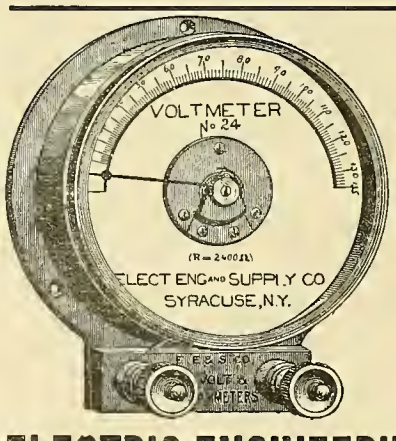

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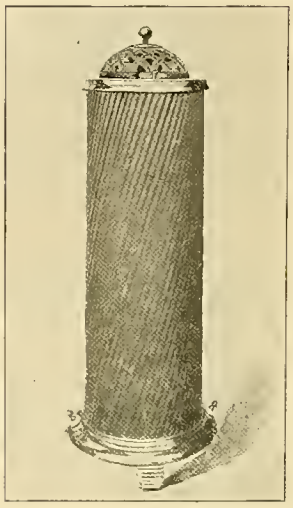

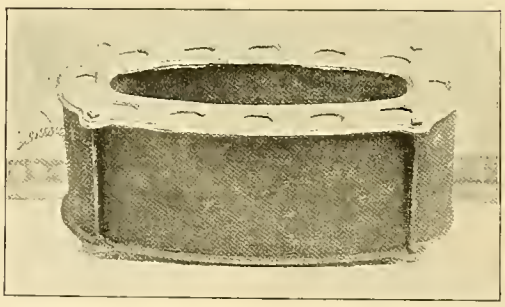

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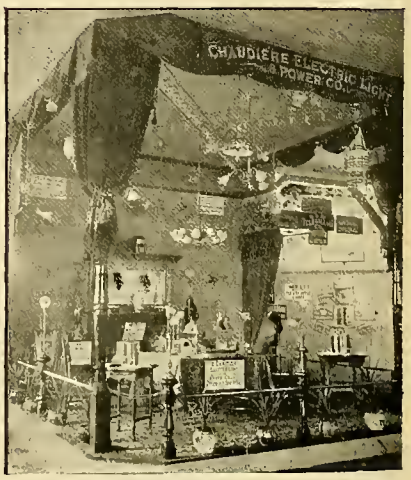

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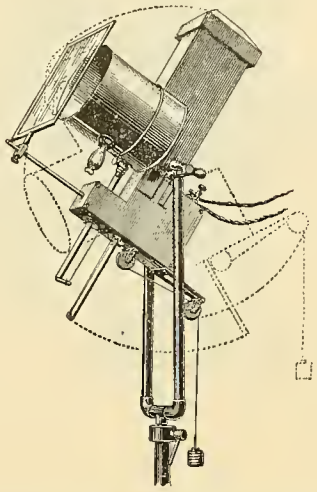

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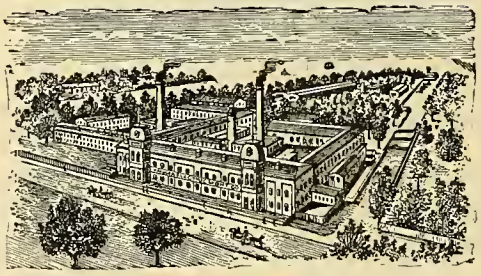

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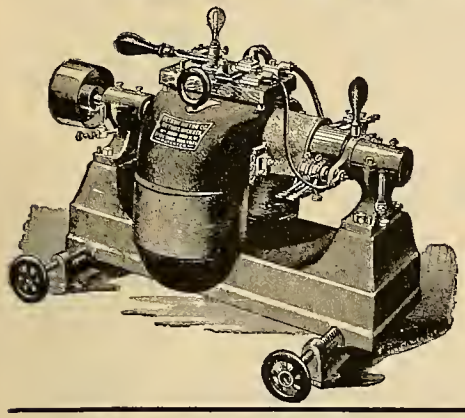

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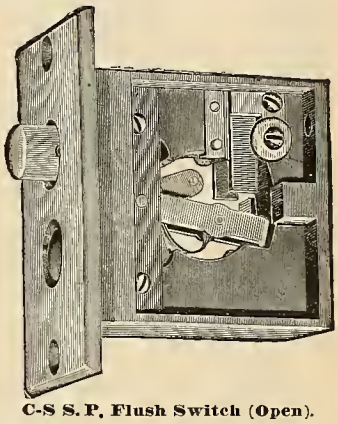

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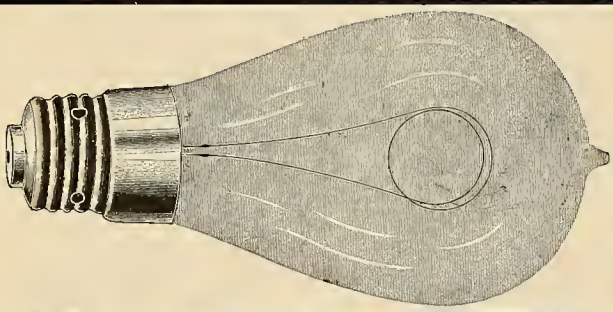

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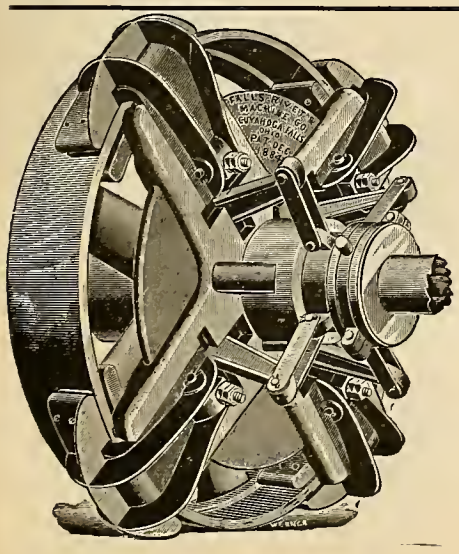

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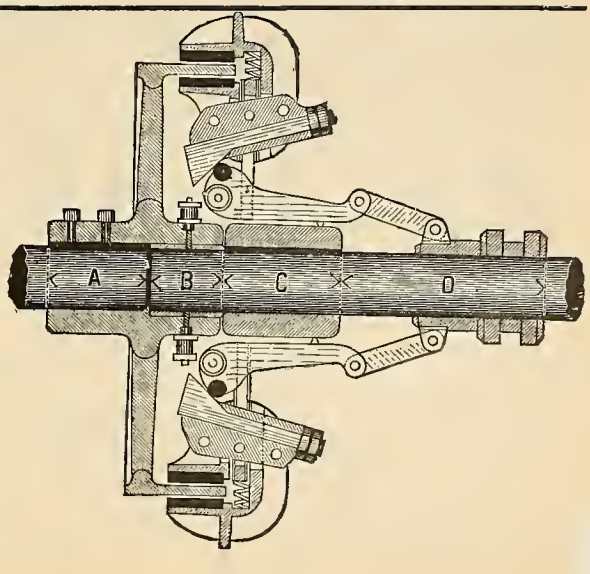

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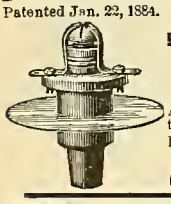

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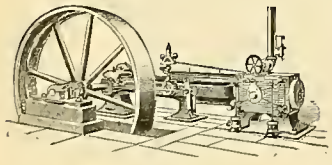

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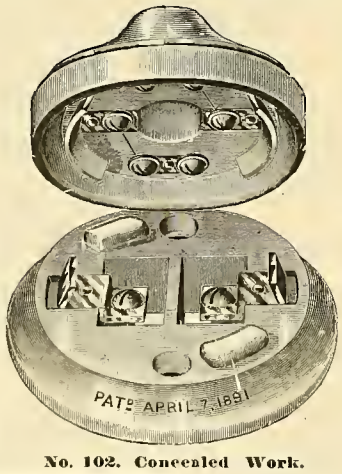

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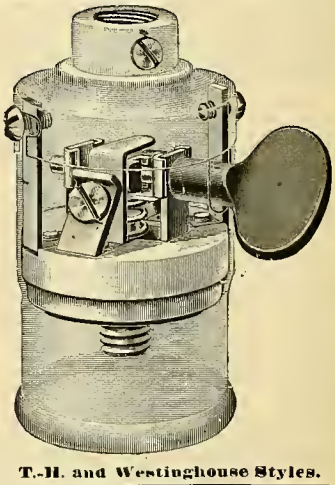

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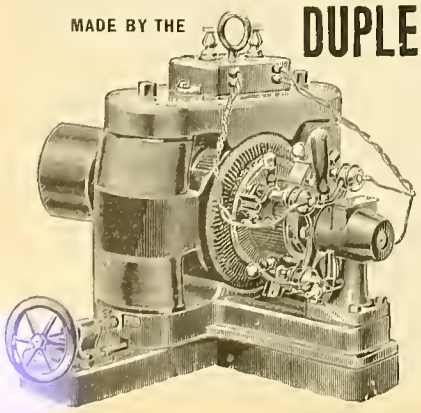

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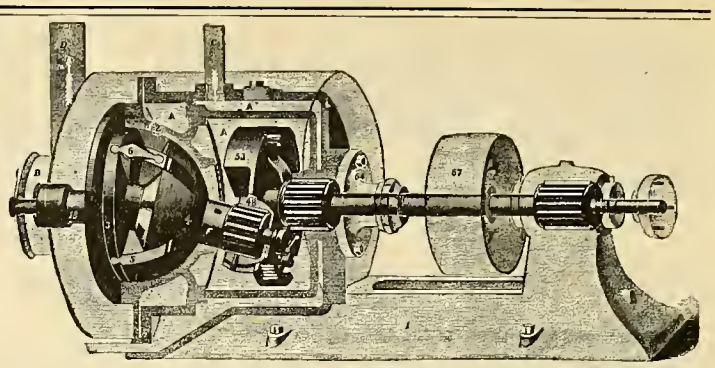

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This Engine is

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as its piston does not revolve; runs standing on either end, or placed horizontally, equally well; is *wholly* self-contained. Takes up but little room.

MARINE TYPE

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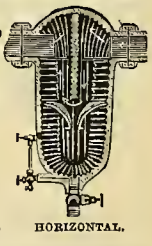

HORIZONTAL.

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The WADDELL-ENTZ COMPANY,

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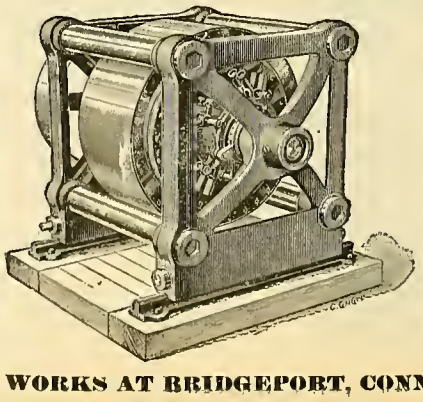

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BUFFALO, 50 Terrace.

WORKS AT BRIDGEPORT, CONN.

Western Electrician.

EVERY SATURDAY.

Vol. XI. CHICAGO, NOVEMBER 26, 1892. No. 22

Electric Lighting in Chicago's Parks and Boulevards.

The quarter of a million people who visited Washington Park in the evening at the time of the recent World's Fair dedicatory ceremonies to see the grand display of fireworks were, it is needless to say, surprised to find the grounds brilliantly illuminated by arc lights. The park commissioners were anxious to give the people a chance to see the park in its new evening dress, and the Brush company was pressed to complete the plant with all possible dispatch. Work was begun on the power house in the latter part of July. On the 1st of August ground was broken for the conduits. This, the apparent beginning of the work, was by no means the actual beginning, because the material was all of a special class. The cable was of unusual insulation, the pipe was a special pipe, and the lamp posts had to be of original design. The arrangement had to be such that all material would be delivered in good time, and that no delay would be caused by the failure of one contractor to get his goods on the ground. From the 1st of August the work was pushed rapidly. The twenty miles of conduit was completed with all the necessary hand holes and man-holes within eight weeks after August first, and the work on the original boilers and the pulling in of cables progressed concurrently. The result was that the lighting of the park was secured in time for the dedication ceremonies. The permanent operation of the plant was inaugurated on the 1st of November. A drive over the boulevards and through the park leaves one with a most favorable impression of the thoroughness with which the engineering work was carried on. Not a wire is in sight; the entire system is underground. The tastefully designed posts, as shown in Fig. 3, with their pendant lamps, backed by bits of winter scenery, constitute the only portions of the equipment now visible outside of the station.

As will be seen from Fig. 2, the power house itself, located as it is among the trees at the edge of the park, with its tall stack looming up, makes a view that is by no means devoid of picturesqueness. In fact the whole work redounds greatly to the credit of Alexander Dow, under whose direction and supervision the station was built and the underground work laid out and completed.

The power house is located in Washington Park at Fifty-eighth street and Cottage Grove avenue. It is a one story brick structure with a trussed roof and a cement floor.

The boiler room contains three 150 horse power Zell improved water tube boilers, under which anthracite coal is burned. These boilers receive feed water through an Excelsior feed water heater and are also fitted with injectors.

The engine and dynamo room, Fig. 1, is about fifty feet square and contains three twin compound high speed non-condensing Corliss engines, each of which develops 110 indicated horse power. These engines operate under an initial steam pressure of 120 pounds, and exhaust into a feed water heater. Provision is also made for exhausting directly into the air. The engines make 140 revolutions per minute, and are belted directly to six Brush arc machines, each of fifty 2,000 candle power lights capacity.

The steam plant was furnished by Fraser & Chalmers, Chicago. The engines are large enough for a fifty per cent. increase of lighting.

The switch-board is of slate. From it the cables pass into a large brick vault just outside of the building, and from this manhole all the conduits start.

The conduit proper is a steel pipe. The lengths of pipe are reamed and drifted to secure a smooth interior, and standard screw couplings are used. Two inch pipe and 1¼ inch pipe are employed, the 2 inch pipe being used where it is necessary to have two cables and the 1¼ inch pipe being laid for a single cable. The cables were furnished by the Safety Insulated Wire & Cable company of New York, and contain a No. 5 solid copper conductor heavily insulated and lead covered. About every 300 feet, or at such distances as would bring them behind lamp-posts, working holes are located. There are three kinds of holes: Cast iron hand-holes in the

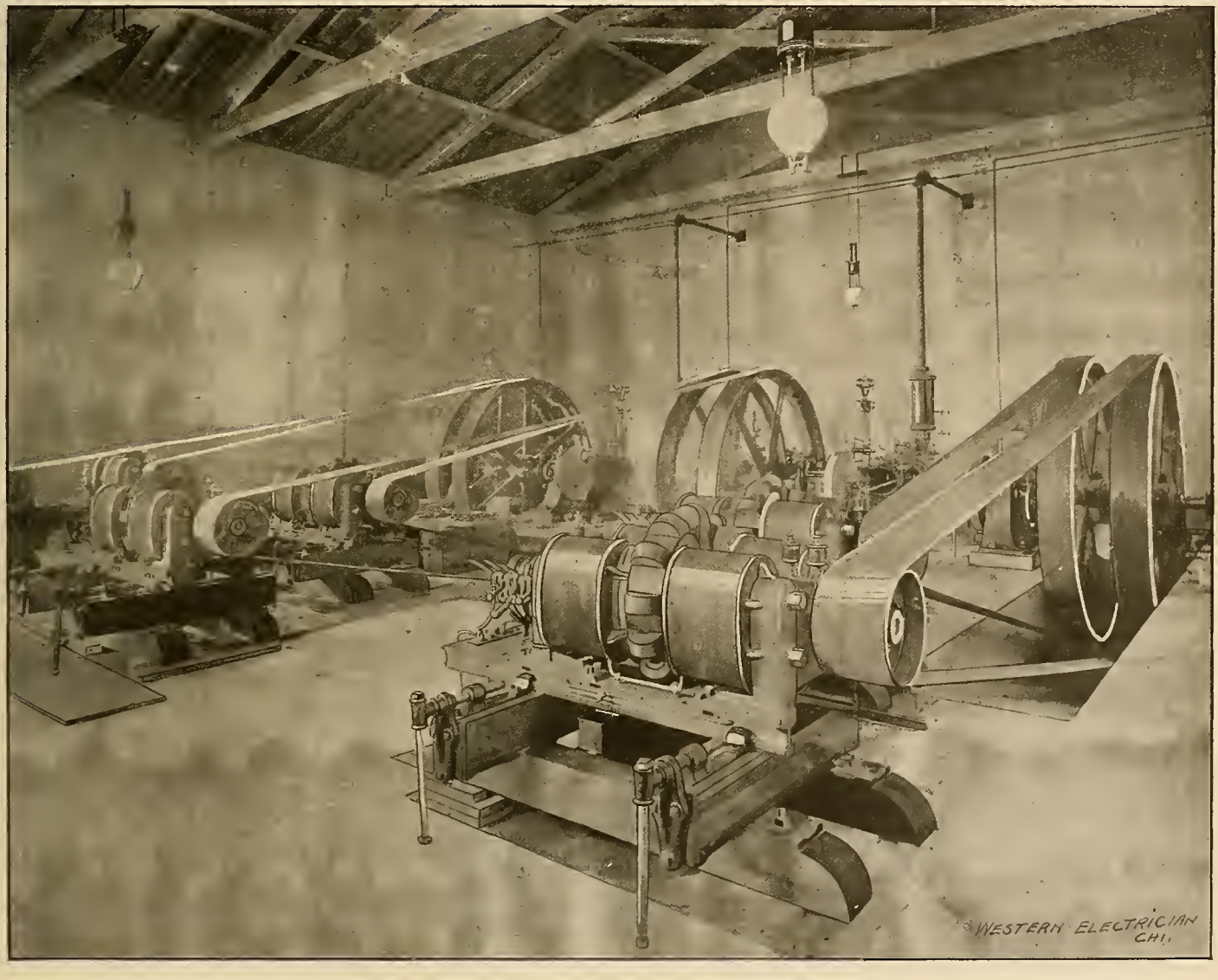


FIG. 1. ELECTRIC LIGHTING IN CHICAGO'S PARKS AND BOULEVARDS.

grass, brick hand-holes three feet deep at the street crossings and at points where the depth was too great to use cast iron holes, and brick man-holes five feet deep or more where the conduit was laid very deep, or where a number of cables entered the same hole. The conduit was laid so that it would drain into the holes. The lamp-posts are of cast iron, and each one is set upon a cast iron base which is firmly embedded in concrete.

The system, supplying 260 lamps in all, is divided into six circuits, covering districts as follows: The north part of the park, the south part of the park, the district north of Grand boulevard and Oakwood boulevard, that south of Grand boulevard, Drexel boulevard and Garfield boulevard.

The park barns are also lighted, and a service box is

FIG. 2. ELECTRIC LIGHTING IN CHICAGO'S PARKS AND BOULEVARDS.

put in the park office, from which connection can be made at pleasure.

Illinois Institute of Mining Engineers.

The third meeting of the Illinois Institute of Mining Engineers was held at Streator, Ill., November 15th and 16th. About 200 members were present. Several interesting papers were presented, among them being several on the application of electricity in coal mining. An interesting discussion followed the reading of these papers in which Elmer A. Sperry and F. B. Badt of Chicago took part. These gentlemen, together with J. B. Wethrell, represented the General Electric company at the meeting, and explained the special mining machinery which this company is turning out. At the invitation of Mr. Sweet, the owner of the Chicago, Wilmington & Vermillion Coal company at Streator, the members of the institute visited this mine and witnessed the operation of two 100 horse power electric locomotives for underground haulage. Mr. Sperry, who had made this installation, explained the details to the visitors.

The Illinois Institute of Mining Engineers was formed in February, and has already a membership numbering 200, including those engaged in the executive, engineering and other departments of practical mining. The object of the organization is the consideration and discussion of subjects of interest to practical mining engineers. The importance of the work of the mining institute in this direction is manifest when the fact is recalled that in Illinois there are 33,000 men employed in collieries; that probably more than $18,000,000 is invested, and $11,000,000 paid out annually for wages and supplies.

Chicago Electric Club.

The first literary meeting of the Chicago Electric club for the season of 1892–'93 was held at the club rooms on Monday, November 21st, at 8 p. m. Wm. M. Willis presented a paper on the "Compound Winding of Generators from a Practical Standpoint."

Before the reading of the paper, F. B. Badt, the presiding officer, called upon the members of the club for criticisms of a small statue which is a model of one that will be used to decorate the electricity building at the World's Fair. This figure is to be placed on the front of the electricity building. The sculptor, Hermon A. MacNeil, was desirous of hearing any suggestions that the club members might care to make as to the proper representation of an electric discharge between two terminals, one held in each of the figure's hands.

Electricity in Japan.

Americans have had occasion to admire the enterprise and energy displayed by the subjects of the Mikado and their desire to acquire a thorough understanding of all that has been done in the arts and sciences outside of their own circle. Numerous expeditions of distinguished Japanese officials and capitalists have visited America during the last few years to study the advancement that has been made in the several departments of industrial activity in this country. Among those who visited this country four years ago was Kunihiko Iwadare, chief engineer of the Osaka Electric Light company, whose mission was to study American practice in electrical engineering. Mr. Iwadare is again a visitor in this country. He reports that great advancement has been made throughout the empire since his last visit to this country and that there is a promising future for electrical workers in Japan. Mr. Iwadare, whose portrait is herewith presented, has prepared the following article, which will give an excellent idea of what has been done in his country:

TELEPHONY AND TELEGRAPHY.

BY KUNIHIKO IWADARE.

工學士 岩垂邦彦 大阪電燈會社技術長

In the year 1868, when the present government of Japan was formed, it was the universal wish of the nation to have modern civilization introduced into the country as fast as possible, and, as one of the means, it was determined to have telegraph lines built all over the country. Accordingly it engaged telegraph engineers in England, and in 1869 constructed the first telegraph line in Japan, some twenty miles in length, between Tokio, the capital, and Yokohama, a seaport on the Pacific ocean. The first few years telegraphy did not make much progress. People not only failed to use it, but even attempted to prevent farther extensions. In addition it was found necessary to import everything used, including materials for the line construction, such as poles and insulators, and, therefore, telegraph lines must have cost a great deal of money for the first few years at least. We now make different kinds of telegraph instruments and all supplies except iron wire in the workshops of the government telegraph bureau. We have not at present sufficient iron in our country to make wire from. Notwithstanding all the difficulties that confronted the exploiters of the telegraph, the determination to introduce modern civilization into the country was so strong that they kept right along, and their efforts have been rewarded with considerable success.

It is now twenty-four years since the introduction of telegraphy into the country, and we now have 8,822 miles

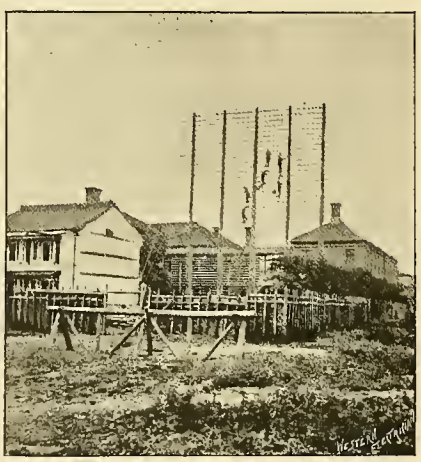


FIG. 1. ELECTRICITY IN JAPAN.

of land telegraph lines, averaging a little over three wires to each line. These figures do not include telegraph lines owned by the government railway department and private railway companies. There are 8,822 miles of land telegraph lines and 215 nautical miles of submarine cables laid across the straits between the islands which are owned by the government telegraph bureau. Farther extensions are now being made. In May last 442 telegraph offices had been established in Japan, and farther extensions were under consideration.

There is a noticeable contrast between American and Japanese methods of construction in telegraph work as well as in other departments.

Our Japanese wooden poles are straighter and stouter and of a yellowish brown color, the poles being subjected to a process by which a sulphate of copper solution is introduced by pressure into the pores of the wood for its preservation. The poles are put up with more care and have more braces and guys than those in this country, especially on curves. Cross arms are bolted to poles, being always at right angles to poles and wires. Porcelain double petticoat insulators are used on long circuits and single petticoat insulators on short circuits. Number 8 B. W. G. iron wire is exclusively used for telegraph work, except in river crossings, where smaller steel wire is often employed. No pains are spared where wires are liable to sway; all wires in one span have exactly the same sag.

Japanese islands are divided into seven or eight telegraph districts, each district having its chief engineer and assistant engineers, and these chief engineers are mostly graduates of the Engineering College of the Imperial Uni-

FIG. 3. ELECTRIC LIGHTING IN CHICAGO'S PARKS AND BOULEVARDS.

versity, Tokio, who look after the construction and repair work of the land lines as well as those of the submarine cables. Prof. W. E. Ayrton, of London, occupied a chair as professor of electrical engineering at this college for five or six years.

An examination of the system employed in Japan will reveal many marked changes from that which now prevails in America. All the lines are worked on the open circuit system, Morse recorders and small Daniel cells being used instead of sounders and gravity cells. Wheatstone's automatic transmitters have been adopted in some offices, and some circuits are worked by the duplex system. It is said that the quadruplex system and multiplex system will be introduced in some of the circuits soon. Women are not employed as operators.

The manner of charging for messages resembles that employed in England. The rate is the same throughout the empire of Japan. They charge 10 sen[1] for every ten Japanese alphabetical letters or under, and 5 sen for addresses of receiver as well as sender, so that they can send a message over a thousand miles by paying about 10 cents of United States gold. In telegraphic communication they can also use a kind of A B C code written in Japanese alphabetical letters, which was gotten up several years ago.

TELEPHONY.

The telephone was first introduced into Japan in 1877. It was extensively used in some towns and districts for police purposes, but no telephone exchanges existed until the fall of 1890. Exchanges were opened in Tokio and Yokohama on the 16th of December, 1890, with 130 subscribers in the former and 40 in the latter place, but now we have 1,200 in Tokio and 280 in Yokohama, the rate of increase of subscribers in Tokio being about 50 per month at present. The Japanese government is going to start the telephone exchanges in Osaka and Kobe this year, and work is now in progress. These two exchanges will probably be opened about the beginning of the year 1893. The number of subscribers which have already made applications in Osaka is 190 and in Kobe 70.

All lines are overhead and single. Poles are erected along the streets to support wires, as the house tops, owing to their construction, cannot be utilized. For town work No. 17 S. W. G. hard drawn copper wire is used, and for long distance talking between different towns No. 12 S. W. G. hard copper is used. Porcelain insulators are used exclusively. Where many wires are supported

1. The Japanese dollar is the yen, which is about equal in value to the Mexican silver dollar. The yen is divided into 100 sen (corresponding with our cent), and the sen is again subdivided in tenths of a sen, this being the smallest copper coin.

spans do not usually exceed 50 yards. Wooden cross arms are employed except in some special cases where repairing and reconstruction are difficult. A view of the exterior of the Tokio exchange, showing the poles and wires, is shown in Fig. 2. This illustration is a reproduction of a photographic view recently taken.

At present ordinary switchboards are used (very nearly the same type as that called the standard switchboard in the United States), but we are going to try a modified form of the Law telephone exchange (Mann's system). For this purpose there has been designed a special form of switchboard for our own purposes, and we expect it will prove successful. In Tokio subscribers are rapidly increasing, and before long it will become necessary to put our lines underground. This being the case, we have already ordered the Western Electric company's multiple switchboard of a capacity of 4,000, equipped for 1,600 subscribers. The key-board of this switchboard is to be made so as to suit metallic circuits.

The telephonic apparatus as used in subscribers' houses is a modified form of the so-called Gower-Bell telephone. The switchboard transmitter is of the Blake type, made by the Bell Telephone Manufacturing company in Antwerp. A battery call system is used in Tokio and Yokohama, as we have not had great success in making magneto-bells in Japan.

Lady operators are employed from 7 A. M. to 8 P. M. From 8 P. M. to 7 A. M. male operators only are employed. As far as our experience is concerned, female operators are more popular than male operators, and in fact some of the subscribers request us to employ female operators even during the night. In employing female operators it is required that they be under 25 and above 14 years of age, and not married, and besides they must have been educated in our common schools. A view of the operating room in the Tokio exchange is shown in Fig. 3.

The aim of our government is to introduce the telephone as cheaply as is consistent with the efficiency of the service. On this account any ornamental work is avoided in every way. The annual subscription is now $35 per year all through the empire.

All materials used in line construction and apparatus fitting (excepting iron and steel wires), rubber covered wires, multiple switchboard and its accessories, are all manufactured in Japan, chiefly in the workshops of the Imperial Government Telegraph Department at Tokio.

An idea of the exterior and interior of the Tokio telephone exchange may be gained from Figs. 1 and 2, copied from original Japanese photographs.

LONG DISTANCE TELEPHONING.

Long distance telephoning is accomplished in connection with our telephone exchanges, between Tokio and Yokohama only, but next year Osaka and Kobe will be connected telephonically. The distance between Tokio and Yokohama is 20 miles and between Osaka and Kobe 25 miles. We have already made experiments between the following towns with No. 12 S. W. G. hard drawn copper wire:

Tokio-Najoya ....240 miles.
Tokio-Osaka..... .....385 miles.

The experiments were successful, but our financial condition does not permit us to make any extensions of the system at present. It will certainly take a few more years to connect Tokio, Yokohama, Osaka, and Kobe.

Keep the World's Fair Open Evenings.

Remonstrances from electrical workers in all parts of the country against the 7 o'clock closing rule recently approved by the National Commission of the World's Columbian Exposition have been placed before the Council of Administration. That the fair authorities are beginning to realize the necessity of taking some action in this matter is evident from the following correspondence kindly furnished by Col. Clowry.

Under date of the 11th inst. Col. R. C. Clowry, chairman of the committee on electricity of the World's Columbian Exposition, sent the following letter to President Higinbotham, together with the petitions signed by the electrical people, which appeared in the last issue of the WESTERN ELECTRICIAN:

I inclose herewith petitions signed by practically all of the electric companies represented in Chicago in reference to the rule adopted by the commissioners of the World's Fair to close the gates at 7 P. M. It appears that the newspapers have also taken up this subject in opposition to closing the gates so early. I am satisfied that the signers of the petition are very much in earnest, and I therefore hasten to call the attention of the council of administration to the subject, hoping that they will take the matter up with as little delay as possible.

In acknowledging this communication President Higinbotham said:

I am in receipt of your communications, 11th and 12th inst., enclosing protests against the closing of the fair at 7 o'clock, and in reply beg to say that it is not the intention of the management, either in the directory or the commission, to close the fair so that evening sessions may not be had.

It was thought best to make the rule to close at 7 o'clock and then the council of administration could, from time to time, open the gates at 8 o'clock in the evening, on such days as it is thought wise to do so, it being the intention to have an evening session from 8 until 11 o'clock on from three to six days each week, according to circumstances.

Kindly communicate the intention of the management

KUNIHIKO IWADARE.

as expressed above, to the protestants, and if you think best have same published in such electrical publications as you may think wise.

This is not what the electrical exhibitors want. They demand that some definite programme be adopted. They want to know whether the fair will be opened one, two, three, or six nights in the week. They prefer to have it open every night, but if this is denied them they want to know how many nights the fair will be open. They do not propose to prepare exhibits on the basis of six evening exhibitions each week when the directors do not intend to have more than three. Here are some additional remonstrances against the offensive rule:

WHITNEY ELECTRICAL INSTRUMENT COMPANY, Boston, Mass.: To close at 7 o'clock would be to deprive electric light exhibitors of all opportunity of effective display, which we expected would make the evening the most brilliant and attractive time for visitors. Moreover, to close so early will make it impossible for those who have but a limited time to remain in Chicago to see as much as they could if the closing hour were at 11 o'clock, and we think there will be many who will feel the expense to be so heavy that it will be necessary to make their stay short. We feel that to close the fair at 7 o'clock would be a great injustice, and we hope your agitation will convince the national commission of this fact.

FREDERIC A. C. PERRINE, Germania Electric company, Boston, Mass.: I should oppose such an early closing from every point of view possible, as an exhibitor, as an onlooker and as a stranger in the city of Chicago. As an exhibitor of incandescent lamps, whether of the regular type or in special designs, it will be impossible to properly show to either experts or the general public the points of excellence of any system save at night, since not even the most experienced eye is able to determine the candle power, efficiency or effect of an incandescent lamp in daylight, even though it be diffused; and I should say that for a daylight exhibit there would be more reason for showing our lamps in cases at our machines and batteries running upon dead resistances, through instruments, than to attempt a lighting display. As an onlooker, with the experience of a large number of exhibitions, I should find far more enjoyment in the evening exhibitions of almost all classes of articles displayed; in evening glancings at the whole effect and excursions of discovery, to be turned to account in the close study of the following day. As a stranger in the city of Chicago, and as one of the strangers, I would wish for myself and my fellows an employment for the evenings which would not be dependent upon the theaters, to say nothing of the less harmless places of amusement, and we should consider that the authorities were blind to the actual condition of life in their own city should they not see the moral effect of such closing. Nor should I say that to the workers of Chicago the fair were open at all did they not have the opportunity of spending at least a portion of their evenings rather than their bread-earning days there.

Charles Schwab, a member of the board of directors, and also one of the four members of the council of administration, in an interview, said: We wish to do whatever the people desire in this matter. While the rules provide that the exposition shall close at 7 o'clock there is a wide latitude for the exercise of discretion. From conversations with members of the council and the members of the board of directors I feel convinced that no mistake will be made in this regard. The rules will be modified to such an extent that the fair may be kept open every night in case such a course be desirable. No apprehension should be felt, because the right thing will be done and the wishes of the people gratified.

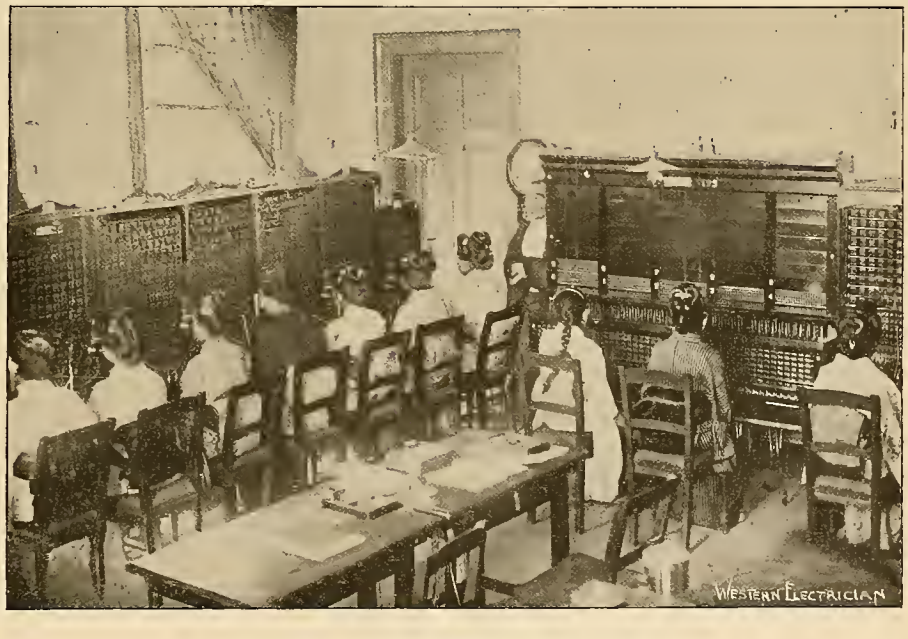


FIG. 2. ELECTRICITY IN JAPAN.

The *Chicago Tribune* says: Electrical firms throughout the country desire that the exposition be kept open every night in the week. In order to discover the attitude of the electrical people in this country the WESTERN ELECTRICIAN has secured interviews from forty seven prominent firms doing business from one end of the country to the other. All unite in expressing the belief that the fair should be kept open nights.

The *Chicago Evening Post* says: Electrical firms all

over the country have made protests against the 7 o'clock closing rule, and many of them have threatened to stay away from the exposition unless it is done away with or greatly modified. The WESTERN ELECTRICIAN of Saturday, November 12th, printed several interviews with prominent electricians protesting against closing the show at night.

The discussion of the 7 o'clock closing rule, to which attention was directed by the WESTERN ELECTRICIAN, is by no means confined to the electrical fraternity. Enough expressions of opinion have been presented in the communications already published in this journal to assure the national commissioners and the board of directors that the electrical fraternity is unanimous in its opposition to the proposed early closing. But the discussion has not been confined to the electrical exhibitors. The daily papers, fearing that the electrical companies would withdraw their displays and realizing that this would cripple the exposition, have taken up the matter and pointed out the absurdity of the position in which the authorities of the fair are placed.

Following are a few of the editorial comments of the daily papers on this subject:

Savannah *News:* The decision of the World's Fair directors that the exposition shall be closed at seven o'clock in the evening was probably made in deference to the Chicago theatres, beer gardens and barrooms. At the Paris exposition the gate receipts for the evenings were almost as large as for the days.

Sioux Falls, S. D., *Press:* Speaking of the World's Fair reminds the *Press* that a rule has been adopted to close the great show every evening at seven o'clock. It is to be closed Sundays, and one may well inquire why not close it altogether? One of the most entertaining features of the exposition is the electrical display, and just how it is to be operated in the daytime is a poser for the average man. Man has made rapid progress in the matter of artificial light, but he is as yet scarcely prepared to buck against the sun with his toy tools. And then, the workers of Chicago would be out entirely if there was no chance for them to see the sights in the evenings.

The Standard, Chicago: It is announced that the management has voted to close the exposition evenings, except on special occasions. It is further stated that this is an indirect effort to secure the repeal of the law closing the exposition on Sunday. If so, the movement is as contemptible as it is unwise. Nearly a million and a half dollars have been expended in putting electric lights throughout the grounds and buildings, and an electric fountain has been built at great expense, and yet, according to this determination, these are to be used only upon a few gala nights. The electric lighting companies, whose expensive exhibits will be practically valueless if only seen during the daylight, are against any such proposition to a man. We cannot believe that any such short-sighted policy will be adhered to.

Chicago Tribune: The electricians are pertinently asking what is the use of expending more than $1,000,000 for electric lighting at the fair if the gates at Jackson park are to be closed at sundown each day of the display. Except for the comparatively unobtrusive power part of the supply the companies might just as well have saved their money if the fair is not to be open in the evening, for man has not yet learned to make electricity compete with the full blaze of sunlight. Arrangements have been made not only for mere lighting, but for decorative effects by means of the electric light. It would seem to be a very one-sided view of the situation that will lead to the decision to throw away all this, and act as if the display at the fair were made near the end of the last century instead of this. We have been graduated out of the age of tallow candles, at least in the cities.

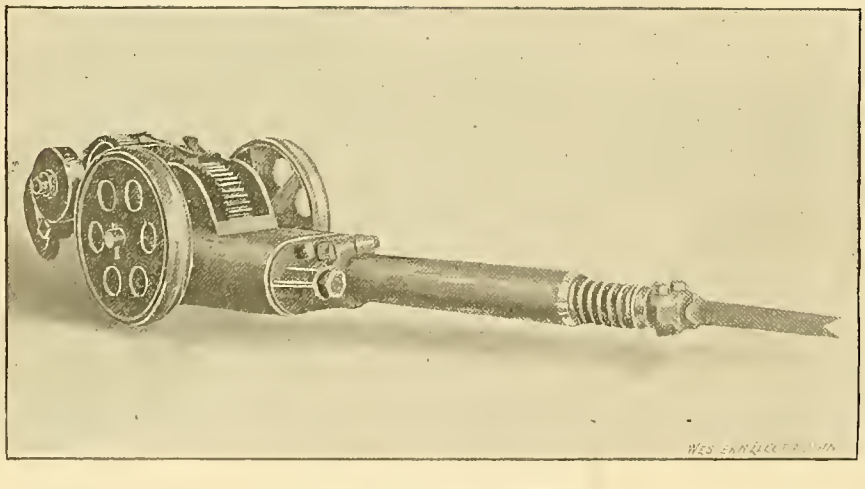
Chicago News Record: Those who favor the opening of the World's Fair evenings are undoubtedly in accord with the weight of public sentiment. This question remains for the local directory to decide. As yet the only weighty argument advanced against evening opening relates to the expense of lighting and operating the exhibition after nightfall. It does not seem reasonable, however, that the cost of providing lamps and dynamos would be at all likely to endanger the margin of profit from gate receipts. If the authorities are wise and keep the World's Fair open, those evening receipts are going to be very large indeed. It will cost something, no doubt, to illuminate the big buildings, but what illumination the surrounding grounds will need should be comparatively trifling. And this expense of lighting would be the only serious addition beyond the cost of operating the exhibition during the day. What reason is there for believing that the World's Fair can be run profitably in the daytime but at a loss in the evening?

Chicago Herald: The directors and national commission have been of opinion that the world's fair should close every evening at 7 o'clock. The only exceptions to this rule they proposed to make are to be occasions when special gala programmes will be arranged. Reflection and investigation will doubtless lead the management of the fair to a different judgment. The problem the management of the fair must see solved before they can settle the question of night opening is a mechanical one. If electricians demonstrate their ability to maintain a plant of adequate power and pure quality the exposition ought to be kept open until at least 10:30 o'clock every evening. Many families will not be able to go to the fair grounds until mid-afternoon. They would naturally plan to get all the good out of it possible before returning home. They would dine or sup in the grounds and expect to spend a pleasant evening there as they do in the parks summer evenings. The lagoons would be a picturesque sight in the moonlight or under the mellow flood of electricity. The great flare lights on the Eiffel tower were sufficient to make all Paris as bright as noonday and to spread over the Trocadero and the Champ de Mars a clear effulgence in which it was easy to read. The electric companies are far better equipped now to light up Jackson park than the French company was in 1889 to do that service for the Universal exposition.

NEW WESTERN UNION BUILDING IN CHICAGO.

Chicago Evening Post: It is not surprising to learn that the whole electrical trade or profession is united in protest against that order of the national Columbian commission which requires the exposition to be closed at 7 o'clock P. M., "except"—so the order reads—"in such cases as the management shall direct for special evening entertainments.' Our contemporary, the WESTERN ELECTRICIAN, has been at some pains to discover the sentiments of persons and firms interested in this most important branch of the fair and presents them in its current issue. There is, so far, as we have seen, not a single voice dissenting from the proposition that if this 7 o'clock order be put into effect the electrical exhibit will lose half its effectiveness and more than half of its beauty. It seems not to have occurred to the gentlemen of the commission that the electrical exhibit is one of the most interesting and important at the fair; that it will consist in great part of illuminating apparatus, or that illuminating apparatus is not seen to the best advantage in daylight. A proposal to exhibit jewels in a dark room would probably have appealed to their sense of unfitness; such a proposal would be scarcely more ridiculous than that to exhibit electric lights in the daytime. We are not surprised that some intending exhibitors propose to withdraw entirely if they be not permitted to make an exhibit at night. But great as is the hardship threatened to them, it is nothing compared with that which the public would suffer if deprived of this marvelous display. It seems necessary to remind the authorities of the fair again that this enterprise was not conceived in the interest of a few bureaucrats or for the convenience, emolument and comfort of a body of servants and attendants, but for the amusement, enlightenment and uplifting of all the people—whose fair it really is.

Rochester, N. Y., *Herald:* As the WESTERN ELECTRICIAN truthfully remarks: "Since the World's Fair was first projected many mistakes have been made in the conduct of the enterprise, as was, perhaps, inevitable." It thinks, however, that most of them have been rectified, and in this also the majority of the people of the United States will agree. The electrical journal then proceeds to "call down" the commissioners in most vigorous phrase for their action in ordering the closing of the fair gates at seven o'clock on all ordinary days. It was certainly an absurd idea to invite extensive electrical exhibits, dependent for their success on night displays, and then calmly close the gates at twilight. The protest of the electrical interests of the country against this decision is entirely natural. There is no good reason for closing the exhibition evenings. As has been pointed out to the management, if the fair is closed on Sundays and on evenings also, the workingmen of Chicago will have no opportunity to avail themselves of the educational opportunities afforded by the fair. The WESTERN ELECTRICIAN hints that the commissioners are endeavoring to force the opening of the gates on Sundays by closing them evenings. If this is the reason, the course of the commissioners is puerile and beneath contempt. Do these misguided people think they can coerce the congress of the United States by any such miserable subterfuge as this? If so they are possessed of monumental assurance. The press of the country should give its aid in convincing them of their folly. The electrical display will be one of the most attractive features of the fair. In no other field has there been such progress since the last international exposition as in that of electrical science. Open the gates evenings and give the electrical men a chance to show what they can do.



ELECTRIC COAL CUTTING MACHINE.

Electric Coal Cutting Machine.

The accompanying cut illustrates an improved form of a two-wheel pick machine for coal cutting. It is a development of the Sperry coal cutter, and in its present form is placed on the market by the General Electric company. In this form of coal cutter a two-wheeled truck furnished with handles at the rear is provided with a continuously operating electric motor of about four horse power, connected by gearing to a catch or retractor. A longitudinally moving heavy projectile with a pick secured to its outer extremity is surrounded by a driving spring of about 125 pounds compression per inch. The line of movement is practically through the center of inertia of the machine. These springs are made in sections, and an initial pressure is given of about 500 pounds. A retraction then takes place of from 6½ to 7½ inches to a pressure of 1,375 pounds, whereupon it is released and allowed to make a vigorous forward stroke. This process is repeated from 160 to 225 times per minute. The mean effective blow of this type of machine is 935 pounds when allowed to strike the cushion, and when striking the work at a distance of one inch from such cushion giving 1,000 pounds mean effective. The mean effective blow in air machinery employed for the same purpose is between 400 and 450 pounds, a 3¾ inch cylinder being the largest employed. The current required for the operation of this machine is about ten amperes at 220 volts. The projectile weighs between 100 and 150 pounds in the different sizes of machines. Under the action of the intense concussion resulting from the percussive blows and shattering strains throughout the machine, a motor to last under such conditions must be essentially different in its construction from the ordinary commercial machine. The armature gear has been made elastic and elastic cushions have also been introduced between the retracting device and the main gear, which is found to still further reduce the shock of the machine. This machine, capable of storing in each stroke of the heavy projectile as great an effort as is required for rapid and effective cutting, must of necessity be comparatively heavy to be capable of backing up the blow without serious recoil, yet the machine on the other hand is sufficiently light for easy handling and direction by a single operator. Another type of this machine is fitted with larger wheels and a universal handle adapted for "shearing."

Western Union Progress in Chicago.

Chicago is one of the greatest telegraphic centers in the country and receives and distributes an enormous amount of business. The bulk of this passes through the hands of the Western Union Telegraph company, and Chicago is the head office for all the United States west of the western boundary of New York state. Ever since the great fire the Chicago office has been housed in the building at the corner of Washington and La Salle streets. The location of this building is convenient, but of late years the business has outgrown the accommodations of the edifice. The structure was erected twenty years ago and is consequently an old building by Chicago standards, outclassed by its taller and more handsome rivals. The company has recognized the need of a change for some time, but was loth to move on account of the fact that all of its underground work diverges from the corner of Washington and La Salle streets, and the work of changing the system for a new building would be troublesome and expensive. A recent decision of the owners of the property to tear down the present building made a change necessary, however, a result more readily acquiesced in owing to the near approach of the World's Fair, with the consequent increase in business.

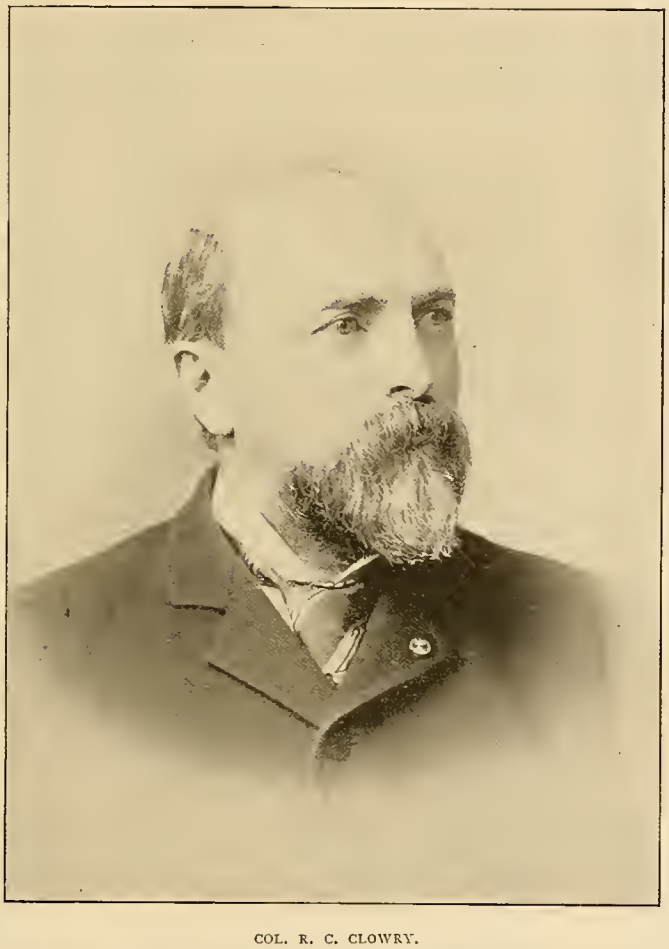
But few buildings suitable to the company's use, and which could be bought, could be found in Chicago, but finally a happy choice was made by the purchase of the Phœnix building, fronting on Clark and Jackson streets and Pacific avenue, from the Phœnix Insurance company for a consideration of $1,500,000. This building, a photographic reproduction of which is given on the preceding page, is one of the handsomest and best constructed in Chicago. It extends 217 feet on Jackson street and is 50 feet wide. Being narrow and facing on three streets, the lighting is excellent. The exterior is of brown sandstone, pressed brick and terra cotta, and the architecture is particularly pleasing, being rich and ornate in effect, although quiet. The building is at present nine stories high above the street or basement floor.

As a telegraph headquarters the building, when adapted to the use of the Western Union company, will be unexcelled in the world, either for size, elegance or convenience. The cellar will be devoted to machinery, containing the steam plant for lighting and heating the building and operating the elevators, as well as the dynamos used for charging the company's lines, as no batteries are now used for this purpose in the large offices. An isolated incandescent lighting installation is included in the plant. The public receiving office will be on the ground floor, on the corner of Jackson street and Pacific avenue, directly across the latter street from the Board of Trade. It will consist of one large room, handsomely fitted up, extending to the elevator entrance in the middle of the building. The Postal Telegraph company has its office on this floor of the building, at Clark and Jackson streets, the corner shown in the illustration, although at the time the photograph was taken the Postal people had not moved in. The building will thus become the telegraphic center of Chicago.

On the eighth floor will be located the offices of the company, that of the vice-president and general superintendent being at the Clark street corner. The district superintendent, electrician, superintendent of construction and other officers will all have apartments on this floor. The ninth floor will be the main operating room, and will be the finest of its kind in the world. The room is a magnificent one, extending the entire length and breadth of the building and 22 feet high in the clear, with light on three sides. The galleries now existing at the ends will be retained and used as gathering and distributing points for messages to and from all parts of the room. The Martin system of carrier boxes will be used for this purpose. In this system the receptacles are carried on moving cables and can be despatched upstairs or down and around corners. In the Western Union building an electric motor will be used to operate these cables. The galleries will also contain the terminals of the pneumatic tubes for the transmission of messages to the receiving room on the ground floor, the Board of Trade and the newspaper offices. An additional story is to be added to the building by its new owner. This will be 16 feet high, and is planned with the idea that it may be used as a second operating room when necessary. At first, however, the space will be given over to the large book keeping force employed by the company and to the restaurant for employes. The latter idea is new to Chicago, but it is in successful operation in the New York building. It is proposed to buy the best of food in large quantities and to sell it to employes, well cooked, at cost. The main operating room on the ninth floor will furnish ample room for 500 operators, and when the tenth floor is added this capacity will be doubled.

Being fire-proof, substantially constructed, well lighted and elegantly finished in mahogany and marble, the Phœnix building has always been a favorite with tenants. Under the new ownership it will still continue to be an office building almost entirely and few of the tenants will be disturbed. The renting and care of the building will continue in the hands of John W. Carrington, Jr., who has filled this position for the Phœnix company to the great satisfaction of all interested. A separate entrance for employes of the Western Union company, of whom there will be nearly a thousand, will be provided on Pacific avenue, and two elevators will be set aside for their use. This leaves three elevators for the exclusive use of tenants. This arrangement will expedite the work of the men as well as emphasize the distinct character of the office building. The work of changing the underground system of wires to connect with the Phœnix building is now in progress, and it is thought that the Western Union company will be able to take possession by May 1st next.

The fact that the Postal company has an office in the building was the cause of some litigation. When the Western Union company purchased the building, the Postal people sought an injunction to prevent the former from occupying the building, alleging that such a proceeding would violate a provision in its lease from the Phœnix company. In its complaint the Postal company alleged that in May, 1888, it leased rooms in the Phœnix building for the purpose of conducting its business, and one of the stipulations in the lease was that no other telegraph company should occupy any part of the same building. The Western Union company contended that it had no intention of injuring the business of the complainant, but that, on the contrary, the latter's business would be benefited by the creation of a great telegraphic center in Chicago, and that it would undoubtedly receive much transient business on that account. The case was tried before Judge Collins, who dismissed the complaint, holding that the provision of the lease in question was a personal covenant that did not run with the land.



COL. R. C. CLOWRY.

The man who is in charge of the immense business that will be sheltered in the recently purchased building, and to whom is largely due the credit for the present extent and efficiency of the service in the West, is Colonel Robert C. Clowry, the vice-president and general superintendent of the company. A portrait of Col. Clowry accompanies this article. Col. Clowry is so well known to the electrical fraternity in general and to those interested in telegraphy in particular that an extended notice of his career seems unnecessary. He has long been identified with the telegraphic business of the West, beginning as a boy, in 1852, in the office at Joliet, Ill., where he learned the business of telegraphing. After service at Lockport and Springfield it was recognized that the young man possessed executive ability of a high order, and in 1857 he became superintendent of the St. Louis & Missouri River Telegraph company. This line, running from St. Louis to St. Joseph, Mo., was almost bankrupt when Mr. Clowry became superintendent, but the whole property was speedily reconstructed, and on December 7, 1859, a dividend of six per cent. was declared. By this time the Western Union company had become a joint owner, and in the spring of 1860 Mr. Clowry was elected one of the directors. On August 1, 1860, the whole property was leased to the Missouri & Western Telegraph company, which had been organized in the interest of the Western Union. This company had greatly extended the lines in Arkansas, Missouri, Kansas and Nebraska, and on September 5, 1860, Mr. Clowry opened an office in Omaha. Shortly thereafter the whole property was merged into the Western Union system, and Colonel Clowry has remained a Western Union man ever since.

During the war Colonel Clowry served on the military telegraph staff and distinguished himself by prompt and vigorous service. In 1863 he was appointed captain and assistant quartermaster, in charge of military lines in the Southwest. In 1864, as superintendent of military telegraphs, he received in quick succession two brevet commissions, one as major and the other as lieutenant-colonel "for meritorious service and devoted application to duty."

After the war Colonel Clowry was appointed to the position he now holds at the head of the Western Union's western territory. In speaking of this appointment Reid's "Telegraph in America" says: "It was a vast trust to offer to the hands of one man. But it was given in a confidence which has been amply justified. The administration of no other department is more thorough or minute. Colonel Clowry carries into his enlarged field all the coolness, sagacity and vigor of his earlier years. No emergency disturbs him. His judgment is practical, reliable, accurate. No man with less force would venture on the administration of such a trust." This is high praise, but well deserved.

On June 10, 1885, the directors appointed Col. Clowry to be acting vice-president of the Western Union Telegraph company, and not long afterward he was made permanent vice-president. Col. Clowry has long been a director of the great corporation with which he is so prominently identified, and is also general superintendent. He is also the principal representative of the electrical interests at the World's Fair, being a director of the local company, chairman of the committee on electricity and a member of the executive committee. He is a member of the Chicago Electric club, and has been active and alert in representing the electrical fraternity of the country in the directory of the exposition. Col. Clowry is highly esteemed by all classes throughout the West, not only for his distinguished ability as an organizer and manager, but for his admirable qualities as a man as well.

The new Citizens' Light & Power company of Rochester, N. Y., has been granted a franchise by the common council.

The city council of Belle Plaine, Ia., is considering a proposition to erect an electric light plant to be owned by the municipal corporation.

Western Electrician.

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CORRESPONDENCE relating to electricity, or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own*. THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring Western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

CONTENTS OF THIS NUMBER.

PAGE.

Electric Lighting in Chicago's Parks and Boulevards. Illustrated 269, 270
Illinois Institute of Mining Engineers 270
Chicago Electric Club 270
Electricity in Japan. Illustrated 270, 271
Keep the World's Fair Open Evenings 271, 272
Electric Coal Cutting Machine. Illustrated 272
Western Union Progress in Chicago. Illustrated 272, 273
Editorial 274
Chicago Edison Company 275
Brotherhood of Electrical Workers 275
Election Returns by Telephone and Telegraph 275
American Institute of Electrical Engineers 275
Electricity at the World's Fair 275, 276
A Remarkable Telegraphic Record 276
Electrolytic Refining of Copper 276
Lamp Litigation Continued 277
Telephony Under Lake Michigan. Illustrated 277
The Only Way To Head It Off 277
Oil Versus Air an Insulating Medium. By James Bowstead Williams, M. D. Part I. (American Institute of Electrical Engineers) 277

DEPARTMENTS.

Correspondence 278
New Incorporations 278, 279
Electric Lighting 279
Electric Railways 279
Telegraph 279
Telephone 279
Miscellaneous 279, 280
Trade News 280
Business 280
Electrical Patents 280

SPEAKING of the esthetic objection to the trolley system, the *Popular Electric Monthly* pertinently inquires: "But is it any more unsightly than a couple of overworked horses slipping and stumbling along a slippery track in winter, pulling an overloaded car? Is it any more unsightly than the poor beasts plodding along under a scorching sun in mid-summer, and the streets dotted here and there on exceptionally hot days with the dead bodies of such horses or mules as are unable to bear the cruel and unnecessary strain?"

And to this might be added that nothing could be more unsightly to the weary waiter on the street corner than the perspective of a long straight street with its long straight tracks and not a car in sight!

THE *Electrical World* of New York printed a brief editorial in its issue of last week on "Evening Displays at the World's Fair" that forms an amusing diversion from the serious discussion of the subject. The *World*, it seems, has become possessed of the idea that there is no such thing as a rule providing that the World's Fair shall be closed at 7 o'clock, for it gravely remarks that "all friends of the enterprise will be glad to learn that rumors of the passage of rules providing for evening closing are not well founded." In view of the letter to Col. Clowry from the president of the board of directors, published in this issue, this sapient utterance is very funny. Mr. Higinbotham expressly says that "It was thought best to make the rule to close at 7 o'clock." If our New York contemporary will read the WESTERN ELECTRICIAN more carefully it will be enabled to avoid embarrassing blunders of this character. By doing so it will be able to appreciate the concessions already made as the result of the agitation led by the WESTERN ELECTRICIAN, and will also be in position to join in the rejoicing when the obnoxious rule shall have been repealed.

FOR two years the New York Rapid Transit Commission has been at work preparing plans for the relief of the people of the metropolis. Last week the result of its labors was laid before the public, and capitalists will be given until December 29th, when the franchise will be offered for sale, to make calculations upon which to base their bids. It is not to be presumed for a moment that the American electrical engineer is oblivious to the fact that this is an opportunity of a lifetime. Ever since the possibilities of electric traction became clear to those engaged in the exploitation of railway apparatus the cry has been "Give us a chance and let us show you what we can do." An opportunity was offered some years ago in New York when the "L" roads permitted the experiments with electric locomotives, but the elevated railway people were not converted, and the little steam locomotive still holds its own in this service at least. That time and the present, though, appear as periods far apart, especially when one takes into consideration the remarkable advance which has been made along the line of electric traction. It is fair to say, for instance, that a manufacturer of electric railway machinery would have hesitated long time before making the proposition—or perhaps would not even have considered the problem—to construct locomotives fit for service in the B. & O. tunnel at Baltimore. Such a work, though, has not only been undertaken, but the contractor has guaranteed its successful completion. And now comes the chance for a grander work. The rapid transit people evidently want electric locomotives. But they have not committed themselves to the adoption of this method of propulsion, and they stand ready to give very serious consideration to "some other form of power not requiring combustion within the tunnel." Undoubtedly electricity will win the fight if there be any at all, but before the final verdict as to the motive power is given out, some very bold plans will have to be drawn and guaranteed. Locomotives will be required sufficiently powerful to start readily a train of eight cars, each weighing, in addition to its load of passengers, not less than 30,000 pounds, on a gradient with a rise of 1½ feet per 100 feet of distance, and the motor must also be able to maintain the same train at a speed of not less than forty miles per hour on a level gradient. Should each car be provided with its own motor, it must be capable of exerting sufficient power to comply for each car with the foregoing requirements.

But after all the opportunity is really all that is wanted. Our foremost electrical engineers are now sufficiently familiar with large work to make the problem of designing these heavy machines by no means a difficult task. We have not the slightest fear that the "some other form of power" will appear as a competitor worthy of serious consideration.

J. B. WILLIAMS' paper on "Oil Versus Air as an Insulating Medium," read at the Chicago meeting of the American Institute of Electrical Engineers, is presented elsewhere in this issue. Mr. Williams gives an account of some experiments carried on with a view of determining the comparative insulation resistance of oils and air when employed in connection with continuous high tension currents; the relative powers of such insulators, however, to resist disruptive discharges and alternating currents were not considered.

Without reference in detail to the tests, it may be said that the conclusions reached were that air, even when it has a humidity of 80 per cent., is infinitely superior to oil for insulating conductors carrying continuous high tension currents; that pure paraffin is far superior to oil, both for insulating conductors and for preventing the escape of the current across the surface of glass; that air having a humidity of 80 per cent. is superior to paraffin as an insulating medium; that oil will not prevent leakage of the current across the surfaces of glass; that whenever oil covers the surface of hard rubber, used in connection with such currents, even when the latter is paraffined, it destroys the high surface insulation of the paraffined hard rubber; that is, the low surface insulation of the oil takes the place of the higher insulation of the hard rubber, when used bare and clean, or when covered with paraffin. In a word, it may be stated that where high tension continuous currents are to be handled, Mr. Williams is a believer in dry air as an insulator in preference to oil or even paraffin. Air is certainly cheaper, he says, than any other insulating material and intense discharges do not destroy or injure it. Burn-outs, too, do not affect it, and when it can be kept dry, which is the great difficulty attending its use, it makes an insulator of high resistance and low electrostatic capacity—two essentials in electrical engineering work.

As oil has just now many advocates it is to be presumed that Mr. Williams' conclusions will provoke discussion. The field for high tension currents, both continuous and alternating, is rapidly widening, and investigators are handling currents at remarkable pressures. The work accomplished, though, up to the present time all indicates that the art of insulation, if such an expression can be used, rather than the current itself, is in its "infancy." As far as alternating currents of high tension are concerned, the results obtained in experiments where oil was employed as an insulating medium would seem to indicate that this fluid is destined for a high place among insulators. But every series of experiments along this line has a value and should be recorded, as this field of research is, practically speaking, an unexplored one.

PRESIDENT HIGINBOTHAM'S letter to Colonel Clowry, acknowledging the receipt of the petition of the electrical people asking that the World's Fair be kept open evenings, is far from satisfactory. The president of the board of directors says: "It is not the intention of the management, either in the directory or the commission, to close the fair so that evening sessions may not be had. It was thought best to make the rule to close at 7 o'clock, and then the council of administration could, from time to time, open the gates till 8 o'clock in the evening on such days as it thought wise to do so, it being the intention to have an evening session from 8 until 11 o'clock on from three to six days each week, according to circumstances." The electrical interests will not be content with this indefinite assurance. They propose to expend large sums of money on evening displays, and it makes a vast difference to them whether the fair is to be open one, three or six evenings a week. If assured that the exposition gates will swing inward on every evening except Sunday—the only reasonable and satisfactory way to meet this question—they will make a display so attractive that the electricity building and the great central station in machinery hall will be the most popular features of the exposition after dark, and will alone serve to draw many thousands of visitors to Jackson Park every night, be it clear or stormy. With the prospect that the exhibition may be open in the evening only half the time, or even less, the electrical firms will not put their money into exhibits which they will have practically no chance to show and thus what promises to be one of the greatest and most beautiful departments of the fair will be shorn of nearly all its brilliancy. The electrical interests of the country are thoroughly aroused and are closely watching the action of the management of the exposition on this question. If the directors desire to keep many prospective electrical exhibitors away entirely and to very materially curtail the exhibits of the remainder they have only to persist in maintaining their present vague and indefinite attitude. Expensive displays, which can be seen to advantage only after dark, will not be set up merely on the assurance that the gates will be opened in the evening "on such days as it is thought wise to do so."

The managers of the fair have displayed a strange timidity in dealing with the question of evening closing, and it is urged that it should be possible to close the gates at 7 o'clock during bad weather. Of course there will be some rainy evenings during the session of the exposition, but with the multitude of out-of-town visitors who want to see as much as possible in a short space of time, and with the Chicago clerks and workingmen who can only go in the evening, it does not seem possible that stormy weather would affect the attendance to such an extent as to make an open fair in the evening unprofitable, especially as only a few of the buildings need be lighted beyond the illumination needed for police protection, which must be afforded in any event. Perhaps the management proposes to close the fair for an hour and then open it again, requiring a separate admission fee for the evening session. This would undoubtedly be a very unpopular measure, although many of the evening visitors, of course, would not come until after seven o'clock if the fair were open continuously.

In considering this question and the probable attitude of the electrical trade, the management should bear in mind the action of the school superintendents of the state of New York, who have decided to entirely abandon the educational exhibit from that state unless proper recognition is given to the educational interests of the United States. This action may yet serve as a precedent in electrical circles.

Chicago Edison Company.

The work of enlarging the operations of the Chicago Edison company is going on at a rapid rate, and Superintendent Church is one of the busiest men in town. A late announcement is that a generating station is to be erected on the North Side. An arrangement has been made with the trustees of the Newberry library by which the new station will be located on the library grounds in the rear of the library building on Oak street, between Dearborn avenue and Clark street. Light, heat and power will be furnished to the library, and it is stated that the arrangement is a very advantageous one for the latter institution. The territory to be covered by the station extends from the northern line of Lincoln park to the river and a similar distance west from the lake. There are many fine residences and business houses in this section that will undoubtedly be glad to take current. The station will be a plain one-story building, similar in appearance to the South Side station on Wabash avenue, near Twenty-sixth street. It will be equipped at first for a capacity of 5,000 16 candle power lamps. The machinery will consist of two Heine boilers—one of 200 horse power and the other of 375—and three Lake Erie upright, non-condensing, compound engines directly coupled to two 50 kilowatt and four 75 kilowatt multipolar Edison dynamos. The underground system of distribution will be used, and it is expected that current will be sent through the mains by next spring or early in the summer. Some objection has been made to the location of the station by adjacent property owners, but no serious difficulty is apprehended.

Work is in progress on the foundations for the new station for the down town district at Harrison street and the river, on the West Side. The foundations for the heavy machinery will be on piles, which are now being driven. At first this station will be operated in connection with the present Adams street plant, and it will probably be a couple of years before the entire down-town load is thrown on the big new station, although it is expected that current may be sent through the mains by next September. Even after all the engines and dynamos are removed from the present station a portion of the building will be retained by the company as a sub-station for distribution, and the circuit switchboard will be retained at this point. The offices of the company will be removed to the Harrison street building, however, and it is possible that the existing structure on Adams street may be built up as an office building.

At the start the West Side station will be equipped with 4 800 horse power in engines, the contract for which has been let to the Southwark Foundry & Machine company of Philadelphia. There will be four 600 horse power engines and two of 1,200 horse power each. These machines will be of the upright, non-condensing, triple expansion type, similar to marine engines, and will represent the latest advancements in the engine builder's art. They will drive, by direct connection, four 200 kilowatt multipolar Edison dynamos and two 400 kilowatt machines of similar design. The ultimate capacity of the station is between thirty and forty thousand horse power, but of course it will be a number of years before engines will be installed to that extent.

The trunk feeders to connect the Harrison street station with the point of distribution on Adams street are now being laid in iron tubes, of which there are fifteen. Each tube contains three wires of the same polarity. There are six positive tubes, six negative and three neutral. Each wire is a million circular mils in area, and a cross-section of any tube would thus show three million circular mils in copper. The sections of tubing are coupled together without soldering by a new arrangement devised by Superintendent Church.

Brotherhood of Electrical Workers.

The second annual convention of the Brotherhood of Electrical Workers of America was held in Chicago, beginning on November 12th. About sixty-five delegates were present. The present membership of the order is said to be nearly 10,000, and there are fifty-two local unions in various cities of the Union. The one in New York city has 700 members, and No. 9 of Chicago has over 600. The Brotherhood has affiliated with the American Federation of Labor. Its membership consists of all employes of electrical manufacturing concerns and men who put up and construct electric and telephone lines, but does not include telegraph operators. Sick benefits are paid to members by the local unions, and in case of death of a member the national body pays his family $100, and on the death of a member's wife he receives a funeral benefit of $50. This is paid from the national treasury, which receives monthly 10 cents from each member of the order.

On Wednesday of last week the brotherhood completed its labors and adjourned till the second Saturday in September, 1893, the meeting to be held in Cleveland, O. The three days' session of the body was productive of much legislation which will be of material benefit to the organization. A new constitution has been adopted, which is of a conservative nature, and will serve, it is hoped, to draw the employer and employe closer together. The reports of the officers showed the brotherhood to be in excellent condition. The New York union has for some reason held aloof from the national organization ever since its formation, but it has recently come to look upon its position as being antagonistic to its own interests. A delegate from the New York organization was at the Chicago meeting and made formal application for the admission of his union into the national fold. The request was referred to the executive committee with full power to act.

Officers for the ensuing year were elected as follows: Grand president, Henry Miller, St. Louis; first grand vice-president, John Dunn, St. Louis; second grand vice-president, Frank Roth, Kansas City; third grand vice-president, John W. Veeve, New Orleans; secretary treasurer, J. T. Kelly, St. Louis; executive board, Frank Allen, Cleveland and P. J. Fleming, Minneapolis, together with the national officers.

Probably the most important measure enacted by the convention was one providing for a mutual insurance association. The work done by the men renders it difficult to get insurance. It was also decided to establish an official journal, which will be printed at St. Louis.

Election Returns by Telephone and Telegraph.

For the first time election returns were transmitted by telephone from Chicago to New York on the night of the recent presidential election. The arrangements at the Chicago end of the line were made by C. E. Mosley and Wendell Baker of the American Telephone & Telegraph company, and these gentlemen received many compliments on the service rendered. The local returns were telephoned from the office of the City Press association in the city hall to the company's office on Quincy street. As fast as received the operator wrote down the bulletins, which were carried to another operator, who transmitted them over the long distance telephone to New York. On the other side of the New York transmitting operator was a third, who received returns from Milwaukee, although these did not come in until late in the evening. These bulletins were also written down and given to the New York sender. From New York the bulletins were sent back to Chicago, with eastern returns, and these were received by a fourth operator who wrote them on slips, which were carried to still another, who spoke them into a transmitter connected with the Chicago, Union League and Iroquois clubs. This seems an elaborate system, as the local returns went through the hands, or, more properly, the lips, of five operators, and made the journey to New York and return before being received by the local customers. In practice the plan worked very well, however, and it is claimed that even by this roundabout system the returns in the Chicago clubs were from twenty to twenty-five minutes ahead of those of the telegraph companies. In New York the Republican and Democratic headquarters and the Manhattan, University Athletic, Union League and Electric clubs were supplied, the service being equally good. Bulletins to the number of 148 were received from New York and delivered to the Chicago customers.

The Western Union company collected its returns from the capitals of the states. All western returns were collected and sent east at Chicago, and all eastern returns were received and distributed at this city. On November 8th, the day and night of election, 119,123 messages were handled at Chicago, and 73,350 bulletins were received. There were 58,833 words of special dispatches to newspapers and 86,929 words of specials that were relayed at this city. Special dispatches to the amount of 181,368 words were received. On the 9th 106,465 messages were handled at Chicago. These figures will give an idea of the vast amount of election business transacted. They are exclusive of the press reports sent over leased wires.

The Postal company's returns came to an editor who compiled the messages to be sent out broadcast over the country. The editor's assistant kept a correct and complete statement of checks against the returns, thus preventing any duplication and unnecessary transmission. The editor handed his completed bulletin to an operator at his right, who in turn sent it to six other operators not twenty feet away. These receiving operators had each eight copies of manifold before him, and as soon as the bulletins were finished the check boys in attendance immediately distributed them to all the different wires served. Thus within a minute after the bulletin left the editor's hands, every Postal office in the western division, which extends south to Georgia, west to Leadville, and east to Pittsburg, had the news. The company also supplied bulletins on all main circuits working to the different large centers of the country, and in nearly every city of importance special wires were erected to supply clubs, theaters, and political committees with the news, which was all sent simultaneously. Over three hundred condensed bulletins giving the gist of the news of the night were sent out between 6 P. M. and 2:30 A. M. Over two hundred and forty operators were employed in Chicago on election night by the Postal.

American Institute of Electrical Engineers.

At the monthly meeting of the council of the American Institute of Electrical Engineers, November 15th, the following named associate members were elected:

Craig R. Arnold, Arnold Electric Manufacturing company, Chester, Pa.; Ludwig K. Bohm, Ph. D., New York city; Edward Durant, New York city; Horace B. Gale, San Francisco, Cal.; Fred S. Hunting, electrical engineer, Fort Wayne Electric company, Fort Wayne, Ind.; James F. McElroy, Albany, N. Y.; T. Stahl, Creusot Works, Creusot, France.

The following associate members were transferred to full membership, their applications having been approved by the board of examiners:

Frank Bourne, New York city; Benjamin F. Thomas, Columbus, O.; Alexander J. Wurts, Pittsburg, Pa.; George R. Metcalfe, New York city; Lewis B. Stillwell, Pittsburg, Pa.

At the meeting of the institute in the evening Dr. J. B. Williams made a series of tests of the insulating qualities of different oils referred to in his paper read at the Chicago meeting of the institute, and published elsewhere in this issue. The insulation of samples of various wires was also tested, and the use of his apparatus fully explained.

Electricity at the World's Fair.

The director-general has authorized the publication of the list of the names of the persons and corporations doing business in the United States who have applied for space as exhibitors at the World's Fair. There are 18,000 of these domestic applications, and the *Chicago News Record* of November 17th printed the list entire. The names took up 28 columns of solid nonpareil type. The electrical fraternity will, of course, be most interested in the applications for space in the electricity building. There are about 300 of these from the United States. It should be remembered, however, that one application may represent several exhibits. Many supply houses in Chicago, for instance, have applied for space sufficient for all the companies whose products they handle. When the exposition is opened it will be seen that there are more than 300 domestic exhibitors in the electricity building. Following is the list for Chief Barrett's department:

Adler, Leon D., 11 Sidney place, Newark, N. J.
Akron Electrical Manufacturing company, Akron, O.
Amateur Electrician, Ravenswood, Ill.
American Bell Telephone company, 125 Milk street, Boston.
American Exhibition company, Ledger building, Philadelphia, Pa.
American Graphophone company, 619 Fourteenth street, Washington, D. C.
American Tanning company, 46 Wall street, New York city.
Anthony Electrical Instrument company, 9 Metropolitan block, Chicago.
Arnold Electrical Manufacturing company, Chester, Pa.
Bain Electric Manufacturing company, 47 South Jefferson street, Chicago.
Barton Bell company, Marion, Ind.
Beacon Vacuum Pump & Electric company, Irvington street, Boston.
Belknap Motor company, Portland, Me.
Berliner, E., Columbia Road, Washington, D. C.
Billings & Spencer Co., Hartford, Conn.
Blodgett Manufacturing company, 1602 Ashland block, Chicago.
Bottome, Turner D., Hoosick, N. Y.
Brady, T. H., New Britain, Conn.
Brooks, R. T., 82 John street, New York city.
Brooks, John C., Paterson, N. J.
Brush Electric company, Cleveland, O.
Bryan, Enholm & Co., 136 Liberty street, New York city.
Butler Hard Rubber company, 33 Mercer street, New York city.
C. & C. Electric Motor company, 402 Greenwich street, New York city.

Central Electric company, 115 Franklin street, Chicago.
Chicago Electric Wire company of Wilmington, Wilmington, Del.
Chicago Society of Operative Electricians, 1303 Chamber of Commerce building, Chicago.
Chicago Magnetic Shield company, 6 Central Music Hall, Chicago.
Columbia Incandescent Lamp company, 1912 Olive street, St. Louis, Mo.
Commercial Electric company, Indianapolis, Ind.
Commercial Cable company, 1 Broadway, New York city.
Consolidated Electric Storage company, Drexel building, Philadelphia, Pa.
Cook, Victor A., 195 Dearborn avenue, Chicago.
Cregier, Dewitt C., Jr., 418 East Chicago avenue, Chicago.
Crocker-Wheeler Electric company, 430 West Fourteenth street, New York city.
Cross, Frank, Washington, Ind.
Cutter, George, 333 The Rookery, Chicago.

Davy Electric Belt & Appliance company, Evansville, Wis.
Day, S. A., 166 Fulton street, New York city.
Dayton Fan & Motor company, Dayton, O.
Delaware Hard Fibre company, Wilmington, Del.
Detroit Electrical Works, Detroit, Mich.
Devey, Matthew H., 353 Parker street, Chester, Pa.
Du Laney Clock company, 79 Dearborn street, Chicago.
Duplex Electric company, Corry, Pa.

Eddy Electrical Manufacturing company, Windsor, Conn.
Edgerton, N. H., 609 Commercial street, Philadelphia, Pa.
Edgerton, E. M , 301 Sixty-third street, Chicago.
Edison, Thos. A., Orange, N. J.
Egan, Chas. E., Englewood, Ill.
Electric Appliance company, 242 Madison street, Chicago.
Electric Engineering & Supply company, Syracuse, N. Y.
Electric Gas Lighting company, 20 Lakeside building, Chicago.
Electric Heat Alarm company, 113 Devonshire street, Boston.
Electric Machine company, 1008 Title & Trust building, Chicago.
Electric Secret Service company, 45 Broadway, New York city.
Electrical Advertising & Display Manufacturing company, 134 South Seventh street, Philadelphia, Pa.
Electrical Age, World building, New York city.
Electrical Engineer, 150 Broadway, New York city.
Electrical Forging company, 163 Oliver street, Boston.
Electrical Industries, Monadnock building, Chicago.
Electrical Merchandise company, 11 Adams street, Chicago.
Electrical Review, 32 Park Row, New York city.
Electrical Supply company, Chicago.
Electrical World, Times building, New York city.
Electricity, 6 Park place, New York city.
Electro Medical Battery company, 128 Main street, Kalamazoo, Mich.
Electrolibration company, Birmingham, Ala.
Elgin Telephone company, Elgin, Ill.
Empire China Works, 144 Green street, Brooklyn, N. Y.
Empire Gold & Silver Plating Works, 75 Nassau street, New York city.
Engineering Equipment company, 143 Liberty street, New York city.
Eureka Electric company, 18 Broadway, New York city.
Eureka Tempered Copper company, Northeast, Erie county, Pa.
Excelsior Electric company, 42 Broad street, New York city.

Field Engineering company, 143 Liberty street, New York city.
Fibre Pipe company, Mechanicsville, N. Y.
Ford-Washburn Storelectro company, Cleveland, O.
Franklin Electric Appliance company, 141 Milk street, Boston.
French, H. W. & John Warren, 833 Exchange building, Boston.
Fort Wayne Electric company, Fort Wayne, Ind.

General Electric company, New York and Boston.
Gamewell Fire Alarm Telegraph company, 901 Ashland block, Chicago.
Germania Electric company, 620 Atlantic avenue, Boston.
Goodwin, F. O., 53d and Yalusing avenue, Philadelphia, Pa.
Gray, Elisha, Highland Park, Ill.
Great Western Electric Supply company, 195 South Canal street, Chicago.
Greeley, E. S. & Co., 587 Dey street, New York city.
Guillaume, Alfred, 215 Dearborn street, Chicago.

Hall, Chas. Fred, New Grand hotel, Plymouth place, Chicago.
Hanson & VanWinkle Electric company, 35 and 37 South Canal street, Chicago.
Heisler Electric company, Drexel building, Philadelphia, Pa.
Hirlimann, Chas. J., 117 MacDougal street, New York city.
Holmes, Nathaniel L , Delta Upsilon house, Ann Arbor, Mich.
Hope Electric Appliance company, Providence, R. I.
Hornell Iron Works, Hornellsville, N. Y.
Houlehan, James, 49 North Clark street, Chicago.
Huestis, Chas. D. C., Fort Wayne, Ind.

Illinois Alloy company, 41 Portland block, Chicago.
India-Rubber Comb company, 9 Mercer street, New York city.
Indiana Insulated Wire & Rubber company, Jonesboro, Ind.
Interior Conduit & Insulation company, 42 Broad street, New York city.
International Electric Railway company, Commerce building, Chicago.

Jenney Electric Motor company, Indianapolis, Ind.
Johns Manufacturing company, H. W., 87 Maiden Lane, New York city.
Johnson Electric company, Cleveland, O.

Kirwan Electric Indicator company, Wilkesbarre, Pa.
K.A.P. Electric Novelty company, South Second street, La Crosse, Wis.

Lang, J., & Co., 44 Michigan street, Chicago.
La Roche Electric Works, 116 North Sixth street, Philadelphia, Pa.
Leatheroid Manufacturing company, Kennebunk, Me.
Le Clanche Battery company, 111 East One Hundred Thirty-first street, New York city.

Manhattan Electric Supply company, 36 Cortlandt street, New York city.
Mason, Jas. H., 120 Park avenue, Brooklyn, N. Y.
Marcus, Wm. N., 218 North Second street, Philadelphia, Pa.
Mather, A. C., 169 Adams street, Chicago.
Mather Electric company, 9 Metropolitan block, Chicago.
McCaskey, Alfred S., and J. A. Ellis, Union Club, Chicago.
McIntire company, C., 13 Franklin street, Newark, N. J.
Moore, Alfred F., 200 North Third street, Philadelphia, Pa.
Municipal Fire & Police Telegraph, Highlands, Mass.
Munson Belting company, 36 South Canal street, Chicago.
Munson Lightning Conductor company, Indianapolis, Ind.

National Carbon company, Cleveland, O.
National Electrical Manufacturing company, Eau Claire, Wis.
New England Butt company, Providence, R. I.
New York & London Electric association, 1021 Main street, Kansas City, Mo.
New York Insulated Wire company, 15 Cortlandt street, New York city.
Newman Clock Manufacturing company, 134 Van Buren street, Chicago.
North American Electric company, 14 Ann street, New York city.
Norwich Insulated Wire company, 112 Green street, New York city.

Owen, Dr. A., 201 State street, Chicago.

Page Belting company, 165 Lake street, Chicago.
Paiste, H. T., 1201 Market street, Philadelphia, Pa.
Pennock Battery Electric Light & Improvement company, 334 Dearborn street, Chicago.
Perry & Runlett, 25 Stickney street, West Lynn, Mass.
Perkins, Frank C., 103 East State street, Ithica, N. Y.
Perkins Electric Lamp company, Metropolitan block, Chicago.
Phelps, A. H., M. D., Glens Falls, N. Y.
Phœnix Glass company, 43 Sixth avenue, Pittsburg, Pa.
Powell, Wm., Co., Spring Grove avenue, Cincinnati, O.
Pratt-Electro Medical Supply company, 75 Madison street, Chicago.
Praul Rotary Steam Engine company, 216 South Seventh street, Philadelphia, Pa.
Pulvermacher Galvanic company, Cincinnati, O.
Pumpelly, Jas. K., 205 South Canal street, Chicago.

Queen & Co., Jas. W., 924 Chestnut street, Philadelphia, Pa.
Quin, J. B., 521 Fifth avenue, Louisville, Ky.
Quinby, Wm. C., 326 Pine street, San Francisco, Cal.

Railway Equipment company, Pullman building, Chicago.
Ranscher, John, 134 Concord street, W. St. Paul, Minn.
Revell, Alex., Wabash avenue and Adams street, Chicago.
Rich, Chas. Clayton, Mt. Vernon, N. Y. (Rich Electric Heating company).
Ries Electric Specialty company, Eutaw and Baltimore streets, Baltimore, Md.
Ries, Elias E., corner of Baltimore and Eutaw streets, Baltimore, Md.
Riker Electric Motor company, 45 York street, Brooklyn, N. Y.
Ringler, F. A , & Co., 21 Barclay street, New York city.
Robinson Machine company, Altoona, Pa.
Roessler & Hasslacher Chemical company, 73 Pine street, New York city.
Rogers, J. Harris, Bladensburg, Md.
Rosseau's Electric Works, 310 Mott avenue, New York city.

Sample, H. C , 145 Ontario street, Chicago.
Sanden Electric company, 169 La Salle street, Chicago.
Sarony, H. J., 4 Liberty square, Boston.
Schieren, Chas. A. & Co., 46 South Canal street, Chicago.
Short Electric Railway company, Cleveland, O.
Sigler, Jas. O., Paterson, N. J.
Standard Paint company, 2 Liberty street, New York city.
Standard Underground Cable company, Westinghouse building, Pittsburg, Pa.
Standard Electric Signal company, Rochester, N. Y.
Standard Battery company, 324 Dearborn street, Chicago.
Stanley Electrical Manufacturing company, Pittsfield, Mass.
Steward Manufacturing company, Chattanooga, Tenn.
Striemer, A., Hayward, Wis.
Strowger Automatic Telephone Exchange, 301 Rookery, Chicago.
Stoelting, Christ. H., 62 South Canal street, Chicago.
Sperry Electric Mining Machine company, Thirty-ninth street and Stewart avenue, Chicago.
Sponholz, Carl L., 126 School street, Lowell, Mass.
Swan Lamp Manufacturing company, Cleveland, O.

Thermo-Electric Heat Regulating company, Easton, Pa.
Thomson-Houston Electric company, Lynn, Mass.
Thomson Electric Welding company, Fiske building, Boston.
Ticonderoga Machine company, Ticonderoga, N. Y.
Tate, 209 West Van Buren street, Chicago.
Thompson & Robertson, 258 Broadway, New York city.
Todd, John T., Newman, Ill.
Tompkins, Mrs. Jennie E., 2408 Wabash avenue, Chicago.
Tropical American Telephone company, 15 Cortlandt street, New York city.

Union Electrical Works, 207 Canal street, Chicago.
Utica Electrical Manufacturing & Supply company, Utica, N. Y.

Vail, Stephen, 18 Cortlandt street, New York city.
Viaduct Manufacturing company, German and Charles streets, Baltimore, Md.
Vetter, J. C. & Co., 214 East Forty-seventh street, New York city.

Waddell-Entz company, Bridgeport, Conn.
Waterhouse Bros., 302 Asylum street, Hartford, Conn.
Washburn & Moen Manufacturing company, Worcester, Mass.
Webb, Dr. G. F., 251 Arcade, Cleveland, O.
Western Electric company, 327 Clinton street, Chicago.
WESTERN ELECTRICIAN, 6 Lakeside building, Chicago.
Weston Electrical Instrument company, 114 Williams street, Newark, N. J.
Western Union Telegraph company, Chicago.
Westinghouse Electric Manufacturing company, Pittsburg, Pa.
Weston, Wm. H. & Co , 830 Filbert street, Philadelphia, Pa.
Wiesinfeld, Robert .S, 2 South Holliday street, Baltimore, Md.
Wing, L. J., 126 Liberty street, New York city.
Woods, Granville T., 136 Liberty street, New York city.
Writing Telephone company, P. O. 1322, New York city.

Zucker & Levett Chemical company, 40 Murray street, New York city.

Chief Barrett and Secretary Hornsby will remove their offices to the electricity building in a day or two. Rooms on the second floor adjoining the hemicycle, are now being fitted up.

A Remarkable Telegraphic Record.

All through the Mississippi valley telegraph wires were down in all directions on Friday of last week, owing to a severe storm. Reports from towns in Iowa and the Northwest were received in the Chicago offices by mail. The rush of accumulated business on Saturday, when the wires were brought up again, was the cause of a remarkable record in the Postal office. One operator, E. D. Williams, handled 326 messages from Minneapolis in three hours and fifty minutes. This is an average of one message for every 42.3 seconds—a record that is believed to stand unequaled.

Electrolytic Refining of Copper.

To the Editor of the WESTERN ELECTRICIAN:

I have just noticed in *L'Industrie Electrique* of October 25, 1892, an article on electro-metallurgy, in which a reference is made to my paper on "Electrolytic Refining of Copper in the United States."

Your French contemporary gives the data on electric power and output as stated by me for the United States, but says that this represents the output for the whole world, "Dans le monde entier," while it should read, "Dans les Etats Unis." Very truly yours,

Chicago, Nov. 14, 1892. F. B. BADT.

New Orleans was thrown into absolute darkness on the night of November 8th, the electric light workers deciding to strike out of sympathy with their fellow strikers, and the Louisiana company, which does the street lighting, having no force to trim its lights. Representatives of the company wrote to the mayor suggesting that the police trim the lights, but no action was taken in the matter.

Lamp Litigation Continued.

In the United States Circuit Court at New York last week, the incandescent lamp litigation was continued, Judge Brown granting a preliminary injunction against the Sawyer-Man company, restraining it from manufacturing incandescent electric lamps. The injunction was stayed, however, until December 6th, or until such other time as the matter may be brought up before the United States Circuit Court of Appeals for decision.

The action was brought by the Edison interests to restrain the Westinghouse interests from manufacturing incandescent lamps. The injunction is asked under the recent decision of the United States Circuit Court of Appeals against the United States Electric Light company, which was a part of the Westinghouse system. Since this judgment, so the plaintiffs in the present action allege, the United States company has gone out of the business of making incandescent lamps, but it has turned all its interests in this direction over to the Sawyer-Man company, another branch of the Westinghouse company. This latter corporation is now making all the lamps for the other Westinghouse companies, it is alleged, and the Edison people ask that the Sawyer-Man company be enjoined from following this course until the case may be heard on its merits in a suit for a permanent injunction and an assessment of damages.

Considerable interest has been manifested in the case owing to the fact that the defense has raised an entirely new claim for consideration, viz.: that the Edison patents are controlled by a "trust." It is claimed that in view of this fact the plaintiffs have no legal standing in court? The Westinghouse interests ask that the court order the plaintiffs to supply the defendant lamps at market prices.

Telephoning Under Lake Michigan.

Doubtless many people are curious to know the manner in which communication will be carried on between the Chicago water works office and the crib four miles out in Lake Michigan. A visit to the mouth of the four-mile tunnel just being completed by Mr. Onderdonk will reveal

TELEPHONING UNDER LAKE MICHIGAN.

the means through which the lonely occupants of the far-away little house out in the lake will be kept, through the telephone, practically speaking, in touch with those in the heart of the great city. The immense reel of submarine cable shown in the accompanying cut almost tells its own story. This cable, which was furnished to the city by F. W. Cushing, general western agent for Day's kerite wire and cables, is said to be the longest armored submarine cable ever brought to Chicago. It is four and one-half miles long, in one piece, and weighs 33,000 pounds. It is composed of three No. 16 B. & S. conductors insulated with 7-32 kerite insulation, juted and protected with an armor of 15 No. 8 galvanized iron wire. This cable is now being placed in the tunnel, 90 feet under the bed of the lake, requiring the services of 50 men to place it in position. Great difficulty was experienced in finding a flat car strong enough to transport the cable from the kerite company's factory at Seymour, Conn. The first car broke down in transit, but the reel finally reached the city without further mishap.

The Only Way to Head It Off.

"So you are in the electrical engineering line," said the traveler in the palace car to a chance fellow-traveler with whom he was exchanging fragments of personal history. "There has always been a fascination for me in that field of research. By the way, don't you think——"

"Beg pardon," hastily interrupted the other, taking from his pocket and handing to him a well-worn card inscribed:

No, the Science of Electrical Engineering
IS NOT
In Its Infancy!

And the conversation gradually drifted to other subjects.—*Chicago Tribune.*

Oil Versus Air as an Insulating Medium.[1]

By James Bowstead Williams, M. D.

Part I.

All who have attempted to enlarge in the smallest degree the bounds of our knowledge, recognize the importance of the faithful collection of facts which, though seeming separately insignificant, may yet when brought together resolve themselves into distinct and important scientific truth. By combining the results of investigations carried on from different standpoints, we obtain a view of the subject more complete than any single mind, however masterly, could give us. Hence every item of information has its importance, as it may prove to some other investigator the exact clue needed to solve some long-pondered problem. Acting upon this principle, the writer now offers an account of some experiments made by himself to determine the comparative insulation resistance of oils and air; and it has appeared to him that the results obtained from these experiments are especially important from the fact that all of the apparatus used was absolutely insulated, and that the only leakage that could take place was through or across the various substances experimented upon.

The relative powers of oils and air to resist disruptive discharges and also to insulate alternating currents, will not be considered at this time, as the writer proposes to reserve those subjects for a future paper.

The instruments used in the experiments from which the results about to be set forth in this paper were obtained, were an electrometer, a discharge key, a six inch spark coil and a Grenet cell to operate it, and apparatus for holding the oils and other substances while they were being tested.

The electrometer was a special form of quadrant electrometer, designed and made by the writer in San Francisco, in 1886, for the purpose of testing insulating material generally, and particularly for determining the comparative insulation resistance of very short pieces of insulated electric conductors. Its quadrants and needle system are similar to those of Lord Kelvin's electrometer, but the mounting of the quadrants and the needle suspension are different. No glass is used for insulating the various parts, this insulation being effected entirely by means of the best quality of hard rubber which is well paraffined. The suspension is of the bifilar type, is about six inches in length and is provided with adjustments. The replenisher and gauge are contained in a separate vessel, and when they are electrically connected with the electrometer proper the combination can be used in the same manner and for the same purposes as the "White pattern" quadrant electrometer. The insulation of this instrument is so perfect that its quadrants, when charged to potentials of about 6,000 volts, will retain their charge for several hours without any perceptible leakage.

Before the electrometer is used for comparative testing, it is so adjusted that the quadrants, when fully charged, will be charged to any desired potential of from one to six thousand volts.

The discharge key resembles those in common use, the only difference being in the trigger, which is so constructed as to insulate as highly as any of the pillars of the key.

This instrument was used when time measurements were taken.

With this apparatus, using the same potential as that used in these experiments, the "dielectric after-working" of Boltzman can be demonstrated, if a few inches of highly insulated wire are tested. The variation of the capacity of a condenser having a small bare wire for its inner coating can also be shown.

The apparatus in which the oils were first tested consisted of a glass cup to contain the oils and two circular brass disks, parallel to each other, which were immersed in the oil and between which layers of oil could be formed.

These disks were each 2¾ inches in diameter, one of the disks, the lower, being fixed and the other, the upper, movable. The movable disk was soldered to the end of an adjustable screw passing perpendicular through the center of the hard rubber cover of the cup, which was 3 inches in diameter. The fixed disk was supported at the middle of a U shaped device formed of hard rubber tubes, both of the arms of which were cemented to the cover of the cup. One of these arms passed through the cover and extended about 6 inches above it, and contained the wire which was soldered to the fixed disk. The disks were absolutely insulated from each other and from the earth, and were separated one thirty-sixth of an inch by each revolution of the adjustable screw. The apparatus in which the second tests of the oils were made, will be described later.

The method of testing the oils was briefly as follows: The needle of the electrometer, the induction plate, and one pair of quadrants were electrically joined to the frame of the instrument and to earth, and the second pair of quadrants joined to the upper disk.

The lower disk was connected with the binding screw of the upper contact of the discharge key, the lever of the key being depressed and held against the lower contact of the key by the trigger. The lever of the key was joined to earth. Oil was then poured into the cup, sufficient to cover the upper disk when this disk was separated from the lower disk by one-half inch, this being about the effective range of the screw.

The quadrants, and, of course, the upper disk were then charged by sparks from the coil, to a potential of about 2,300 volts, the illuminating apparatus and scale having previously been adjusted so that when the quadrants were fully charged the image of the cross wire would settle at the upper end of the scale, at 300, say.

As the quadrants and disks were absolutely insulated at the potential used, there could be no leakage of the charge as long as the lower disk remained insulated from the earth; but as soon as this disk was connected to the earth, either through the medium of the discharge key or by having its electrode touched with a wire fastened to the gas pipe, leakage would take place through the layer of oil, whatever its thickness might be between the disks; and the rate at which this leakage took place was indicated by the rate at which the image of the cross wire passed down the scale, i. e., by the rate at which the electrometer was discharged.

Before entering into a description of the experiments I wish to refer to a phenomenon which occurs when all good insulating material is tested by means of charges of high potential, if the material form the dielectric of a condenser.

Take any highly insulated wire and form say four inches of it into a condenser by closely wrapping the dielectric with tinfoil; and then carefully paraffine the ends to prevent surface leakage. The condenser thus formed, is absolutely insulated from earth, and connected with the electrometer and discharge key in the same way as the condenser formed by the two disks and the layer of oil between them, i. e., by connecting the wire with the quadrants, and the tinfoil with the upper contact of the key. The quadrants are then charged to potentials of 2,000 volts or more. This causes the needle of the electrometer, and with it the image of the cross wire to be violently deflected to the right or left, depending upon which pair of quadrants is used. The needle then vibrates, but each succeeding vibration becomes quicker and shorter until the image finally settles at 300, say.

Now, if the trigger of the key be made to release the lever, connection is made between the tinfoil and earth. A sudden "drop" of the image then occurs, which is due to the rapid absorption of a portion of the charge by the dielectric. The needle again vibrates, but the image soon settles at 250, say, if the wire be very highly insulated, and will remain at 250, thus showing that there is practically no leakage. But if the wire be a little less highly insulated, the drop still occurs, but the image simply "hesitates," as it were, at 250, say, and then passes slowly down the scale in proportion to the amount of leakage which is taking place through the dielectric. If the ground circuit be now broken by depressing the lever of the key, the quadrants again charged to the same potential as before, and the ground circuit established, the drop is then very slight, oftentimes nil, and the falling of the image along the scale is now due to the leakage through the dielectric and not to absorption by it.

No absorption of the charge by the dielectric can be detected as long as the outer coating of the condenser is insulated. If the image should move, there is a leakage in some portion of the testing apparatus, which must be remedied if the tests are to have any value. This drop is observed only when the best kinds of insulating material are tested by the method just described. It cannot be detected when the poorer qualities of insulating material are subjected to the same tests on account of the rapid leakage through them.

The potential of the charge was determined in the following manner:—The length of spark produced by suddenly discharging the quadrants in air was approximately determined by bringing a pointed wire, held in the hand, close up to the electrode of the charged quadrants. Two bright tin disks, each 1⅛ inches in diameter, were then rigidly cemented upon the ends of two stout hard-rubber tubes which were well paraffined. These tubes were fastened together at the other ends in such a manner that by insertion a wedge between them, the disks could be separated or made to approach each other and still remain substantially parallel at the striking distance of the spark. One of the disks was joined to the quadrants and the other to the discharge key. The quadrants were then fully charged and the key closed. If a spark passed between the disks, they were separated a little further apart and the test repeated. If a spark did not pass, the disks were brought a little closer together and the test again repeated. After several trials, the disks were separated at a distance corresponding to the exact length of the spark.

Slips of thin writing paper were then inserted between the disks until they exactly filled the space between them and the thickness of the layer formed by the paper measured with a Brown and Sharp's micrometer gauge.

A suitable spark electrometer provided with parallel plates would have given the spark length by a direct reading, but the writer did not have the time either to make or procure one.

The length of spark was found to be .03 of an inch. From tests made with a Thomson static voltmeter, this length would correspond to a potential of about 2300 volts. (A spark .026″ long = 2,000 v.)

But whatever the potential of the charge may have been—whether it was two, three or five thousand volts—the same potential was used in all of the experiments described in this paper.

The oils tested were rosin, paraffin, linseed, cotton-seed and castor. The rosin oil was what is known as London oil. The paraffin oil had a specific gravity of 24° B. All of the samples were procured from wholesale dealers, and were declared to be of the best quality.

The first set of experiments include tests of paraffin and rosin oils, air, and a specimen of a well-known insulated wire. This last test was made to show what took place when the dielectric of insulated wires was tested by means of charges of high potential, and also to make a rough comparison between specific resistance of this dielectric and that of the oils about to be tested.

The temperature during the tests was 82° F., and the humidity, as indicated by a Lambrecht's polymeter, 80.

1. Read at the general meeting of the American Institute of Electrical Engineers, Chicago, Ill., June 8, 1892.

A Milwaukee man paid an election bet by remaining several hours on a platform erected on a telegraph pole 25 feet above the ground. The platform and its supporting braces were painted red, white and blue, and the cross bars of the poles were ornamented with flags. A rope attached to a basket ran through a pulley fastened to one of the crossbars, and in this basket food and drink were elevated to the platform.

CORRESPONDENCE.

New York Notes.

NEW YORK, November 19.—The specifications and terms of sale for the proposed rapid transit underground railway were published on Wednesday last, and already there have been enough inquiries for the pamphlet to indicate that capitalists are taking a lively interest in the project. Undoubtedly from now until December 29th, when the franchise will be offered for sale in the city hall, there will be some careful figuring not only among engineers on this side of the water but on the other side as well. It is said that some London capitalists are strongly disposed to favor the project and believe than an investment on terms fair to themselves would be remunerative. There seems to be no doubt in any quarter among those interested that if the city could be supplied with genuine rapid transit a substantial and satisfactory revenue would reward those whose money should be invested in such an undertaking. The sale of the franchise is to be practically in perpetuity, being for a term of 999 years. The purchasers are required to make a deposit of $1,000,000 as a guarantee of compliance with the terms of the sale, and to give a bond for $2,000,000 as security against property damages and for restoring the streets in good condition. The company to be formed must have a capital of $50,000,000, and may be authorized to incur a bonded indebtedness up to the maximum limit of $50,000,000, which affords an opportunity of raising capital to the amount of $100,000,000 if necessary.

With reference to the motive power to be employed, which is the question of the greatest interest to electricians, it may be said that the cars must be propelled by electricity, or by some form of power not requiring combustion within the tunnel. The motor must be sufficiently powerful to readily start a train of eight cars, each weighing, in addition to its load of passengers, not less than 30,000 pounds, on a gradient with a rise of 1½ feet per 100 feet of distance, and the motor must also be able to maintain the same train at a speed of not less than forty miles per hour on a level gradient. Should each car be provided with its own motor, such motor must be capable of exerting sufficient power to comply for each car with the foregoing requirements. Full plans, descriptions, and specifications of the methods of propulsion proposed must be prepared by the company and submitted to the commissioners and approved by them before adoption.

It is stated that the efforts of an outside syndicate believed to be represented by Drexel, Morgan & Co. and H. B. Hollins & Co., to get control of the surface railways in Brooklyn still continue, and local investors are deeply interested in what is going on. Drexel, Morgan & Co. bought the Broadway road, the North Second street road, and the electric line to Jamaica a few weeks ago, and Tuesday it leaked out that H. B. Hollins & Co. had quietly purchased 100,000 shares of stock in the Brooklyn City Railway company, which controls nearly all the roads that use Fulton street as its trunk line. It is said that both these firms represent the Metropolitan Traction company. Congressman Tom L. Johnson of Ohio, who has had some experience with Brooklyn railways, is also reported to be trying to get control of the Atlantic avenue system, now managed by "Deacon" Richardson.

Speaking of Brooklyn reminds me that the people on the other side of the big bridge have not become accustomed to electric cars. They complain that the trolley cars are larger and heavier than the old horse cars, and while better upholstered and better illuminated at night, they do not go any faster than their old competitors. This is true enough, but the people seem to forget that the reason for this is that the cars have to go through the crowded portion of the city. Wagons, trucks, and carriages block their way, and the presence of a large number of women and children in the streets makes rapid transit for a surface road out of the question in the business district.

The electrical executioner is to have another victim. Peter Schultz, the young German who was found guilty of murder in the first degree in the Kings county court of sessions, has been sentenced to death by electricity during the week beginning December 19th. The prisoner, it will be remembered, was indicted with Adam Haas for the murder of the baby of Mary Werthheimer.

W. F. O.

Milwaukee, Wis.

MILWAUKEE, November 19.—The papers in the suit of Charles F. Pfister against the Milwaukee Electric Railway company, asking that a receiver be appointed to take charge of the company's property and business, have been filed in the Circuit Court. The complaint recites the fact that the company has existed as a corporation since March 10, 1890, its capital stock being $500,000, and that on November 3, 1892, Pfister secured a judgment against the company for $145,085.25. A writ of execution was issued, but the sheriff could not find any real or personal property belonging to the company whereon to levy.

At the last meeting of the common council resolutions were adopted to compel the Milwaukee Street Railway company to run more cars on Walnut street, from Fond du Lac avenue to Washington avenue, and on North avenue, from Farwell avenue to Twenty-first street, as well as on Eighth street, from State street to Center street. The council also ordered the company to remove its tracks, switches and turn-tables from Eighth street, between Center and Burleigh streets.

At Oshkosh has been organized the Northwestern Electric association, which is designed to include all electric light and power interests in Wisconsin, Minnesota and Northern Michigan. The objects are mutual protection and the advancement of business. The officers are as follows: President, Carroll Collins of Green Bay; vice-president, C. C. Paige of Oshkosh; secretary and treasurer, T. A. Pamperin; executive committee, W. D. Baker of Waupaca; George A. Davis of Neenah, and C. S. Leghorn of Antigo. The association will hold its next meeting in Milwaukee during February.

In Milwaukee the Wisconsin Telephone company is equipping a large number of its subscribers' instruments with metallic circuits.

The Crowdus Electric company has just been incorporated in Milwaukee for the purpose of supplying dwellings and business houses with independent light and power outfits. A number of prominent gentlemen of the city are interested in the company. The officers of the company are as follows: President, Alex. McD. Young; vice-president, H. B. Sanderson; treasurer, D. E. Murphy; secretary, Thomas K. Ewing. These gentlemen, with Howard Bosworth of Milwaukee and W. S. Baker of Chicago, compose the board of directors. Mr. Baker is the manager of the Union Electric Works, Chicago, which owns the battery that the Milwaukee company will handle. The batteries are incased in strong boxes, provided with handles, and can be carried about easily. With the batteries electric lights can be furnished, and small machinery, such as sewing machines, dental engines, etc., can be operated. The company which will introduce the battery in Milwaukee has a capital of $75,000. C.

Northwestern Notations.

MINNEAPOLIS, November 19.—It has been thoroughly demonstrated that steam cannot compete with electricity in interurban service such as that between Minneapolis and St. Paul. Thomas Lowry's interurban line via University avenue has knocked out the steam short lines. Before the building of the electric line the Milwaukee and Great Northern companies ran heavily loaded trains, leaving each city every hour or oftener. The Minneapolis & St. Louis had just gotten ready to get a share of this big business. The companies charged 50 cents for the round trip. Then the electric cars appeared and their 10-cent rate either way, with transfers at the end of the interurban ride, promptly caught the crowd. It was not many weeks before the railroad companies began pulling off trains. They have been doing this ever since. They hoped to be able to hold some business on the strength of making so much faster time, but Mr. Lowry gradually increased the electric cars' speed and the railroad trains went back and forth empty, save for a few holders of "transportation." The companies have finally given up the fight, and the announcements have recently been made of the taking off of the last of the "short line" trains, leaving nothing but the through train service. The electric service has steadily improved, the fine new vestibule cars being the latest. The service is now about all that can be expected of a single line. The next necessity is a second interurban line, and it is urgent. The taking off of the short line trains leaves many suburban residence centers without proper facilities. It seems altogether probable that Mr. Lowry will before many months have the second interurban running via St. Anthony Park and Como. It would tap a big district already quite well built up. The present fight in St. Paul is all that stands in the way. The talked-of line to Como Park would be the St. Paul end of interurban line No. 2. It is to be hoped that the hatchet will be buried pretty soon and the new line put into operation at the earliest possible date. The interests of both cities and the company will thus be served.

The St. Paul tangle, however, doesn't unravel very fast. The mayor has signed the ordinances directing the company to build a horse car line to Como and an electric line from Rice to Grotto streets. He has a year to build electric and "reasonable time" (whatever that may be) for building the horse car line, which he will never build presumably. At the last meeting of the St. Paul board of aldermen an ordinance was introduced limiting the speed of electric cars in the business center to eight miles an hour. Another ordinance demanded that cars stop at every crossing on the interurban line, and that the signs indicating that trains stop at certain crossings only be removed at once. Both ordinances were referred. The aldermen voted unanimously to postpone indefinitely the ordinance granting permission to put in the proposed safety device at Selby avenue. Finally the ordinance allowing the company to put in "T" rails was repealed. Thus it is evident the aldermen are going to do all in their power to harass President Lowry.

The contract for electric lights for Tracy, Minn., has been let by the council to the Northwest General Electric company of St. Paul. There is to be a 60 horse-power engine, a 30 arc light dynamo, 10 street lamps, 17 commercial lamps, and 110 incandescents. The outfit is to be ready next month, and it is predicted that an early enlargement of the plant will be necessary.

The newly organized Midway Electric Light company has petitioned the St. Paul council for permission to put up poles and string wires in the interurban district. The usual red tape must be gone through, but the franchise will doubtless be granted.

The new electric street railway at Brainerd, Minn., is about ready to begin operation.

The electric power plant in the Boulder camp near Big Timber, Mont., has been started up and now furnishes power to the mines and mills of that district.

Forty incandescent lights are being put in the court house at Hastings, Minn.

The Rapid Transit company at Helena, Mont., proposes to extend its lines from Villard avenue to Mountain University.

C. G. Keebler is about through equipping Fairmount, Minn., with electric lights. The business men have taken 350 incandescent lights and 100 more will probably be put in. Some lights have been ordered for private dwellings. H. C. C.

New England News.

BOSTON, November, 19.—The Haverhill and Amesbury electric road has declared a dividend of 4 per cent. As this road has been running but a short time and some of the stock was not taken till September, this is a remarkable showing.

The capacity of the Haverhill Electric Light company's plant is being increased. The company have just placed a contract for a 2000 light alternator of 2000 volts potential and a 90 horse power generator. The latter will be used for operating stationary motors. It will be wound for a 500 volt current. It may also be used partially for operating street cars.

A corporation to be know as the Danvers Electric Light and Power Company is to be formed at Danvers, Mass, with a capital of $25,000 for the purpose of furnishing electric light and power.

North Conway, Interdale and Lower Bartlett, three popular summer resorts of the New Hampshire mountain regions, are utilizing their water falls for electric lighting purposes. It is probable that by next summer all the hotels of this region will be lighted by this means.

The Suburban Light & Power company has won its fight with the Bay State Gas company. The Suffolk insolvency court, before which Mr. Addicks, president of the gas company, brought it on a petition of insolvency, has declared that the company is perfectly solvent. The testimony showed that the assets of the company were $150,000 while the liabilities were but $90,000 the most of which was a bonded debt. The company is required to furnish a bond to dissolve the attachment brought by Mr. Addicks in order to secure any judgment he might recover in a suit he has brought in the superior court for a debt of $7,786.60 which he claims is owed him.

J. C. E.

PERSONAL.

H. H. Brooks, of the American Circular Loom company, of Boston, will visit San Francisco before his return home from his western trip.

Thos. H. Bibber, of Boston, well known to the electrical fraternity, has been appointed general manager of the American Magnetic-Electric company of Boston.

Carl Kammeyer has severed his connection with the National Electric Manufacturing company of Eau Claire, Wis., in order to branch out for himself. Mr. Kammeyer will engage in the manufacture of transformers, safety devices and other electrical appliances covered by his patents. The new factory will probably be located in Chicago and will be known as the Delta Manufacturing company.

NEW INCORPORATIONS.

Lancaster Carbon company, Lancaster, N. Y.; capital stock, $5,000; to manufacture electric carbon points and other electrical appliances.

Jefferson Light & Power company, Jefferson, O.; capital stock, $10,000; manufacturing and furnishing light, heat, and power, etc.; W. D. Packard, Warren, O.

Warren Electric & Specialty company, Warren, O.; capital stock, $15,000; to manufacture and sell electric machinery and appliances; Elmer W. Gillmer, Warren, Ohio.

American Motor Manufacturing company, Denver, Colo.; capital stock, $10,000; purchasing, selling, leasing, operating and constructing electric motors and other electric appliances.

Reynoldsville & Rathmel Electric Street Railway company, Reynoldsville: Pa.; capital stock, $25,000; constructing and operating an electric railway in Reynoldsville, Jefferson county, Pa.; F. K. Arnold, Reynoldsville, Pa.

Electric company, Canton, O.; capital stock, $10,000; manufacturing and dealing in all kinds of electrical machinery and supplies, etc.; Miller & Pomerene, Canton, O.

Mahoning Railway company, Mahonington, Pa.; capital stock, $150 000; constructing and operating an electric railway in Lawrence county; Geo. H. McLane, Mahonington, Pa.

Standard Glass Insulator company, Portland, Maine; capital stock, $1,000,000; to manufacture and deal in glass, porcelain or any other kind of insulators; Arthur C. Libby, Portland, Maine.

Nutall Railway Supply company, Chicago, Ill.; capital stock, $25,000; to manufacture, buy and sell all kinds of railway and electrical supplies, apparatus and machinery; John J. Aroey, 45 Portland b'ock, Chicago, Ill.

Heinze Electric company, Portland, Maine; capital stock, $10,000; to manufacture and deal in all kinds of electrical, hydraulic and other kinds of machines, machinery and tools; Clarence Hale, Portland, Maine.

Emme Ground Electric Generator company, San Francisco, Cal; capital stock, $1,000,000; to deal in patents for generating electricity and furnish light, heat and power for all purposes; E. M. Morgan, San Francisco, Cal.

Bradford Self-Closing Telegraph Key company, Clinton, Maine; capital stock, $500,000; to manufacture and deal in electric telegraph keys, especially the invention known as "automatic circuit closer for telegraph keys;" Forrest J. Martin, Clinton, Maine.

Jeanette & Penn Electric Street Railway company, Jeanette, Pa.; capital stock, $30,000; constructing and operating an electric railway in Penn and Jeanette boroughs, Westmoreland county; E. N. Frisbie, 29 Broadway, New York, N. Y.

Lehigh Traction company, Hazleton, Pa.; capital stock, $10,000; construction and operation of motors, cables, electrical appliances, or other machinery for supplying motive power to passenger railways, etc.; Geo. R. Redferoe, 14 Franklin street, Wilkes Barre, Pa.

Eighth Street & West Dubuque Street Railway company, Dubuque, Iowa; capital stock, $100,000; to purchase, acquire, construct, maintain, operate, sell and lease electric and other street railways, lighting and power; Henderson, Hurd, Daniels & Kiesel, Dubuque, Ia.

Lake Cities Electric Railway company, Michigan City, Ind.; capital stock, $300,000; constructing and operating by means of electricity or other motive power lines of railway in Michigan City, generating electricity for light, heat and power, etc.; R. B. Harrison, New York, N. Y.

Sacramento Electric Power & Light company, San Francisco, Cal.; capital stock, $1,500,000; to contract for water and other power for use and distribution, maintain and operate works and apparatus for electrical and other methods of lighting and heating; L. T. Hatfield, Sacramento, Cal.

California Electric Railway company, Stockton, Cal.; capital stock, $1,000,000; to construct and operate an electric railway in San Joaquin and Calaveras counties for passengers and freight; build and maintain depots, stations and other houses; single track, narrow gauge, to run from Stockton to Lodi to Wallace; T. D. Woods, Stockton, Cal.

General Electric Launch company, Camden, N. J.; capital stock, $300,000; manufacturing, using, buying, selling, leasing and otherwise acquiring electrical batteries, motors, switches, apparatus and equipment for use in connection with any of the operations or undertakings of the company, etc.; Henry Weston, 120 Broadway, New York, N. Y

ELECTRIC LIGHTING.

At Alameda, Cal., the city trustees have decided not to sell their electric plant, but will spend $6,000 improving it.

The Kansas Water & Light company has amended its charter, increasing the capital stock from $300,000 to $500,000.

Geo. E. Fisher, manager of the Commercial Electric company of Detroit, recently sent a communication to the city council, in which he spoke of the present "local electric light combine." He advised that the city own and operate its own plant, or that the next contract be made for at least five years.

The Pacific Grove, Cal., Electric Light & Power company has given to the board of trustees of that city a bond for $5,000 to insure the erection of an electric lighting system and the building and equipment of an electric railway from Pacific Grove through Monterey to Hotel del Monte, all to be in successful operation in one year.

By the provisions of its franchise the Indianapolis Electric Light company should have been ready for business on November 1st, but a section of its contract gives the Board of Public Works authority to extend the time, and this was done. It is claimed by the company that it has made its plant more extensive than was anticipated, put in more machinery and expended many thousands of dollars more than the original intention. Its conduits are down and the work of stringing the wires has begun. But on account of the brick famine the company reports that it has been unable to complete its building.

A bill of equity has been filed in the Common Pleas Court of Philadelphia by Jules Wellens, asking that the officers and board of directors of the Merchants' Electric Light company be enjoined from selling their shares of the company's stock to the Northern Electric Light company. The bill, in brief, states that the Northern company has declared its intention to control the Merchants' company by acquiring a majority of the shares of its stock, intending then to abandon the generating plant of the Merchants' company and supply the latter's customers from the plant of the Northern company. The effect of this, Mr. Wellens says, will be that the holders of the minority of the stock of the Merchants' company will derive no revenue therefrom, and the stock will be worthless. Mr. Wellens declares that the defendant officers of the company are mismanaging the affairs of the company in agreeing to make the sale of stock, and asks that a receiver be appointed. Judge Arnold granted a preliminary injunction.

A man from Chicago went out to Cicero recently and stole 100 feet of electric light wire from the poles in defiance of the local police department. Officer O'Mara of the Austin force saw the thief at work. The latter was a big fellow, and, if the report of the suburban policemen can be believed, was a veritable Hercules. He had scaled the electric light poles on West Madison street, near Central avenue, and had removed therefrom a quantity of new copper wire, which had just been placed in position by the linemen. Officer O'Mara is short of stature and light of weight, but he had his suspicions that all was not right, and approaching the man with the wire asked some questions which the latter deemed impertinent. Without waiting to argue the matter he struck O'Mara between the eyes, knocking him into the gutter, and then walked away with the wire. O'Mara secured the aid of Officer Johnson, also of the Austin force, and the two called at the Desplaines street station and invoked the aid of the police in searching the lodging houses where it was supposed the thief had secreted himself. They did not find him.

Injunction proceedings have been commenced to prevent the city officials of Columbus, O., entering into a contract with the Thomson-Houston Electric Light company for the construction of the plant in accordance with the action of the council in adopting that system and awarding the company the contract. All the officials had signed the contract except the mayor, and he hesitated because he imagined he would be personally liable, when he was informed by the solicitor he would not be. The solicitor was notified by Messrs. Baker, Buehler and Scheidler to enjoin the matter, and set up the plea of misapplication of funds, not properly passed by the council, in contravention of law, and that fraud and corruption had been used in procuring said contract. This is a very serious charge, and unless it can be substantiated it may operate against the gentlemen. The solicitor informed the gentlemen that every opportunity would be given them to sustain the charges by evidence. The mayor wanted to sign the contract for the Babcock & Wilcox boiler, but the solicitor declined to allow him to have it, claiming that if one was illegal the other was. What the outcome will be remains to be seen.

ELECTRIC RAILWAYS.

Canandaigua, N. Y., is to have electric cars.

The council of Oakland, Cal., has granted H. W. Meek and others a franchise to build a double track along High street in that city.

President J. S. Ticknor, of the West End Street Railway company, Rockford, Ill., says: "This company has been running by electricity for sixteen months, during which time we have transported 324,867 passengers without an injury of any kind to any individual, or a claim for damage to persons or property."

An ordinance has been passed granting right of way to the Chicago, Blue Island & Harvey Railway company for a street way, wires, and electric conductors on Burr Oak avenue, from the east boundary line of the village of Blue Island to Ashland avenue, thence on Ashland avenue from Burr Oak avenue to One Hundred and Nineteenth street.

The Denver, Lakewood & Golden company of Denver, Colo., has let the contract for the erection of its new power house. The site chosen is the east line of Lakewood. The building will cost $10,000, and will have a front 128 feet long. Golden pressed brick will be used in the front of the building. Forty days will be required by the contractors before the finished building is turned over for occupancy. The machinery is already on the ground.

The City Suburban Railway company of Baltimore has secured a site for a power house for the operation of its system at the corner of Pratt street and O'Donnell's wharf. The company has purchased property in that vicinity with a depth of 200 feet on O'Donnell's and Dugan's wharves and fronting about 140 feet on Pratt street. This includes all the property on Pratt street between the wharves. On O'Donnell's wharf the purchase includes the present Waterhouse electric plant, the two warehouses to the south running up to the old Maryland sugar refinery building and the property from the Waterhouse plant to Pratt street. The ultimate capacity of the power house is designed to be 5,000 or 6,000 horse power—sufficient to operate every car line in Baltimore by electricity. The entire machinery for this capacity will not be put in immediately. It is the intention of the engineers to have machinery of 2,500 horse power capacity in working order for the operation of the York road and Highlandtown lines of the city and suburban system, which are expected to be fully equipped for electrical operation by February.

TELEPHONE.

The various plays in the great Yale-Harvard football game of last week Saturday were known in the University club of Chicago almost as soon as made on the field at Springfield. This was accomplished by the long-distance telephone. Forty receivers were attached to the circuit, and in addition, Wendell Baker, the contract agent of the American Telephone & Telegraph company in Chicago, repeated the bulletins in a loud tone of voice.

During one night recently the entire switch-board of 1,750 connections of the Cumberland Telephone company of Nashville, Tenn., was removed from the third story of the building at 125 North Market street, across an alley, to the third story of the new building in the rear of the Merchant's Exchange on College street. The new "central" was erected during the past summer at a cost of $30,000. The offices of the company and the public telephone station are on the first floor. The second floor will be rented as offices, while the third floor will be the exchange proper. The switch-board was transferred as follows: First, a bridge was built across the alley. Then the connections were cut, and twenty-six linemen, under Foreman J. D. Russell, bore the great steel frame, weighing 8,000 pounds and extending fifty feet in length, slowly across the bridge and into the new quarters. The lines were cut and telephone service discontinued at nine o'clock. At 11:10 o'clock the switch-board was in the new building, and the electricians were ready to make new the interrupted connections. By midnight 300 telephones were working, and in the morning nearly the entire board was in order.

TELEGRAPH.

In Georgia the telegraph companies will hereafter be exempt from penalties for failure to deliver messages on Sunday. The Supreme Court has decided that it is made unlawful by the code for any person (and this includes a telegraph company) to pursue his business or the work of his ordinary calling upon Sunday; works of necessity or charity only excepted. It follows that a telegraph company is not put by law, and cannot put itself by contract, under any duty to transmit and deliver messages on that day unless, by reason of the subject matter of the messages in question, that transmission and delivery can be fairly considered as a work of necessity or charity. A failure to perform the work on Sunday with reasonable dispatch will not subject the company to the statutory penalty, and an action therefor is not maintainable.

A new telegraph convention between Russia and China has been signed at Pekin by the Russian minister and the head of the Chinese telegraph administration, and now awaits ratification by the respective governments. The treaty states that it is intended to establish telegraphic connection between the two countries, and it is agreed that the points of junction shall be Hunchun Possiette, Helampo-Blagoveschensk and Kiachta. The tariff, which to the rest of the world is the important part of the convention, provides that Russia is to receive 1.73 francs per word on all messages between Asiatic Russia and China, 2.73 francs on messages to and from European Russia and China, and 3 francs on messages in transit, while China receives 2 francs on all messages from any part of Russia and 5.50 francs on messages from any other European country, out of which she is to pay the proportion due to the European country or countries over whose wires the message passes, in accordance with the rules of the telegraphic union. Where the Danish and British cable companies (the Great Northern and the Eastern Extension companies) have stations, the rates charged by the Chinese lines shall not be less than those now charged by the Great Northern company; but if the companies reduce their rates, the Chinese administration may do the same. The treaty is to last until December 31, 1892. By this arrangement messages between China and Asiatic Russia cost only 3.73 francs, and between China and European Russia 4.73 francs, while the rest of Europe will pay 8.50 francs. By the foreign mercantile communities in China this treaty is regarded as hostile to their interests, for its effect will be to maintain the present very high rate for messages between China and Europe.

MISCELLANEOUS.

In Buffalo there is a corporation known as the Electric Hoof Stuffing company.

A dispatch from Boston states that the General Electric company will issue a circular offering common shareholders the right to subscribe for $6,000,000 additional 5 per cent. bonds at par, making the total issue $10,000,000. There is $30,067,200 common stock, and the allotment will be in the ratio of one to five. The issue has been underwritten for a small commission, which is a practical gratuity to the underwriters, as the bonds would naturally sell themselves. It is announced that the proceeds are required for working capital.

A suit against the city of Chicago for infringement of the electrical tripping and recording device commonly

used in fire engine houses has been brought in the United States court by Nathan C. Ross, trustee for Elbert W Shirk, Peru, Ind., Edward C. Egan and Atwater J. Treat of Indianapolis. The bill alleges that the patent of Robert Bragg for such electro-magnetic devices was granted in 1875; that he assigned the patent in 1886 to Edwin C. Walker, of Indianapolis, who in turn assigned it to the complainants this year. Further the bill alleges that the city is using an infringing device and intends to use more. An injunction is prayed for.

The Philadelphia electrical bureau has asked the common council of that city for anappropriation of $168,710 for 1893. A large part of this it is intended to use in laying underground systems, $10,000 being recommended for Twenty-second street, north of Montgomery avenue; $20,000 for Spruce street; $60,000 for completing the system on Market street, and $26,000 for an underground service on Girard avenue, from the Delaware river to Broad street. An increase of $5,790 in the pay-roll of the bureau was recommended, $1,000 to be added to the salary of the chief, making it $5,000.

An interesting discussion has recently been carried on on the subject of the first visible color of incandescent iron. T. C. Porter now describes how he tried a similar experiment with the carbon filament of an ordinary incandescent electric lamp. Using an 80 volt 16 candle power lamp, he passed a current from a storage battery through the lamp and a water resistance, which was gradually reduced by the addition of sulphuric acid. The room in which the experiment was performed was carefully darkened, and the observers were kept in darkness some minutes before the current was switched on. As the current was increased by regular stages the observers (twenty five in number) carefully inspected the lamp in rotation, and every one wrote down his impressions of the color of the filament in the dark, so that the eyes were not affected by extraneous light. It was unanimously decided that the color of the filament was at first very pale. Thirteen called it pale yellow; three took it for white; seven for a faint pink; two for a bluish white. All agreed that as the temperature rose the color grew deeper and redder, passing through orange before arriving at crimson. The words used to designate the final tint reached in the experiment varied from deep reddish orange to copper color, dark red, blood red and crimson. In diffused daylight this would be a dull red.

TRADE NEWS.

George Cutter, Chicago, has just returned from an eastern trip, during which he arranged with Queen & Co. for a license to manufacture the Cutler non-inductive voltmeters under the Cardew hot wire patents.

W. C. McKinlock, manager of the Enterprise Electric company, Chicago, has just returned from St. Louis, where he secured an order for fifty thousand feet of N. I. R. wire. W. H. Ferris, the St. Louis manager of the Enterprise Electric company of Chicago, reports excellent business.

The Electrical Supply company, Chicago, general western agents for the Stanley transformers, has recently closed contracts for immediate delivery to one of the largest alternating stations in the West for 690 transformers, amounting to over $45,000. The Stanley transformers, the company states, are to replace those at present in use, and the exchange was made on account of the small leakage current of the Stanley converters, which was so little as to show a saving in operating expenses great enough to make it economical to throw out the old transformers and substitute new ones. Such sale certainly bears evidence of superior workmanship in the manufacture of the Stanley transformers.

The Standard Electric Time company, New Haven, Conn., has contracted with Cheney Bros. of South Manchester, Conn., to put in one of its new striking electric tower clocks and a system of forty-eight electric dials. This will give South Manchester a uniform system of time that will be greatly appreciated, as all the dials will be controlled from one master clock, this being corrected daily from observatory time, the signals will give correct and uniform time throughout the town and the works of the company. A contract has also been signed for a large time plant, including an electric tower clock, in the School for the Deaf and Dumb at Fulton, Mo. This is the third institution of this kind to adopt the Warner system of electric time within a few months. The De La Vergne Refrigerating Machine company of New York is also to adopt the Warner system. The electric tower clock made by this company, although a comparatively new thing, has given such general satisfaction in the past two years that it must supersede the old wind-up clock where accurate time is required. Being controlled by a fine master clock in the building, the extremes of temperature have little or no effect upon the service.

BUSINESS.

The New Jersey Bronze and Lamp company, of New Brunswick, N. J., has appointed Charles E. Grogan, New York representative.

The Leominster Electric Light & Power company, of Leominster, Mass., is now represented in Boston, 620 Atlantic avenue, by Treasurer T. T. Robinson.

Negotiations for the purchase of the Pratt & Whitney Machine works, of Hartford, Conn., by an English syndicate, have been practically completed. It is stated the price paid was $2,500 000, of which $1,000,000 was for preferred stock. One million of bonds are to be issued.

The Whitney instrument has already won its way into favor, and the Electric Appliance company, Chicago, is receiving daily orders from customers who have given the instrument a careful test, and are well pleased with its operation. The company's new Acme expanding wire guard is also meeting with a large sale.

W. F. Richardson, of the Enterprise Electric company, Chicago, has just returned from a two weeks' trip east. He visited the factory of the National India Rubber company at Bristol, R. I., and made arrangements for a consignment of one and one-half million feet of N. I. R. wire to the Chicago office of the Enterprise company. A complete stock of wire will be carried at all times, and orders promptly filled.

From all accounts the new substitute for shellac, "insullac," now being introduced by the Massachusetts Chemical company, Boston, is coming to the front with astonishing rapidity. Insullac is achieving an enviable reputation. It is stated that field coils of large size, insullated with insullac, have shown a resistance of twenty-three megohms before drying or baking. Insullac was recently tested by the Massachusetts Electrical Engineering company, and the report on the tests will be furnished on application.

The Pennsylvania Electric Engineering company, Philadelphia, engineers, is sending to the trade, a handsome lithographic copy of the P. & R. terminal, Philadelphia, which is said to be not only the finest building of its kind in the world, but one of the handsomest public buildings in America. This depot occupies four city squares, is fireproof, and cost, in connection with the elevated tracks, upward of ten million dollars. The Pennsylvania Electric Engineering company is installing the electric light plant in the terminal, consisting of 300 Western arc lights, 10 Western dynamos and the entire construction work.

The Ball & Wood company, of New York is to be congratulated upon the satisfactory service its engines gave in furnishing the power for lighting the Manufacturers and Liberal Arts building during the recent dedication ceremonies at the World's Fair grounds. Considering that the engines were taken directly off the cars and immediately started on their work, the results obtained speak well for the perfect condition in which these engines are turned out at the shops. The Ball & Wood company was much gratified to hear of the satisfactory work through a recent letter from Mr. Sargent.

The Viaduct Manufacturing company, of Baltimore, Md., is nicely settled in its new quarteres in the Telegraph building, corner of St. Paul street and Bank lane. The offices are on the third floor and are finely fitted up. The ground floor is used as a salesroom and for storage purposes. In the new quarters, much better facilities are afforded to display the various lines of electrical goods which this company carries It should also be stated that the Viaduct company has secured 608 square feet of space in the balcony of the electricity building at the World's Fair, where it will exhibit a large line of specialties.

Chas. E. Gregory, Chicago, reports business as exceedingly brisk. The following is a list of recent sales: Hatch Cutlery company, South Milwaukee, 10 light Sperry arc machine with lamps, 100 light incandescent machine, 25 horse power Westinghouse engine; Drop Forge & Foundry company, Kensington, Ill., 10 light Sperry arc machine with lamps; Geo H. Benedict & Co., Chicago, 10 horse power Belding motor and 15 light Excelsior arc dynamo; Holt & Follett, West Plains, Mo., 25 light Sperry arc dynamo; H. McFarlane, Chicago, 25 light Sperry arc dynamo; Jacob Furst Sons, Chicago, 20 light Sperry arc dynamo; M. Lindholm & Co., Chicago, 6 light Sperry arc dynamo; Geo. C Baker, South Chicago, 15 horse power Thomson-Houston 220 volt motor; M. Lenard, South Chicago, No. 2 Edison compound generator; E. Hildmaier, Chicago, 15 light Sperry arc machine; T. C. Diener & Co., 125 light Thomson-Houston compound dynamo; W. H. Purcell & Co., 250 light Thomson-Houston compound dynamo; Jones Woolen Mill company, 300 light Thomson-Houston compound dynamo; Rose Electric Supply company, 650 light Thomson-Houston alternator; Chicago Arc Light & Power company, 35 light Thomson-Houston arc with lamps; Charlotte, Mich., Electric company, 30 light Thomson-Houston arc with lamps; R. A. Cook, Stevens Point, Wis., 10 light arc machine with lamps; A. L. Ide & Sons, Springfield, Ill., 75 horse power Ideal engine, 12 light Sperry arc; Geo. H. Meeker, 5 kilowatt Edison dynamo; World's Columbian Exposition company, one Edison dynamo; Gray Electric company, one Edison dynamo; John Wolf, Cincinnati, Ohio, 400 ampere Edison dynamo; H. G. Brownell, 150 light United States dynamo; Armour & Co., 500 volt motor; G. P. Grune & Co., Chicago, 30 light Sperry arc dynamo with lamps.

ELECTRICAL PATENTS.

Issued November 15, 1892.

486,068. Electric Locomotive. William E. Allington, East Saginaw, Mich.

A compound wound motor is connected by means of speed and power gear to the driving axle, means are provided for throwing either the speed or power gears into action, and a switch is simultaneously operated to throw in or out of circuit the series coils of the motor.

486,078. Armature for Dynamo Electric Machines and Electric Motors. Charles S. Bradley, New York, N. Y.

The coils are wound in longitudinal slots, the coils upon the ends of the armature being bent so that they will occupy positions in two parallel planes, whereby none of the coils are in contact with the adjacent coils.

486,094. Secondary Battery. Rudolph Eickemeyer, Yonkers, N. Y.

The battery plates are arranged in a pile, insulated from each other, each plate having openings registering with corresponding openings in the other plates, and affording spaces for occupation by the battery fluid

486,123. Electric Meter. John Perry, London, England.

The meter consists of a rotary circular body, means for sending a current from its edge to its center, or vice versa, whereby motion is produced, the body rotating in a non-uniform magnetic field to produce Foucault currents in the body to retard its motion.

486,149. Test Circuit for Burglar Alarm Systems. Edmund R. Wilder, Kansas City, Mo.

486,176. Electric Forge. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass.

The invention embodies an electrode adapted to grasp and release the bars to be heated, the faces of the clamping jaws being adjustable and interchangeable to suit bars of different shapes.

486,206. Police Signal System. John C. Wilson, Boston, Mass., assignor to the Municipal Signal company, Portland, Me.

486,212. Circuit Controller. Harry W. Leland, Jersey City, N. J.

The controller comprises a sheet of elastic material provided with protuberances on its surface, and having circuit controlling contacts mounted on the under surfaces of the protuberances which are adapted to make contact when the protuberances are depressed.

486,213. Governing Electric Motors. Robert Lundell, New York, N. Y.

The electric motor has its armature and field magnet, each wound with independent sections of coils; circuit changing devices being provided for varying the series and multiple arc relation of the armature coils, and of the field magnet coils.

486,214. Governing Electric Motors. Robert Lundell, New York, N. Y.

Three or more conductors are provided, between different pairs of which different electromotive forces are maintained; the motor is adapted to be connected at will between different pairs of these conductors, and circuit changing devices are provided for altering the relation of the armature coils.

486,215. Double Snap Switch. Robert Lundell, New York, N. Y.

486,234. Armature for Dynamo Electric Machines. Albert L. Parcelle, Boston, Mass.

The armature is of the iron-clad type, each coil being composed of a number of independent insulated lengths of wire whose ends are electrically connected to form the desired circuit or circuits through the coil.

486,241. Electric Switch. Ernest P. Warner, Chicago, Ill.

The switch is adapted for arc light circuits, the circuit being through a pair of springs and contact points to the lamp; a metallic contact piece is adapted to be brought against both springs to lift them from their contact points, and to close the circuit between the springs, whereby the lamp is cut out of circuit.

486,243. Electrical Annunciator. Franklin S. Carter, Burlington, N. J., and George P. Stumpf, Philadelphia, Pa.

486,244. Microphone. Charles Clamond, Paris, France.

The microphone consists of two electrodes at a distance from one another, and a plastic, viscid conducting body maintained in invariable contact with the two electrodes, the approaching of the electrodes acting to decrease the length and increase the cross section of the plastic body to alter the resistance of an electric circuit, and vice versa, whereby sound waves may be reproduced.

486,264. Electric Battery. John J. O'Lalor, Boston.

486,270. Wire Covering Machine. John A. Barrett Brooklyn, N. Y.

The machine embodies a hollow rotating shaft through which the conductor to be wrapped is drawn, a tape reel carried by and rotating with the shaft, and devices carried by the shaft to apply fluid to the tape.

486,282. Messenger Call System for Buildings. Frank H. Fuller, Springfield, and Charles B. Perkins, Holyoke, Mass.

486,315. Electric Railway Conduit. Augustine W. Wright, Chicago, Ill.

486,324. Sign for Electric Lamps. Edwin W. Clay, Louisville, Ky.

An incandescent lamp is used in connection with a concealed lamp having several carbon filaments of different resistances, a switch being provided for throwing in the resistances to alter the candle power of the incandescent lamp.

486,332. Telegraph System. Adolphus Gipperich, Richmond, Va.

486,334. Regulable Electric Lamp. George W. Hall and Joseph J. De Marr, Georgetown, Colo.

486,333. Trolley for Electric Railways. Augustus H. R. Guiley, South Easton, Pa.

486,338. Electric Alarm. Henry A. Hull, New Brunswick, N. J.

486,354. Electro Magnetic Bell. James J. Ross, Detroit, Mich.

486,377. Electric Arc Lamp. Daniel Higham, Boston, Mass.

A variable resistance is connected in series with the carbons a yielding connection being provided between the feeding mechanism and the variable resistance, whereby the variable resistance is acted upon by the feeding mechanism to compensate for variations of the resistance at the arc.

486,393. Application of Magnetic Attraction. Armand De Bovet, Paris, France.

486,399. Workman's Time Register. Charles J. Garnett and Alfred Moore, Keighley, England.

486,417. Regulator for Dynamo Electric Machines. Alexander Dow, Elgin, Ill.

The regulator is adapted for machines with field magnets whose coils are traversed by a pulsating current in consequence of which the inductive resistance of the field magnet coils must be taken in consideration; the regulator consists of a series of coils having inductive as well as electrical resistance adapted to be thrown in shunt with the field magnet coils, whereby the current may be properly regulated.

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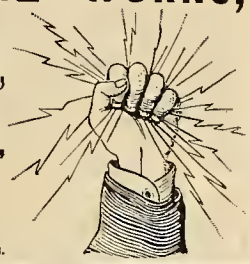

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Two 60-light Vandepole, 110 lamps, 7 amp. $1,900.00
One 45-light Brush, with all fixtures, 23 lamps, $1,100.00.
Nineteen Sperry dynamos all new, all sizes, cheap.
1,000 light National alternator, new, price mailed.
600-light Edison, 110 volt, good order, $600.00.
No. 2 Edison Compound, 110 volts, $325.00.
350-light, 70 volt, U. S. Dynamo, $450.00.
300-light, 110 volt, U. S. Dynamo, $450.00.
Four Engines, Automatic, 40, 60, 75 and 100 H. P., smoke stacks, belts, etc.
All the above delivered f. o. b. Chicago, for cash.

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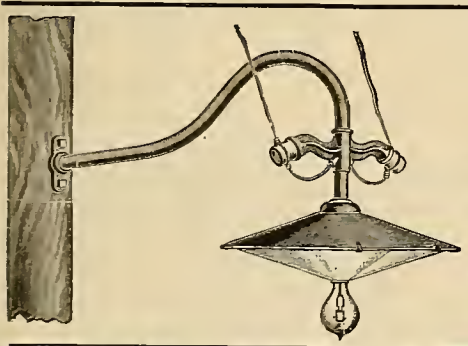

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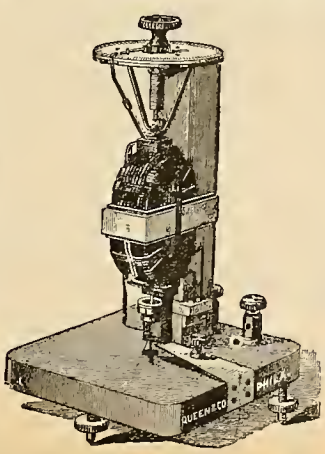

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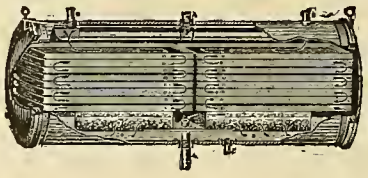

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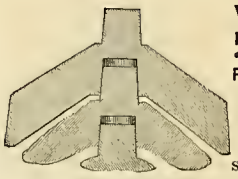

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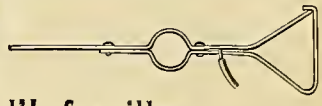

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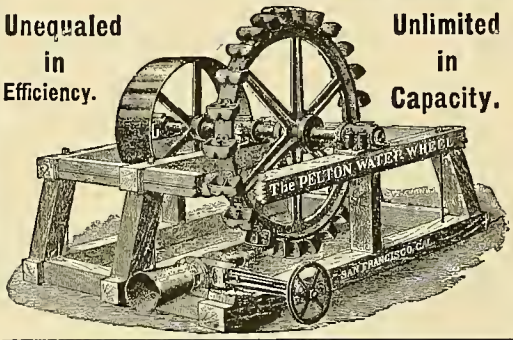

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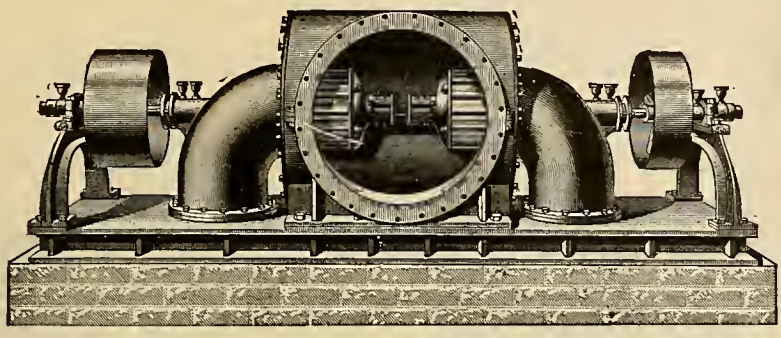

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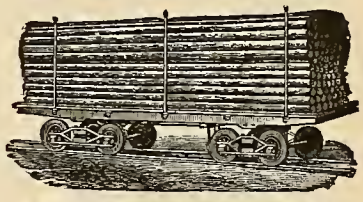

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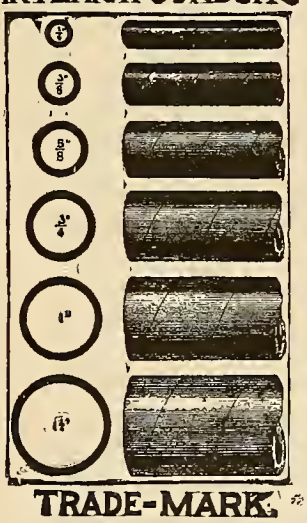

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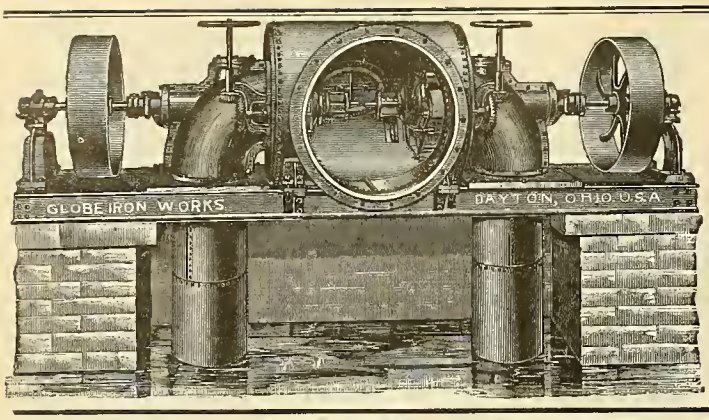

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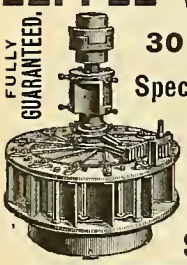

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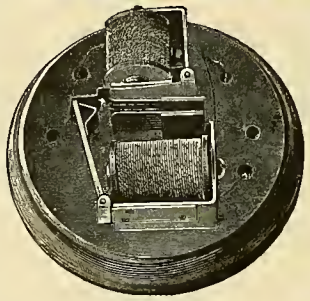

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1.	" "	13th "	" "	85 "
1.	" "	14th "	" "	85 "
1.	" "	15th "	" "	85 "
1.	" "	16th "	" "	85 "
1.	Pittsburgh Chronicle-Telegraph,	3d "	Pittsburgh, Pa.,	60-Stan.
3.	West Mich. Furniture Co.,		Holland, Mich.,	25-Jun.
3.	H. Mueller Plumbing Co.,		Decatur, Ill.,	35 "
4.	F. J. Parsons & Co.,		Nineveh Junc., N.Y.,	15 "
4.	Cochrane Chem. Co.,	3d "	Boston, Mass.,	35 Stan.
5.	Crescent Steel Co.,	6th "	Pittsburg, Pa.,	75 Jun.
5.	Pennsylvania Tube Works,		" "	75 "
5.	Dawson El. Lt. and P. Co.,	1st "	Dawson, Pa.,	75 "
5.	" "	2d "	" "	75 "
5.	" "	3d "	" "	35 "
5.	Nicaragua Eng'g Co.,		Managua, Nic.,	10 "
5.	Adam Blumer,		Monroe, Wis.,	25 Stan.
5.	Bridgeport Copper Co.,	6th (Kodak.)	Bridgeport, Conn.,	100-Comp.
5.	Westinghouse El. & Mfg. Co.,	35th order,	Pittsburgh, Pa.,	330 "
5.	" "	36th "	" "	130 "
7.	Wm. Clark Thread Co.,		Westerly, R. I.,	10-Stan.
7.	United Gas Imp. Co.,	25th "	Philadelphia, Pa.,	75 "
7	H. J. Russell,		Tekoa, Wash.,	50-Jun.
7.	Evanston El. Ill. Co.,	5th "	Evanston, Ill.,	100-Comp
7.	J. E. Reinecker,		Chemnitz, Ger.,	85 "
7.	Ynan Boyer,		Ygualade, Spain,	45 "
7.	Yg. Y. Bertran,		San Felice,	65 "
7.	Jose Solderila Casas,		Balsareny,	85 "
7.	Jose Tobra,		Castellar,	200 "
8.	Rourke, Straub & Co.,		Knoxville, Tenn.,	35 Jun.
10.	Pittsburgh Reduction Co.,	5th "	Kensington Pa.,	330-Comp.
10.	" "	6th "	" "	330 "
10.	Detroit Citizens' St. Railway Co.,		Detroit, Mich.,	260 "
11.	Montgomery St. R'y.		Montgomery, Ala.,	130 "
11.	Columbian Exposition,	5th "	Chicago, Ill.,	130 "
11.	" "	6th "	" "	130 "
11.	Odd Fellows Hall,	1st "	Philadelphia, Pa.,	85 "
11.	" "	2d "	" "	85 "
11.	" "	3d "	" "	85 "
11.	First Nat. Bk. B'dg.,	1st "	Pittsburgh, Pa.,	45-Stan.
11.	" " "	2d "	" "	45 "
13.	Tacony Iron and Metal Co.	1st "	Tacony, Pa.,	25 "
14.	S. D. Warren & Co.,	264th "	Yarmouthville, Me.,	85-Comp.
14.	W. G. Wildermanth,		Pomeroy, Ohio,	5 Jun.
14.	F. Glazier & Son,	2d "	So. Glastonbury, Ct.,	25 "
15.	Union Hardware Co.,		Torrington, Ct.,	160-Comp.
17.	Johnstown Pass. Railway Co., (kodak.)		Johnstown, Pa.,	330 "
17.	Rust & Mason,	2d "	Forest Mills, Minn.,	65 "
17.	Shaw Stocking Co.,		Lowell, Mass.,	10-Jun.
17.	Kalamazoo Paper Co.,	2d "	Kalamazoo, Mich.,	75 "
17.	Unknown,	order,	Moscow, Russia,	35-Jun.
17.	"		" "	25 "
17.	Unknown,		" "	15 "
17.	"		" "	35-Stan.
17.	"		" "	25 "
17.	"		" "	15 "
18.	O. B. Shallenberger,		Rochester, Pa.,	15 "
18.	Irvin Van Wie,	9th "	Syracuse, N. Y.,	15 "
18.	R. D. Nuttall & Co.,	2d "	Allegheny, Pa.,	15-Jun.
20.	Fontaine Crossing Co.,	8th "	Detroit, Mich.,	5 "
20.	Roberto Law,	4th "	Monterey, Mexico.	5-Stan.
22.	Standard Oil Co.,	3d "	Bayonne, N. J.,	35 "
22.	Hoyle, Harrison & Kaye,		Philadelphia, Pa.,	25 "
22.	Alex. McLaren,		Osceola, Ont.,	50-Jun.
21.	E. B. Hillman & Co.,		Kahoka, Mo.	50 "
25.	Spreckels Sug. Ref'y.,	64th "	Philadelphia, Pa.,	75-Stan.
25.	" " "	65th "	" "	100 "
25.	" " "	66th "	" "	100 "
25.	" " "	67th "	" "	100 "
25.	" " "	68th "	" "	100 "
25.	Otis Falls Pulp Co.,	2d "	Otis Falls, Me.,	5 "
25.	Charleston Gas and Electric Co.,	2d "	Charleston, W. Va.,	330-Comp.
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26.	Long & Marvin,		Olenville, Minn.,	35 "
26.	William Knight,		Chicago, Ill.,	35-Stan.
23.	Tacony Iron and Metal Co.,	2d "	Tacony, Pa.,	10 "
26.	Justice, Bateman & Co.,	2d "	Philadelphia, Pa.,	15 "
27.	Moore, Arms & Thompson,		Bellows Falls, Vt.,	75 "
28.	Balt. Elec. Refin. Co.,	5th (kodak)	Baltimore, Md.,	100-Comp.
29.	Balt. Traction Co.,	(kodak)	" "	260 "
29.	Penoles Mining Co.,		Mapimi, Mex..	10-Jun.
29.	Ott, Mergenthaler & Co.		Baltimore, Md.,	50 "
31.	Globe Furniture Co.,		Northville, Mich.,	75 "
31.	Cohannett Mills,		Taunton, Mass.,	5-Stan.
31.	Gaiety Bijou Theatre,		Boston, Mass.,	5 "
31.	Niag. Falls Paper Co.,		Niagara Falls, N.Y.,	35 "
31.	Waters-Pierce Oil Co.,		St. Louis, Mo.,	50-Jun.
31.	Colum. Exposition,	7th order.	Chicago, Ill.,	330-Comp.
31.	" "	8th "	" "	330 "
31.	Unknown,		St. Louis, Mo.,	50-Jun.
31.	Westinghouse Machine Co.	19th "	Pittsburgh, Pa.,	25 "
31.	Kahn, Lang & Co.,		Epinal, France,	65 Comp.
31.	Monongahela Furnaces,	1st "	McKeesport, Pa.,	6-Stan.
31.	" "	2d "	" "	5 "
31.	Carnegie Steel Co.,	16th "	Pittsburgh, Pa.,	5 "
31.	Allegheny Co. Lt. Co.,	54th "	" "	5 "
31.	" "	55th "	" "	5 "
31.	Otis Falls Pulp Co.,	3d "	Otis Falls, Me.,	5 "

SUMMARY.

33 Compound Engines,	aggregating	5185 H. P.
35 Standard "	"	1180 "
30 Junior "	"	1160 "
TOTAL, 98 ENGINES,	aggregating	7525 H. P.

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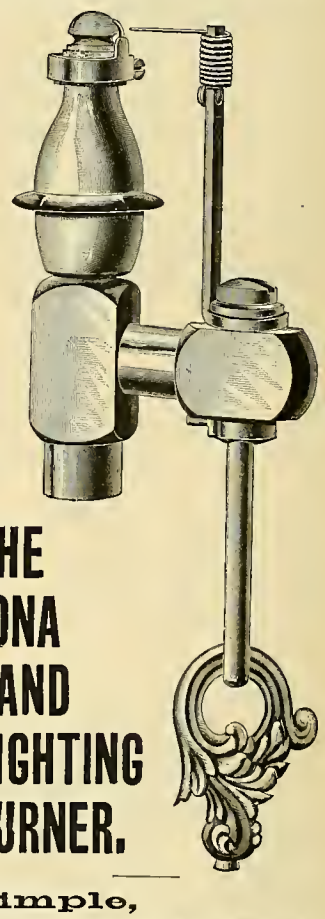

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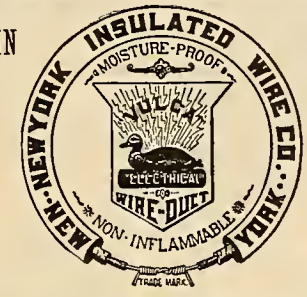

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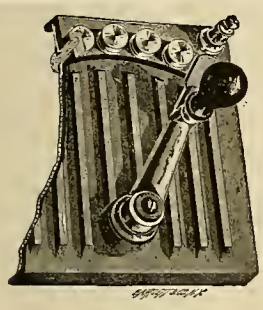

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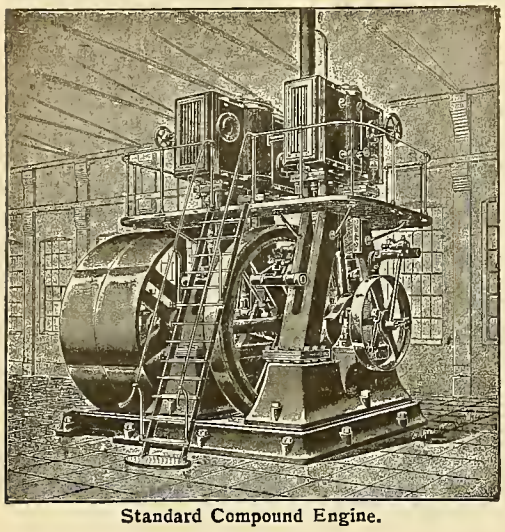

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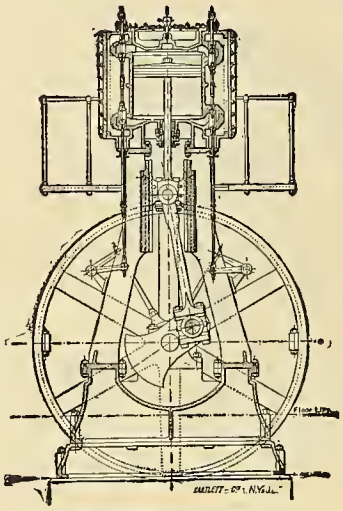

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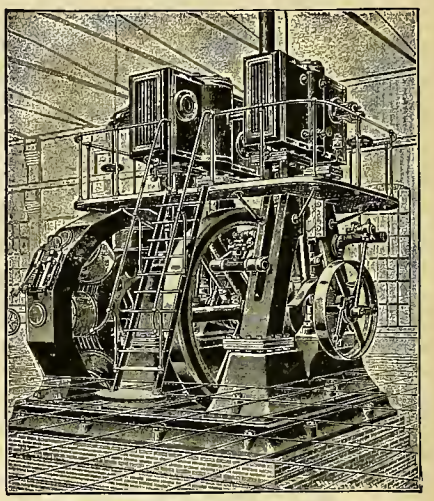

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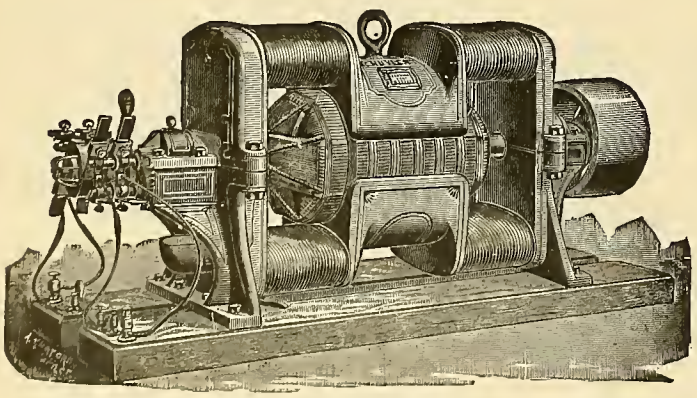

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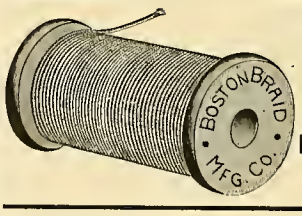

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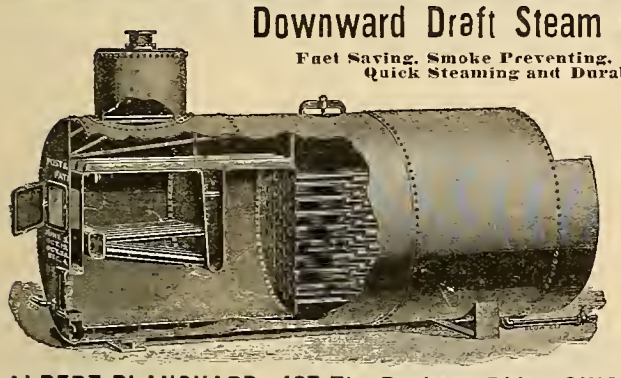

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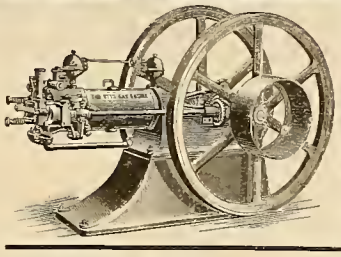

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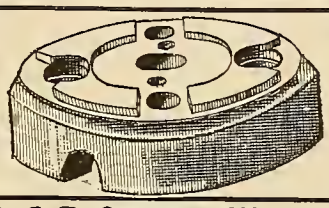

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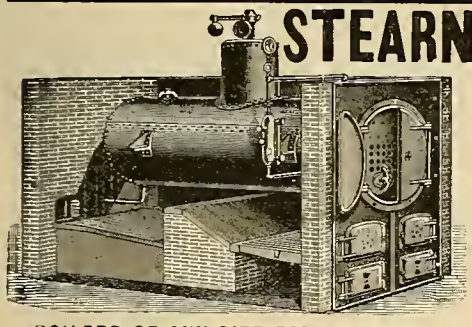

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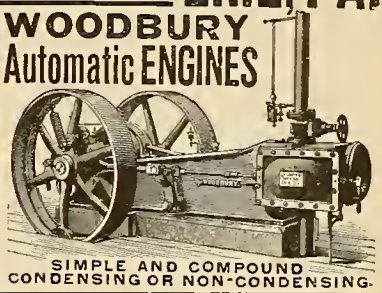

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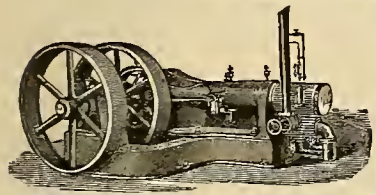

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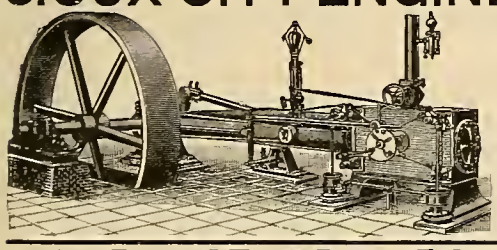

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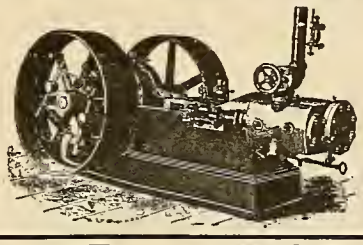

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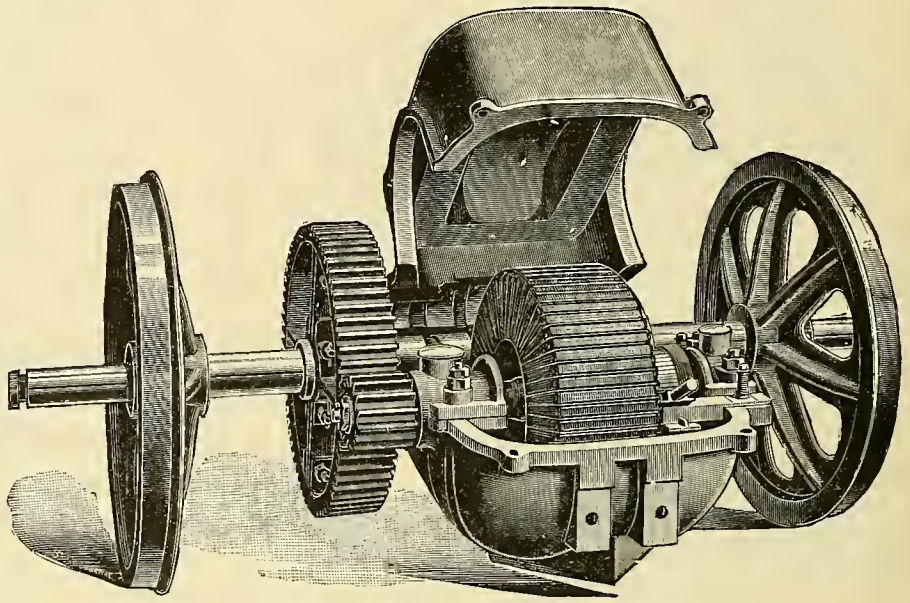

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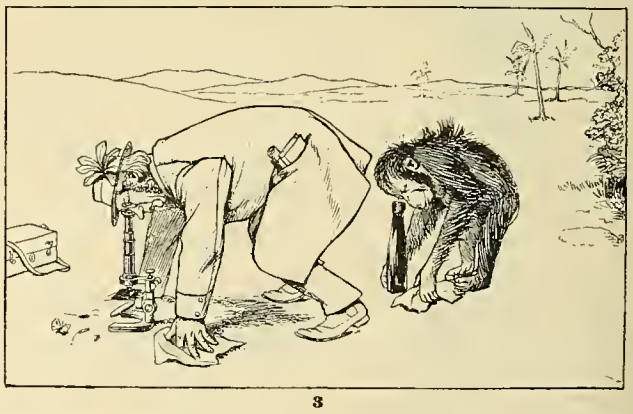

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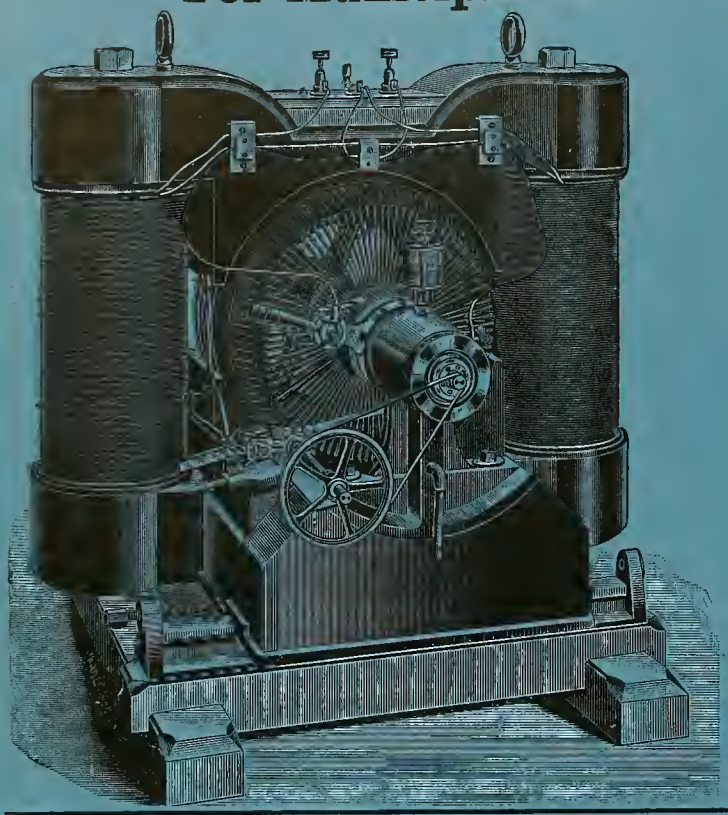

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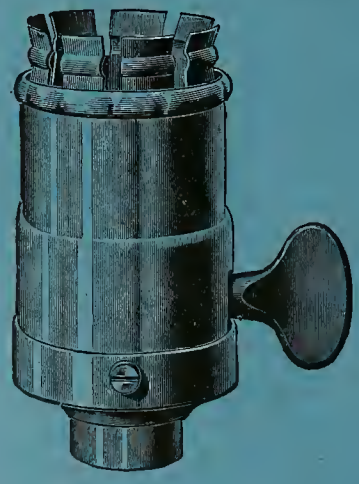

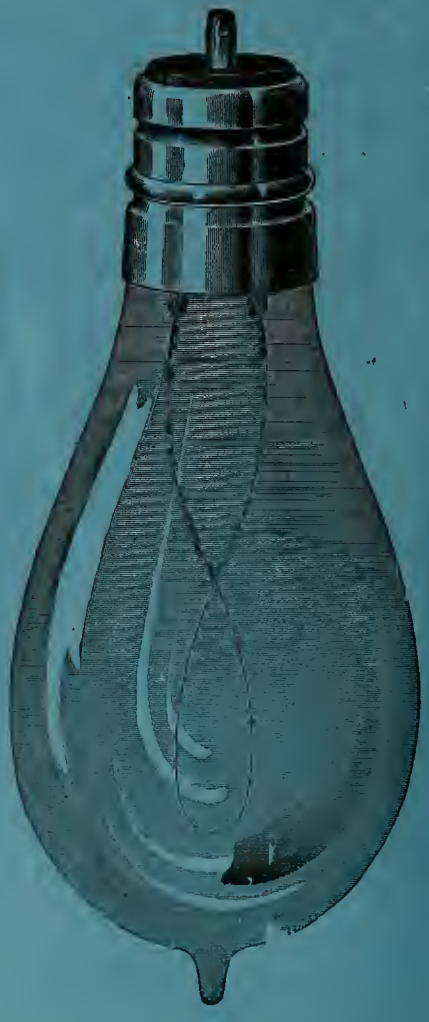

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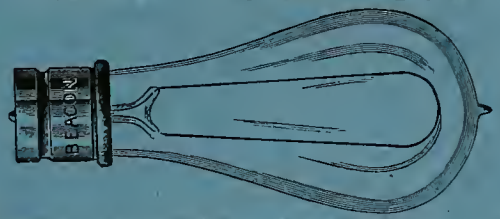

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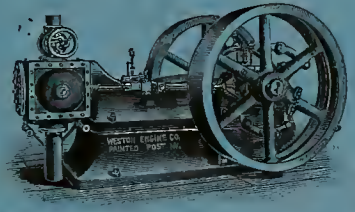

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INDEX AND CLASSIFICATION OF ADVERTISEMENTS.

ALPHABETICAL LIST.

American Battery Co..... ix
American Electrical Mfg. Co.. ix
American Electrical Works.... xiii
American Engine Co..... xii
Babcock & Wilcox Co., The.... i
Baggot, E xiv
Baker & Co..... xii
Ball Engine Co..... xxi
Ball & Wood Co., The i
Beacon Vacuum Pump & Elec. Co.i
Becker Mfg. Co., John..... xiii
Beggs, J. E., Mch. & Supply Co.xvi
Beinstein Electric Co..... xii
B'anchard, Albert... ..... —
Boston Braid Mfg. Co..... —
Bowers Bros..... xix
Bridgeport Mach. Tool Wks.. —
Brookfield, Wm..... xii
Brush Electric Co xix
Bryan, W. H.. xiv
Bryant Electric Co..... ... xii
Buckeye Electric Co., The..... ix
Cabell, L. Breckinridge..... iv, x
Carpenter Enamel Rheostat Co. xix
Central Electric Co..... ... v
Chicago Rawhide Mfg. Co.... —
Columbia Inc. Lamp Co..... —
Crescent Ins. Wire & Cable Co. xiii
Crocker-Wheeler Electric Co.. xiii
Cushing, F. W..... vii
Cutter, Geo.....i, xxvi
Cutter Electrical & Mfg. Co... —
Dayton Globe Iron Works Co.. xvi
Densmore Typewriter Co..... xii
Diamond Electric Mfg. Co.... xii
d'Infreville, G..... xvi
Dixon Crucible Co., Jos..... xv
Duplex Electric Co., Ltd..... —
Eastern Electric Cable Co..... xiii
Eastman Kodak Co..... xiv
Edwards, W. S. Mfg. Co..... iv
Electric Appliance Co xii
Electric Cons. & Supply Co.. xv
Electric Engr'g & Supply Co.. iv
Electrical Eng. & Supply Co. The.—
Electric Secret Service Co.... xxi
Electrician Pub. Co. xiv, xv, xvi, xviii
Electrical Construction Co. The. xiii
Electrical Mfg. Co , The xi
Electrical Supply Co., The ...xxiv
Elektron Mfg. Co..... iv
Empire China Works x
Enterprise Electric Co..... xix
Falls Rivet & Machine Co..... ix
Ferracute Machine Co..... xiv
Ford-Washburn Storelectro Co.. iv
For Sale Advs. .....xii, xiii, xvi
General Electric Co..... ii, xxii
Great Western Elec. Supply Co— —
Greeley & Co., The E. S..... i
Gregory, Chas. E..... xiii
Hart & Hegeman Mfg. Co..... x
Heisler Electric Co..... —
Hill Clutch Works..... xxi
Hine Eliminator Co.... ..... —
Holmes, Booth & Haydens.... xiv
Hood & Co., Wm.... xi
Hughes Bros. Mfg Co..... xiv
India Rubber & G. P. Ins. Co. xxv
Innis & Co..... xiii
Institute of Technology..... xix
Interior Conduit & Insulation Co. xv
International Okonite Co..... i
Jewell Belting Co..... i
Johns Mfg. Co., H. W..... xvii
Kartavert Mfg. Co..... xix
Klipstein, A..... xiii
Knapp Electrical Works..... xxiii
Lake, J H. & D., Co ..... —
Lake Erie Engineering Works.. xx
Lane & Bodley Co..... —
La Roche Electric Works xvii
Leclanche Battery Co., The .. xvi
Lefmann, Julius xv
Leffel, & Co., Jas xvi
Link Belt Machinery Co..... xv
Loud, H. M. & Sons Lumber Co. xiv
Manz & Co..... x
Mass. Chemical Co..... x
Midland Electrical Wks..... xii
Moore, Alfred F..... i
Morse & Co., A. M..... .. xiv
Munsell & Co., Eugene..... xii
National Electric Mfg. Co .... —
National India Rubber Co .... —
New York Insulated Wire Co. xix
N. Y. Safety Steam Power Co. xvi
New York & Ohio Co..... i
Otto Gas Engine Works..... —
Osborne Steam Engineering Co. xiii
Ostrander & Co., W. R..... xxi
Page Belting Co..... xvi
Partrick & Carter Co..... ix
Pearson & Co., W. B..... xx
Pelton Water Wheel Co..... xiv
Penn. Electric Engineering Co x
Perkins Elec. Switch Mfg. Co.— —
Phoenix Glass Co..... ... xxi
Porter-Leavitt Elec. Motor Co. xiii
Queen & Co..... xiii
Racine Hardware Mfg. Co.... —
Railway Equipment Co.....vi, ix
Redding Electric Co..... xvi
Ries Electric Specialty Co..... x
Roebling's Sons Co., J. A .... —
Rose Elec. Light Supply Co... xii
Samson Cordage Works. xii
Sawyer-Man Electric Co viii
Scott Electrical Mfg. Co xvii
Schuyler Electric Co..... .. xvii
Sechrist, Albert..... xvi
Shawmut Fuse Wire Co xvi
Shultz Belting Co..... xv
Siebert, G..... —
Siemens & Halske Electric Co. xi
Sioux City Elec. Supply Co... —
Sioux City Engine Works.... xxi
Smith, A. T.... .... —
Smith, Thos. G. Jr..... —
Sperry Elec. Mining Mach. Co. xix
Standard Electric Co..... viii
Standard Paint Co x
Stanley Electric Mfg. Co..... v
Stearns Mfg. Co..... xxi
Steuben Lamp Works..... xiii
Sterling, W. C..... xv
Stillwell & Bierce Mfg. Co. xlv, xv
Sunbeam Incand. Lamp Co.. xxv
Taylor Engine Co..... —
Taylor, Goodhue & Ames....xxvi
Union Hardware Co..... xii
Utica Elec. Mfg. & Supply Co. x
Van Nuis C. S..... i
Vulcanized Fibre Co..... xv
Waddell-Entz Company..... xii
Wannopee Pottery Co xvii
Washburn & Moen Mfg. Co.. iv
Western Electric Co..... x
Westinghouse, Church, Kerr & Co..... xx
Westinghouse Elec. and Mfg Co..... xi
Weston Engine Co..... i
Worthington, Henry R..... xii

CLASSIFIED LIST.

Annunciators.
Central Electric Co.
Electrical Supply Co., The.
Knapp Electrical Works.
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Beggs, J. E., Mchy. & Supply Co.
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Electrical Supply Co., The.
Enterprise Electric Co.
General Electric Co.
Great Western Electric Supply Co.
Holmes, Booth & Haydene.
International Okonite Co., The.
India Rubber & G. P. Ins. Co.
Knapp Electrical Works.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Roebling's Sons Co., J. A.
Shawmut Fuse Wire Co.
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Electric Appliance Co.
Electrical Eng. & Supply Co., The.
Electrical Manufacturing Co., The.
Electrical Supply Co., The.
General Electric Co.
Hood & Co., Wm.
Knapp Electrical Works.
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Bowers Bros.
Johns Mfg. Co., H. W.
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Milling Machinery.
Becker Mfg. Co., John.

Mining Apparatus, Electric
General Electric Co.
Sperry Elec. Mining Machine Co.
Westinghouse Electric & Mfg. Co.

Model Making.
Midland Electrical Wks.

Motors.
Brush Electric Co.
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Electrical Eng. & Supply Co., The.
Ford-Washburn Storelectro Co.
General Electric Co.
Great Western Electric Supply Co.
Knapp Electrical Works.
La Roche Electric Works.
Porter-Leavitt Electric Motor Co.
Siemens & Halske Electric Co.
Waddell-Entz Company.
Westinghouse Electric & Mfg. Co.

Name Plates.
Becker Mfg. Co., John.

Pins and Brackets.
Central Electric Co.
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Hughes Bros. Mfg. Co.
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Lefmann, Julius.
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Publishers, Electrical.
Electrician Publishing Co.

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Central Electric Co.
Electrical Supply Co., The.
Knapp Electrical Works.
Union Hardware Co.
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Railways, Electric.
(See electric railways.)

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Ries Electric Specialty Co.

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Carpenter Enamel Rheostat Co.

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Innis & Co.
Klipstein, A.

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Hine Eliminator Co.

Silk Braid.
Boston Braid Mfg. Co.

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Central Electric Co.
Electrical Supply Co., The.
Knapp Electrical Works.
Ostrander & Co., W. R.
Western Electric Co.

Speed Indicators.
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Steam Pumps.
Worthington, Henry R.

Supplies, Electric Railway.
Electric Appliance Co.
Lefmann, Julius.
Railway Equipment Co.

Tapes, Insulating.
American Electrical Works.
Central Electric Co.
Cushing, F. W.
Crescent Ins. Wire & Cable Co.
Electrical Supply Co., The.
India Rubber & G. P. Ins. Co.
International Okonite Co., The.
Knapp Electrical Works.
New York Insulated Wire Co.
Standard Paint Co.
Washburn & Moen Mfg. Co.

Telegraph Apparatus.
Central Electric Co.
Electric Secret Service Co.
Electrical Supply Co., The.
Greeley & Co., The E. S.
Knapp Electrical Works.
Western Electric Co.

Telephones, Electric.
Western Electric Co.

Test Instruments.
Central Electric Co.
Electrical Supply Co., The.
Greeley & Co., The E. S.
Knapp Electrical Works.
Queen & Company.
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Transformers.
Diamond Electric Mfg. Co.
National Electric Manufacturing Co.
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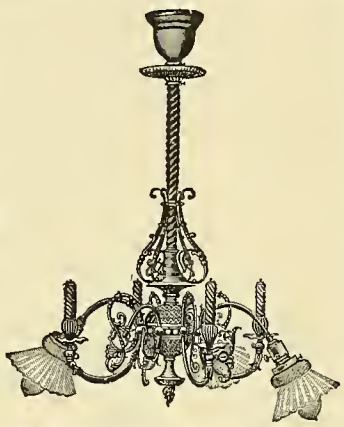

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These mines are of ancient discovery, and were worked with great profit for a long period, being only abandoned on account of political troubles before and after the War of liberation.

These troubles have been happily settled for over a quarter of a century, and the Colombian Republic is based upon the theory of and similar to our own government, with civil and religious liberty and equal rights to all, and is as stable as any government in the world.

These mines are so richly endowed with auriferous material, from the easily-worked sand, gravel, and dirt (carrying virgin dust and nuggets), to the fissure veins of free milling quartz, that when properly equipped a profit of ten thousand dollars ($10,000) a day, or over three million dollars ($3,000,000) annually is a very low and conservative estimate.

There is an abundance of timber and unfailing water power, with a genial and healthy climate.

It is proposed to organize this property on a basis of five million dollars ($5,000,000), upon which there can be dividends earned of 60 per cent. or more, and the parties furnishing the original capital, in small or large sums, for this organization, which will be about twenty-five thousand dollars ($25,000), will be let in on a basis of two and a half cents (2½c.) on the dollar, with the privilege of purchasing pro rata at five cents (5c.) on the dollar, a sufficient amount to give them a controlling interest if they so desire.

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An experienced miner who has been over and thoroughly examined the property, says more gold is there than in the entire State of California, while another says so great is the evidence of mineral wealth I sometimes doubted my own sanity, and were I to tell California and Colorado miners even a tithe of what I actually saw, I would be branded as a foolish liar or raving maniac.

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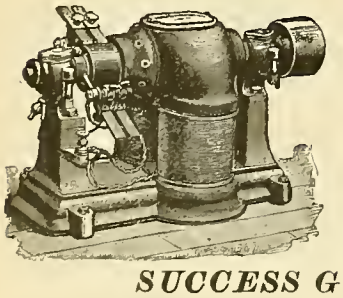

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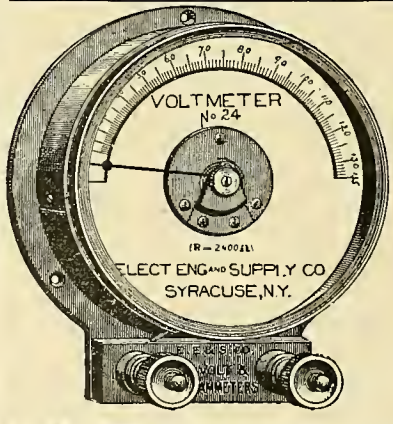

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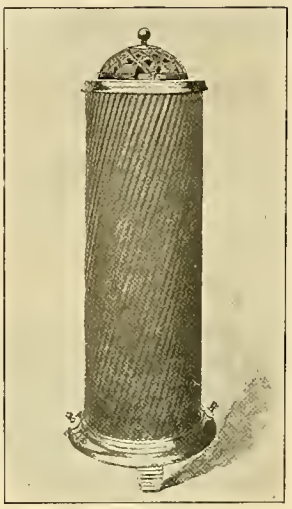

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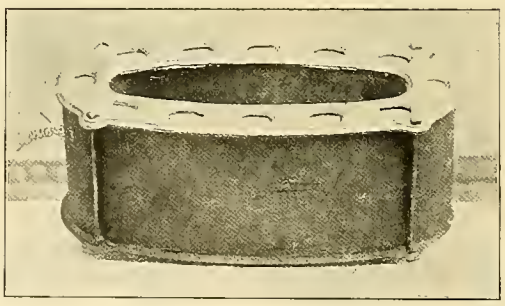

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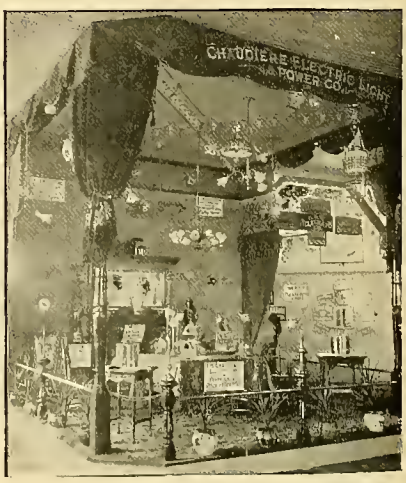

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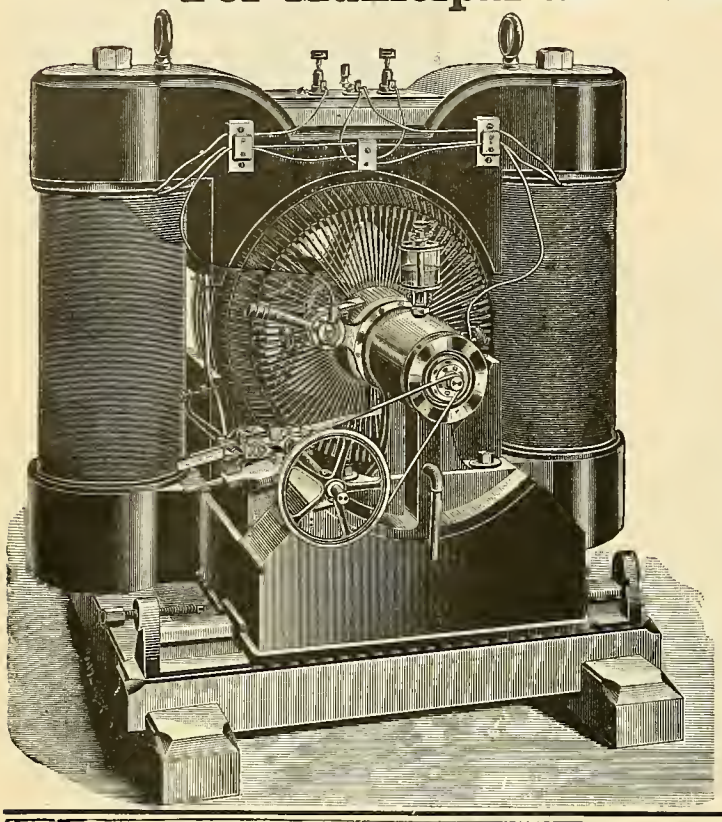

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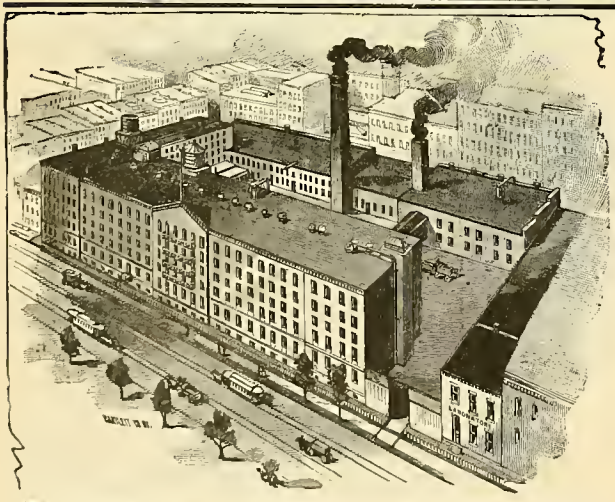

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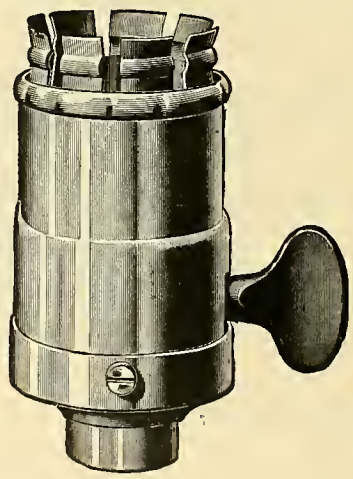

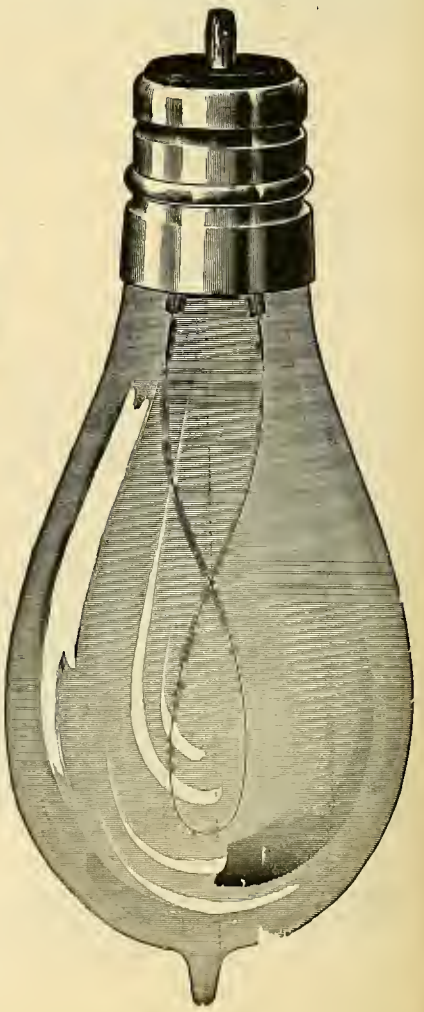

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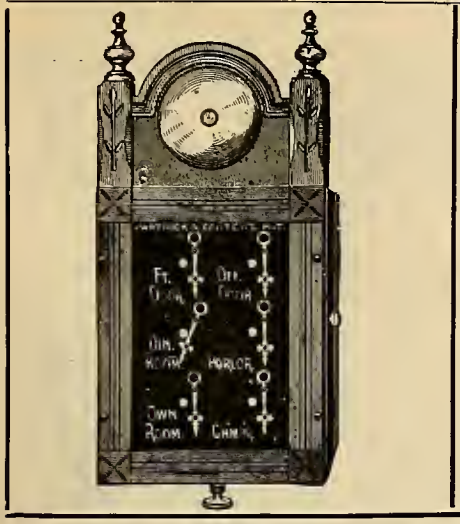

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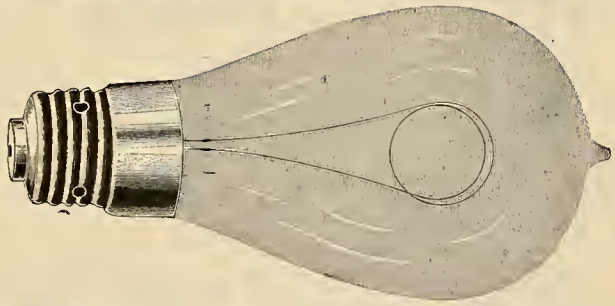

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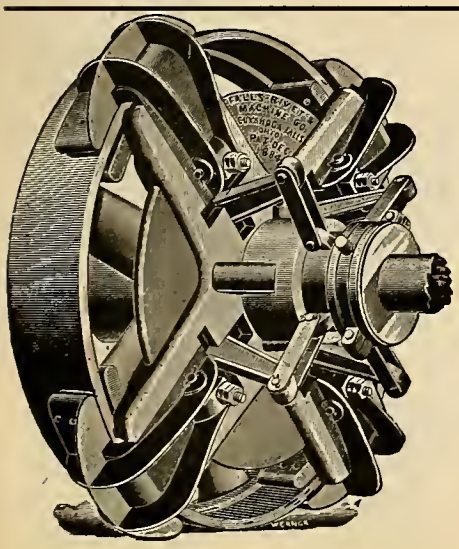

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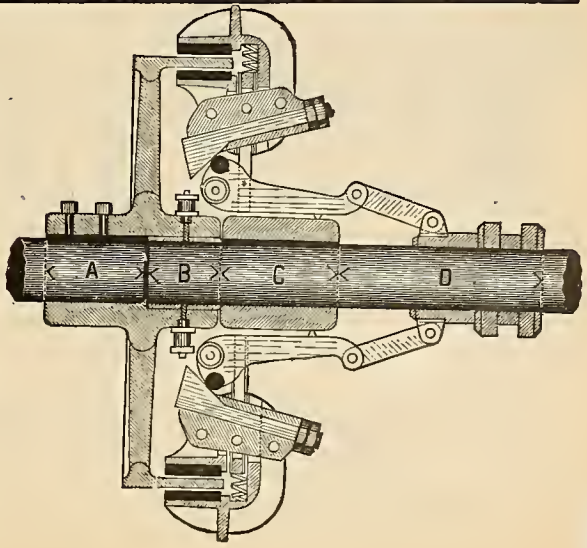

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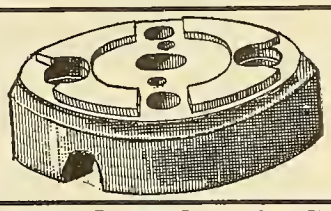

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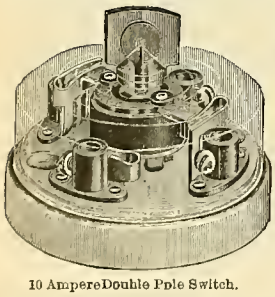

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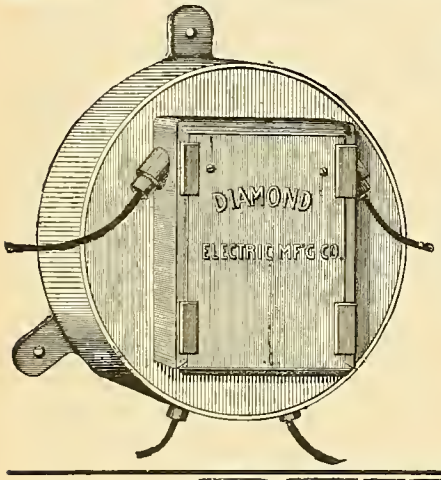

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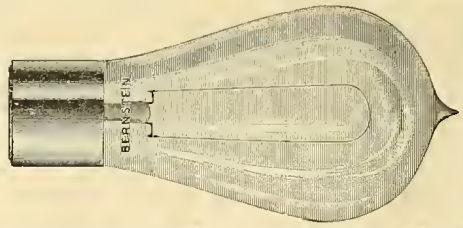

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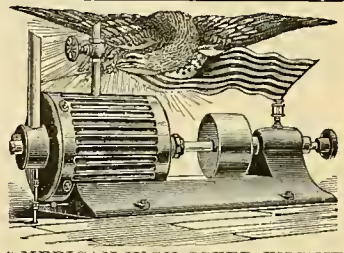

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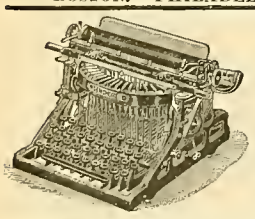

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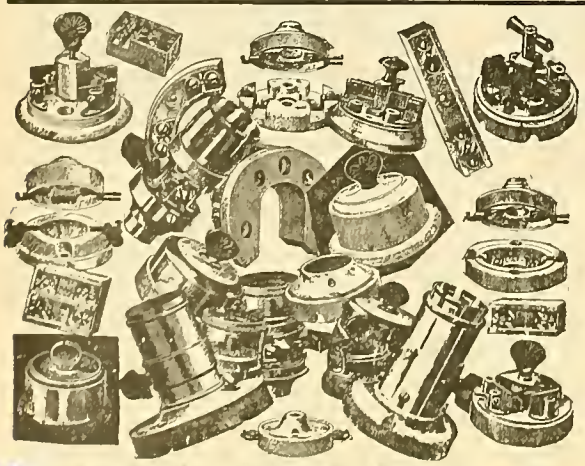

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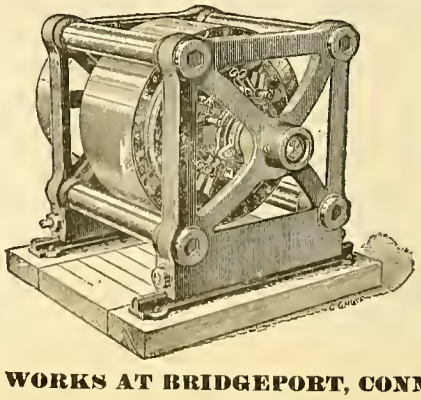

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Western Electrician.

EVERY SATURDAY.

Vol. XI. CHICAGO, DECEMBER 3, 1892. No. 23

An Electric Excavator.

New applications of electricity are always interesting, and the novel use of electrically transmitted power shown in the accompanying illustrations deserves the attention of electrician and layman alike on this account. The machine shown is nothing more or less than an electric power shovel, which has superseded a steam shovel in a large brick yard south of Chicago.

This, the first electric shovel in the United States, has just been installed at the works of the Purington-Kimbell Brick company at Purington, a small suburb of Chicago, about fifteen miles south of the center of the city on the Rock Island railway. Extensive clay pits are located at this point, and the clay has until recently been excavated by a steam power shovel, the dipper or scoop being operated by an engine and boiler enclosed in a car, running on a temporary track, by means of which the shovel could be moved from time to time to new positions along the clay bank that is being cut down. The dipper is operated by a crane and a system of gearing, and as fast as the clay is scooped up it is loaded on dump-carts running on tramways and is hauled to the works by horses. The change to electricity was made by disconnecting the steam pipes in the car and installing a 50 horse power Thomson-Houston motor, supplied with current from a generating station several hundred feet away, on top of the bank.

A general view, showing the electric shovel at work in the pit, is given in Fig. 1, in which the conductors leading from the station to the trolley stand on the car can be seen. A nearer view of the car and dipper is shown in Fig. 2, while the motor and outside connections are represented in Fig. 3. A view of the generating plant is given in Fig. 4.

The motor used in this installation is of the ironclad type, being completely protected by the yoke of the motor fields, as shown in Fig. 3. It is rated at 500 volts. The external diameter of the commutator is large, with many segments, so that sparking at brushes is practically eliminated. The motor is of the series type, the field spools being wound with a loop for high speed. The only attention the motor requires during the day's run is in starting and shutting down, which is done with an incombustible rheostat, the resistance of which is made up of thin iron plates insulated with mica. The shovel moves three feet forward on its track every hour; the locomotive power is obtained by throwing a pair of driving wheels into gear with the motor.

In the generating station, Fig. 4, there is an 85 horse power 550 volt Thomson-Houston compound generator, running from a New York Safety 100 horse power engine. The generator runs at 900 revolutions per minute, and is supplied with carbon brushes. It is mounted on a solid sewer brick foundation with oak capping. One interesting feature of the power house is that the furnaces are fired with oil, forced under the boilers by steam pressure.

From the generating station a pair of feeder wires runs to the bank, partly along the sides of the sheds and partly on poles. From the end of these feeders, Fig. 1, runs a pair of bare copper trolley wires along the bank, so arranged on iron poles that they may be moved from time to time as the shovel demands. This pair of bare wires is connected with two armored cables running to the trolley stand on the car. The contact between these cables and the trolley wires is made by means of a special connecting piece, which can be moved from time to time along the trolley at a moment's notice, as the shovel gradually moves forward in its course.

The motor is suspended under the car on rubber cushions, so that when a sudden load is put on the motor the cushions will give to the whole a degree of elasticity which will to some extent relieve the motor of sudden strains. The motor is geared to a countershaft; this in turn is geared to the drum of the hoist by friction plates, so that if the shovel strikes a stone imbedded in the clay the motor will not come to a standstill, as these plates are so constructed that they will not at any time make a perfectly adhesive contact between the parts. The countershaft is also connected by gearing with the device for elevating the dipper and the device turning the boom on its vertical axis. The catch releasing the bottom of the dipper is operated by hand, as in the steam machine. The dipper of this machine has a capacity for 1 cubic yard.

A new shovel with 50 per cent. increase of capacity is soon to be installed. This will be operated by two motors of similar design and capacity to that in use on the present shovel.

The installation was made by the Chicago office of the General Electric company, from designs made in the engineering department.

FIG. 1. AN ELECTRIC EXCAVATOR.

National Electric Light Association.

George F. Porter, secretary of the National Electric Light association, announces that the sixteenth convention of the organization will be held in the Bell Telephone building, St. Louis, February 28th and March 1st and 2d

Keep the World's Fair Open Evenings.

Despite the assurance of President Higinbotham that it was the intention of the world's Fair authorities to keep the exposition open several evenings each week, the electrical fraternity and the people generally are dissatisfied with this indefinite arrangement. As has been pointed out in the WESTERN ELECTRICIAN the electrical concerns want to know just how many evenings each week the fair will be open before they finally decide upon the nature and ex-

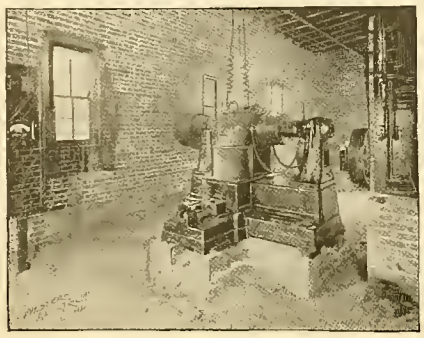


FIG. 4. AN ELECTRIC EXCAVATOR.

tent of their display. The people, too, want the fair open every night. The greater number of the people of Chicago will have no other time to see the fair, and visitors from other cities demand evening exhibitions in order that they may thoroughly examine all departments and yet not prolong their visit beyond the time they can afford to spend. Many daily papers and class journals have taken up the subject, and they are unanimous in their approval of the course followed by the WESTERN ELECTRICIAN in this agitation. Here are a few additional extracts from editorials on this subject:

Omaha Bee: The decision of the World's Fair directors in deciding to close the doors at seven P. M. has met with a storm of righteous indignation everywhere. If the doors are not to be open Sunday when are laboring people to see the fair? This is not a Puritan country, whose people retire at sundown.

Chicago Evening Journal: Electricians are almost universally in favor of keeping the World's Fair open nights, and public opinion seems to be with them. Certainly some of the greatest effects can be secured at night, and, when the great amount expended on the electrical department is considered, it appears surprising that early evening closing is thought off.

New York *Sun:* At great expense the managers of the fair have provided for about 100,000 incandescent lights in the buildings and for 5,000 arc lights on the grounds, with a huge generating plant that is already ordered. To spend about half a million dollars in preparing to light up the World's Fair on afternoons darkened by thunder clouds, or in the event of a possible solar eclipse, would seem to be a singular proceeding. Probably common sense will prevail and the fair will be kept open in the evening.

New York *World:* It is said that the World's Fair managers propose to close the grounds at 7 o'clock every evening. If any such decision has been reached it should be reconsidered at once. To close the fair at such an hour would compel visitors from a distance either to remain longer in Chicago than they desire or can afford, or to see the exhibition much less thoroughly than they otherwise would. That would help the Chicago hotel keepers,

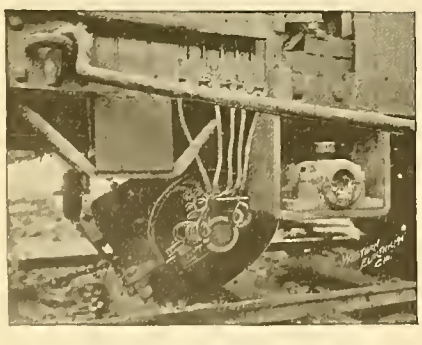


FIG. 3. AN ELECTRIC EXCAVATOR.

theaters and beer halls to get money out of the people, but it would work serious inconvenience and wrong to visitors.

Chicago *Journal of Commerce:* The project for closing the World's Fair at seven o'clock in the evening is first cousin to the adopted scheme for closing the entire exposition on Sunday. With Sunday closing conceded, the evening is the only time left for the great bulk of Chicago working people to see the great show. This idiotic policy would rob thousands of an opportunity to avail themselves of the greatest educator of modern times. It would throw a vast multitude upon the saloons, gambling houses and other evil resorts. But one of the most serious objections is found in the circumstance that such a plan would very nearly destroy the effect of the electrical display. Sunday closing is bad enough, but this latest scheme is entitled to the palm. That it was suggested by some enemy of the great enterprise no one can doubt.

Electricity: The national committee of the World's Columbian Exposition has decided to close the fair every evening at seven o'clock. Unless a reconsideration of this decision can be brought about, and a more reasonable hour determined upon, the last nail is driven in the coffin of the electric lighting exhibit, which, notwithstanding its many vicissitudes, had promised to be one of the main features of the grand show. The industry, which now employs a capital of $700,000,000, and which has practically come into life since the Philadelphia show in 1876, deserves better treatment, and we trust the gentlemen in charge will yet be brought to look at it in this light. To this end, every electrical concern in this country, and every man, woman and child who wants to see a grand ensemble of what has been accomplished in the newest of the sciences, should send in an emphatic protest to this committee, and at once.

Electrical Review: We are pleased to learn that a large number of protests from intending exhibitors at the World's Fair have been received by the national commission against closing the fair at 7 o'clock in the evening, except on fete occasions. It has been understood from the first that the fair would be open to visitors at least until 10 o'clock every night. Naturally, an electrical exhibition, including electric lighting features of great magnitude and importance, is of no value unless it can be displayed at night. The national commission should at once modify the rules so as to enable the electrical display to be shown to the proper advantage, or they will find that what

FIG. 2, AN ELECTRIC EXCAVATOR.

promised to be the most important part of the World's Fair will dwindle down to a mere side show. Several large electrical companies have already threatened to curtail their exhibits unless the rules are modified.

Chicago News: The commission, while decreeing that the gates of the fair should be closed at 7 P. M., except on "fete nights," meant that the "fete nights" should be so frequent that the rule itself would operate only to afford exhibitors and employes a sort of needed breathing-spell. Perhaps it will occur to the majority of people to inquire: If the commission realized the importance and necessity of evening exhibits so fully as this explanation would imply, why didn't they say so, and why did they say something else—namely, that the gates be closed at 7 save upon exceptional cases? The people unquestionably demand open evenings. They have all the arguments on the side of the demand. There is scarcely a doubt that evening exhibits will be profitable both to the directory and the public. Therefore, why not grant them frankly instead of grudgingly, through a special programme, which is subject to change and likely to be misunderstood?

Rochester, N. Y., *Herald:* There are some features of the World's Fair programme that the general public ought vigorously to resent. One of them is the reported decision that the exposition will be closed at 7 o'clock each evening. The injustice of this resolution is only equaled by the selfishness of the object that doubtless inspired it. That motive is to give Chicago store-keepers and others the largest opportunity for money-making while the city is crowded with visitors. The sooner that the Chicagoans are convinced that the fair is not to be run exclusively for their benefit the better. The majority of the visitors to the fair will be men and women of moderate means, whose time will be limited and who will desire to see as much of the exposition as they possibly can within the period of their sojourn. The proposed arrangement would be an outrage upon this large class. If this plan is persisted in, Congress ought to interfere to protect the people at large.

Electrical Age: One of the greatest blunders that the World's Fair commissioners could have possibly committed was the adoption of the rule providing for the closing of the gates to the fair grounds at 7 o'clock each evening, and it is with much favor that we note the strong sentiment in the electrical trade at large against the proposition. Early closing concerns not only the electrical exhibitors, but all others. The former class, however, would be more affected for the reason that natural darkness is essential to obtain the best effects and results with electric light displays. It would not make so much difference if power was the only manifestation of the electric force, because the applications of electric power can be just as well shown in the daytime as at night, but with the electric light it is quite different. The proper time, of course, to produce the best effects with the electric light is when the conditions exist which make light a necessity. It will be decidedly advantageous—morally, mentally, physically, financially and commercially—to keep the fair open evenings, and all the power and influence we can command will be exerted in the direction of securing a modification of the rule.

Stationary Engineer: A recent decision of the World's Fair directors to keep the grounds closed evenings has brought forth protests from a great many, not only in the city of Chicago, but in surrounding cities and states. The idea of keeping an exposition of the kind that will be held in Jackson Park closed during the evening is something incomprehensible and uncalled for; in fact, a very large portion of the attendance will be during the evening, after the day's work is finished, when the visit will serve as recreation as well as being interesting and educational. The principles and views which would call for the closing of the exposition during the evenings would, with very little dilation, close the grounds against visitors at all times, with the exception, perhaps, of two or three hours during the day. If Chicago wishes to make a success of the World's Fair, let the directors keep it open day and evening during the prescribed time. It is safe to say that the the evening attendance between the hours of six o'clock and closing time will be fully as great, if it does not exceed that of the day time. Plenty of preparation has been made for lighting the grounds at night and, with the grounds and buildings closed during the evening, there will be little, if any, opportunity to display the beauties and wonders of electric lighting. Keep the fair open evenings.

San Francisco Chronicle: There are some things about the administration of the World's Fair calculated to puzzle the outsider. Among them may be noted the determination to close the exhibit at 7 P. M. If this is done one will naturally ask why was an imposing building erected to house the exhibits of the manufacturers of electrical machinery, which consists very largely of apparatus for illuminating purposes and which can only be shown to advantage after dark? The people practically interested in electricity are not waiting until the fair opens to ask this question. They are already protesting against a ruling which will result in minimizing the value of their exhibits, and many of them declare flatly that unless the order is revoked and the exhibition kept open at night they will make no displays. The WESTERN ELECTRICIAN prints interviews with three or four score of prominent manufacturers of electrical machinery, etc., all of whom unite in saying that they will not exhibit unless the rule is modified. There is no good reason why the rule should not be modified. Perhaps it

may not be advisable to keep open all the departments of the exhibition at night, but there can certainly be no practical objection to the opening of such buildings as that of manufactures and liberal arts, the art palace and annexes, the electrical building, etc. It would not be necessary to make any changes in the rate of admission, for it is inconceivable that any considerable proportion of the day visitors would extend their sight-seeing late into the night without departing from the grounds, and, in any event, there would be immense numbers of fresh visitors after 7 P. M., whose entrance fees would add greatly to the receipts of the exhibition. If displays in which electric lighting and fireworks played an important part were frequently made the night admissions might come to rival in importance those of the day time, for it must not be forgotten that in a city of over a million inhabitants the number that cannot or will not sacrifice a day to sight-seeing is immense. The managers will make a great mistake if they persist in their determination to close down at 7 o'clock, and unless they can advance better reason for their action than they have heretofore they will encounter a storm of adverse criticism and popular discontent

Electrical Engineer: If there is any likelihood—which we can hardly believe—that the fair will close at the hour when it can be made most attractive, we beg to enter at once our most emphatic protest against any such proceeding, and, if it is insisted on, we advise dynamo and lamp manufacturers to abstain from exhibiting. It is estimated that the electrical exhibits will run into millions of dollars in value, and the largest part of this money will be spent on apparatus for light and power. Are we to believe that this apparatus is to be idle just at the moment when it can best illustrate its benefits as an addition to modern means of convenience, comfort, economy and beauty? If so, electrical manufacturers have been fooled and played with. It seems to us that the management, if serious in such a proposition, forget the obligations into which they have entered. Many of the concessions awarded have, to our knowledge, been based by the lessees on calculations that included several hours after sunset. Besides that, a great many of the state buildings have made special plans and arrangements for artistic electric illuminations. Are we to understand that this expense has all been incurred for nothing on a deliberate misrepresentation? Of what use would these decorations be in the daytime? The fair authorities have themselves also gone to enormous expense for electric lighting. One leading object of the fair authorities having made such liberal provision of current should, on the contrary, be to stimulate the larger exhibitors to new and original displays of decorative electric lighting, and thus to emphasize the great fact that light has to-day become, equally with color and drapery, an element of the beautiful and æsthetic. We feel very much like saying that, after all, this is just what we feared. When Chicago first got the fair, and a building was devoted to electricity, and the air was full of enthusiastic talk, it really seemed as though the world was going to witness the illumination of all Lake Michigan, backed by a display of about ten billion lights in the fair buildings and grounds. Gradually and gradually the dream has been sobering down into a dismal reality, and now we find that there is virtually to be no electric illumination at all. Once more, we protest. In the name of the electrical exhibitors; of the various concessionaries for all sorts of privileges sold at fabulously high prices; of the authorities who have ordered elaborate illuminations for state buildings; of the workingmen and modest wage earners of America; and in the name of all others interested in seeing the fair, and in getting quickly back home again—we protest.

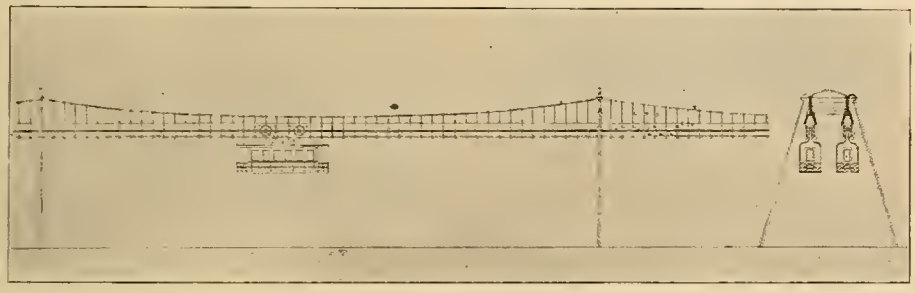


FIG. 2. JOHNSTON ELEVATED ELECTRIC ROAD.

Electric Signaling Through Fire Hose.

Joseph B. Strauss of Cincinnati has devised a system to be used by firemen in signaling to engineers at fires. It consists merely of establishing electric communication along the line of hose, between the nozzle and engine. A test was made recently at the foot of Race street by the Cincinnati fire department, and under the direct supervision of Chief Hughes. The invention consists of a battery placed on the engine near the point where the hose is jointed. Well insulated wire is woven through the sections of hose, just beneath the outside covering. At the coupling of the sections of hose is a self-adjusting electrical connection, thus allowing an unbroken current to the end of the line of hose. In the nozzle, and connecting in the same manner as in the sections of hose, a wire runs to a little push button, by means of which the signals are made. The first test wes merely with hydrant pressure. A push on the button gave one ring at the engine, and was the signal to turn on the water. Two pushes at the nozzle, and corresponding rings at the engine, meant to shut the steam off. After the hydrant pressure had been found to work nicely, the engine was put to work, and the full pressure used had no effect toward interfering with the working of the electric current. Inventors have been at work for years in a vain endeavor to perfect some such device enabling the firemen to communicate with the engineer, and thus do away with so much shouting and running, allowing the firemen to reserve their lung power for the more effectual struggle against the fire fiend. The one now perfected by Mr. Strauss does this and saves time in getting a stream on the fire, as the time required from the moment of pushing the button by the fireman and turning on the water by the engineer occupied but twenty seconds. Chief Hughes was satisfied with the test. He said: "It is certainly a success. Every signal was answered promptly, and it worked like a charm."

Johnston Elevated Electric Road.

One of the latest claimants for attention in the discussion of rapid transit methods is L. Johnston, the inventor of the elevated electric railway system illustrated herewith. Mr. Johnston has constructed a working model of the invention at the corner of Wentworth avenue and Sixty-fifth street, Chicago. Fig. 1 is a view of this road and Fig. 2 shows details of construction.

The road consists of a series of suspended beats of, say, 150 feet span, and held by wire cables, after the fashion of a suspension bridge. The cable is supported at intervals of 150 feet on heavy iron or steel posts connected on top and across the track by a heavy girder or truss, on which the wire cables rest and to which they are securely fastened.

The rails are held in position by means of heavy iron or steel stirrups or yokes with horizontal top bars and vertical arms hanging from each end of the bar. The vertical arms at the lower end have inwardly and upwardly turned lugs, on which the rails rest and to which they are securely bolted.

The car trucks travel on the lower rails and are held securely by the use of a guide rail made of angle iron or steel and securely bolted to each of the suspended arms of the stirrup about opposite the center of the wheels, running continuously along the track on each side of the trucks and parallel with the lower rails, the cars being suspended from the center line of each truck. By this arrangement, it is claimed, the trucks of the cars are securely held in position and can not become displaced.

The stirrups take the place of the cross ties on the ordinary railroad, and are suspended from the wire cables by means of wire ropes. It is proposed to operate this road by means of electricity. Power will be supplied by a trolley wire over the center of the car and between the two rails. It will be securely insulated from contact with the structure, and will be held in position under the top bar of the stirrup. The current is conveyed from the wire through the motor and wheels to the rails, thence to the whole structure, and is grounded through the supports of the main structure.

It is claimed that an electric storm could have no damaging effect on the power wire, owing to the fact that it is protected by the main cable and suspended wires and cross bars of stirrups.

A speed of twenty miles an hour has been obtained on a 50 foot track with an 8 foot circle on each end and a 3 inch wheel on the trucks. A 12 inch wheel will give a 75 mile speed, while a 30 inch wheel, it is claimed, will give 150 miles speed with perfect safety. The cost of the road will vary in proportion to the rate of speed desired.

The cost of road for 12 inch wheel is estimated by the inventor at $35,000 to $45,000 per mile of double track.

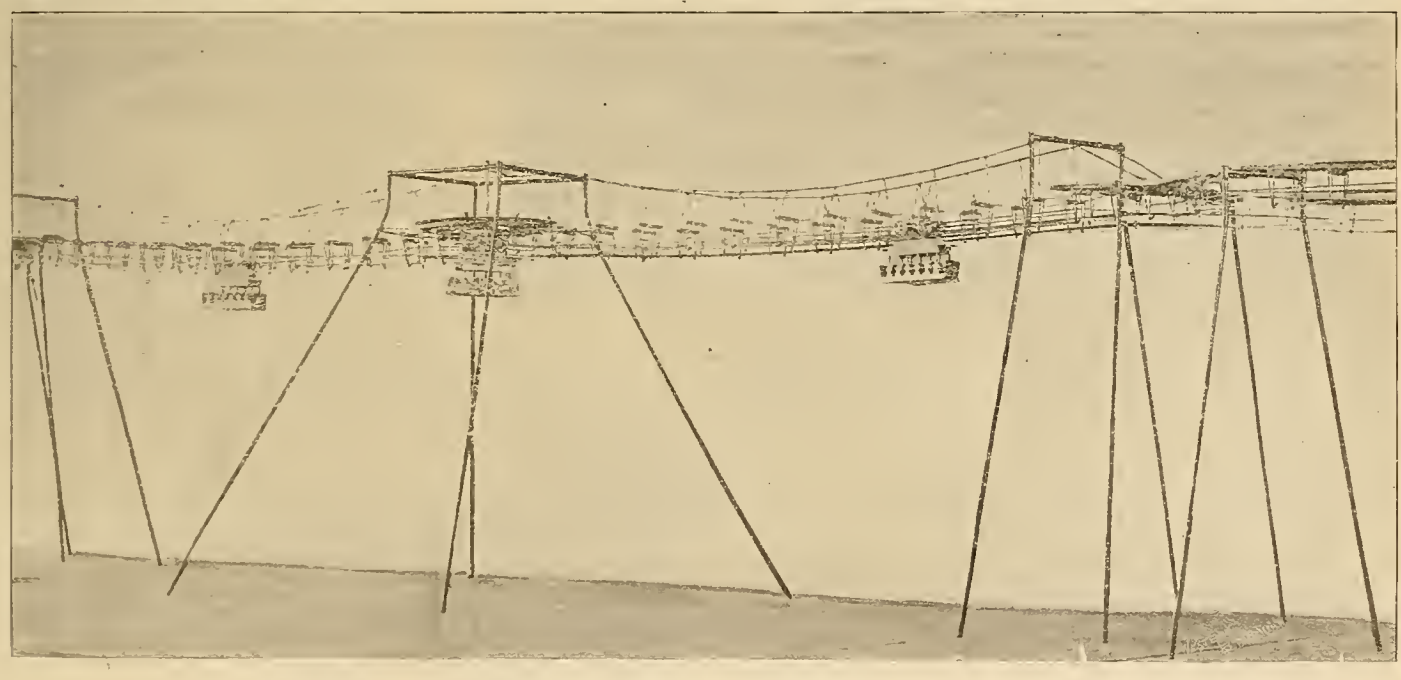


FIG. 1. JOHNSTON ELEVATED ELECTRIC ROAD.

The Compound Winding of Generators From a Practical Standpoint.[1]

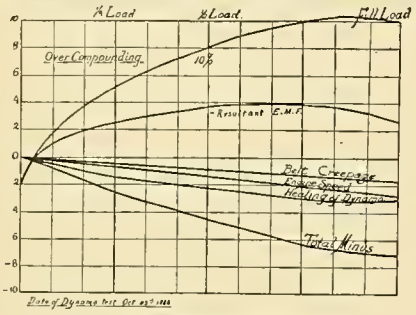
By M. Willis.

The Chicago Electric club requested me to read a paper on a subject which would bring up a good warm discussion, and I believe, if I am not much mistaken, I shall have struck, before I am through, the right chord to realize the desired result.

The subject I have selected is "The Compound Winding of Generators From a Practical Standpoint," with especial reference to their use in practice.

In the first place we find that in all electric installations, whether for incandescent lighting or power transmission, the first requirement is that the dynamo or dynamos shall maintain a constant potential difference at the brushes or at some distant point.

On examination we find that the shunt machine by armature reaction alone as a single factor, not to mention the host of other factors which enter into the equation, is unable in practice or theory to fill the before mentioned requirement, viz , to keep a constant potential difference at any point predetermined without hand regulation or some form of governing device, such, for instance, as an automatic rheostat. Therefore one has to look for some one of the many devices introduced which will the most nearly fill the requirements in practice as well as in theory. I believe that it has been decided by electricians the world over that the requirements are the most nearly reached by the com-



THE COMPOUND WINDING OF GENERATORS FROM A PRACTICAL STANDPOINT.

pound machine, the electromotiveforce of which keeps constant or increases directly as the load on the machine increases.

We find in the building of compound machines that certain conditions are assumed. In the first place we find that the speed of the machine is assumed constant, whatever that constant may be. This of course introduces a slight source of error, as in practice in a large percentage of cases, more especially in small plants, the speed varies

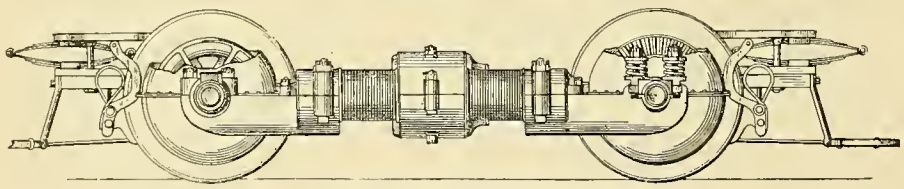


FIG. 4. RAE'S NEW ELECTRIC RAILWAY SYSTEM.

at least two per cent., as I believe two per cent. variation in speed between full and no load is about the best warranty obtainable on the greater number of makes of high speed engines, with which one in, modern practice has mostly to deal. This, however, be it remembered, does not take into consideration the creepage of dynamo belts, which amounts to from one and one-half to two and one-half per cent. by actual experiment, not to mention belt slippage. All these factors of course increase in direct proportion to the load. In railway practice and in the transmission of power a few per cent. variation is however permissible.

It would seem advisable to over-compound even railway generators to a slight extent to make up for small variations of speed. This may be accomplished in some machines without special winding, as for instance by varying the length of a German silver shunt used to divert a portion of the main current past the series coils and thus allow a larger proportion of the main current to flow through the series coils of the machine. In incandescent lighting, however, variations of speed are attended with far more evil results, and in only too many cases the dynamos are blamed for inconstancy of the candle power of lamps when it is the transmission of mechanical power to the dynamo shaft that is to blame. We will now consider the use of the compound and over-compound machines under various conditions. We will first take the case of a compound wound machine running singly. We find that its series winding may be constructed with such a number of turns that it will practically compensate automatically from no load to full load. For all internal reaction, such a machine is evidently eminently fitted for railway and similar work, as it will maintain a practically constant potential at the generating station

The next case is one in which we have an over compounded generator running singly. We find that its series coils if correctly constructed will fairly compensate for internal reactions and also for the varying percentage of loss in line, all of which will vary directly with the current. A machine of this class and under these circumstances would be admirably fitted for incandescent lighting and transmission of power, and more highly fitted for railroad work than a straight compound machine.

The next case is one in which we have two compound wound machines running on the three-wire system. The series windings of these machines will compensate for internal reactions and thus keep the potential at the generating station constant even if the system becomes unbalanced, as the excess load on one side above another would pass through the series coils of the more heavily loaded machine and increase its magnetic field, thus keeping its potential at a level with the more lightly loaded machine. Under

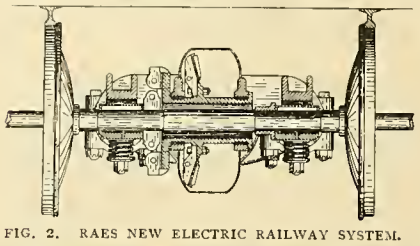


FIG. 2. RAES NEW ELECTRIC RAILWAY SYSTEM.

similar conditions, of course, a shunt machine would lower its potential.

The next case is one in which we have two over-compoundedmachines running on the three-wire system. In this case one finds that however unbalanced the load may be both machines will maintain a practically constant potential at any predetermined point if the compounding is correctly figured. One hundred and ten volt dynamos of such a type and under such circumstances would be the correct thing for incandescent lighting where the distance of lamps from generating station does not exceed one-half mile and where the cost of conductors on the 110 volt system and the cost of transformers on the alternating system would make these last two systems too expensive in comparison with the 220 volt system. A system of this kind would also be fitted for the distribution of power over short distances of say one-half mile for the 220 volt and three miles for the 1,000 volt system.

The next case is one in which we have compound wound generators running in multiple on the two-wire multiple arc system. We find here that the generators will compensate for internal reactions, but will not compensate for loss in transmission. Machines of this form and running in multiple would be but little better than straight shunt machines. One of the only advantages would be that they would divide the total load among them more equally than shunt machines would under similar conditions.

The last case to be taken up is the one in which we have over-compounded generators running in multiple. The series winding will fairly compensate in the average manufacturer's machine of this class for internal reactions due to varying load and also when all the machines are running for all variations in loss in the system due to varying load. It is this form and arrangement of generators for incandescent lighting which at present is rightly popular for isolated plants.

We will now turn to a case in which this arrangement of over-compounded machines in multiple will not maintain a constant potential at the lamps. The case is one in which we have two or more compound machines running in multiple. Suppose we are running our feeders at 10 per-cent. loss and at some one time we have but one-third of our total load of lamps on. Now it is poor economy to run two or more dynamos on a light load when one can take the total load. Therefore in practice we would cut out all generators except one. Doing this we should find that the voltage at the lamps would increase considerably for the reason that as at full load with all machines running our loss is 10 per cent. in feeders and the voltage of lamps correct, when we cut two-thirds of the lamps off our loss drops in direct proportion and we have each machine taking its equal share of the reduced load. This share passes through its series coils, producing the correct voltage necessary to run the lamps at the new percentage of loss in the feeders. When we cut out all machines but one, say, then the total current which was previously divided among all the machines will be drawn from the remaining one and in consequence will pass through its series coils and thus raise the voltage at the lamps because the percentage of loss in the feeders has varied from 10 per cent. to the percentage of loss at one-third load.

This case may prove very serious with 110 volt lamps. On two wire multiple arc systems, for instance, the voltage at the lamps would vary from 110 volts to at least 118 volts. Of course in this case hand regulation with ordinary generators would have to be resorted to and the only benefit derived from the compound winding would be the accurate division of load between compound wound generators running in multiple and the practically automatic regulation obtained for varying loads with all machines running.

A solution of this problem of how to keep voltage at lamps down when all machines but one, say, are cut out, would be either to wind the series coils in sections and when machines are thrown out to short-circuit a certain portion of each of the series coils of the balance of the gen-

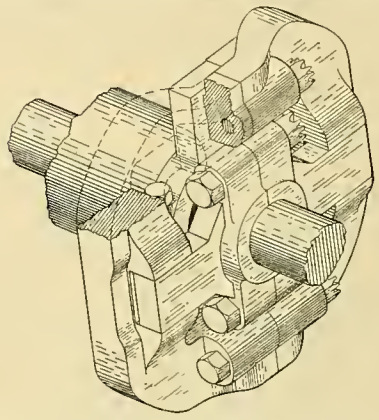


FIG. 3 RAE'S NEW ELECTRIC RAILWAY SYSTEM.

erators; or to operate a shunt of variable resistance, which would act to cut down current flowing through the series coils in direct proportion to the number of machines cut out. In addition to this it would also be advisable to excite the shunt field spools of all machines from a separate exciter run from a source of power and independent of that which runs the generators themselves.

One finds in practice that few compounded machines will maintain within one per cent. constant potential at any predetermined point. A factor will creep in which it is almost impossible to provide for in the compound winding. I have reference to the heating up of the machine which depends on the ventilation of the machine itself, on the ventilation of the dynamo room, and also on the temperature of the outside air.

Therefore, in conclusion it should be said that in general too much is expected of a compound machine or one over-compounded and too few allowances are made.

Return Circuit in Electric Railway Work.[1]

Mr Pearson, of Boston: There is one point in connection with this report on track construction which has not been touched upon, and which merits attention; and that is, the return ground. In small towns and systems where there are few cars running, the ordinary method of returning the current through the rails and supplementary wire will be sufficient unless the distance is great. On large roads where the traffic is heavy, more return ground

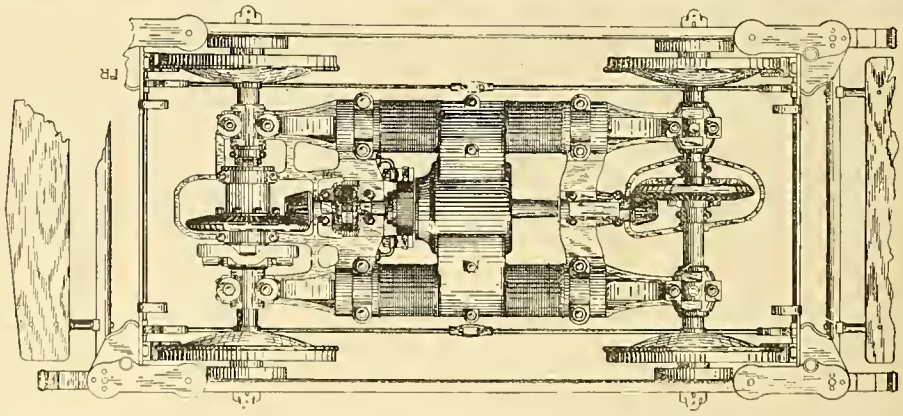


FIG. 1. RAE'S NEW ELECTRIC RAILWAY SYSTEM.

than have been used heretofore will have to be installed. We found it so in Boston, and from a lack of return feeders a great deal of electrolytic action was caused in our supplementary wire, and we are now putting up a large

1 Read before the Chicago Electric club November 21, 1892.

1. Abstract of discussion on report of committee on "A Model Electric Railway Roadbed and Underground Wiring," presented at the eleventh annual meeting of the American Street Railway association, Cleveland, O., October 19-21, 1892.

amount of overhead copper for return grounds; I do not think it possible to put it underground, as it will corrode and rust away. There is no advantage in using iron, as the conductivity is only one-seventh that of copper. The question has been asked me if we run the positive or negative current through the trolley wire. Originally we ran the positive through the trolley wire, but we found that the action on the supplementary wires was too great, and we changed it. I do not imagine that there will be much less effect, as it merely transfers the action to another point. If you have a large volume of current going through the earth, it will take hold of a water pipe or a gas pipe, or any other pipe, and there will be an electrolytic action set up; and in any large railway system, if the attempt is made to use the earth for a return ground by putting in ground plates in driven wells, or by putting them in the rivers and the return current is not provided with a good metallic circuit, it seems to me that the current must inevitably injure the water pipes and all other pipes. The current when it leaves the car goes into the ground and taking a water pipe may go a mile on that pipe, then leave it for a better conductor; the result being that the pipe will be corroded at this latter point.

MR. RICHARDSON of Brooklyn: I would like to ask the gentleman whether he has given thought to the idea of using a portion of the old rails which we have to take up, by putting them in the ground; on the basis, as he says, that in iron there is only one-seventh of the power of transmission as in the same weight of copper. I mean to take the relative value of our old steel rails, about $13 or $14 a ton, and using five, six, seven or eight, side by side, and making a continuous pathway for the return current, fastening them, of course, so as to make a continuous conductor, not necessarily under the roadbed, but alongside of it, or between that and the sidewalk, so as to provide a proper return, instead of depending on gas pipes, water pipes, or the earth.

MR. PEARSON: It seems to me the difficulty would be to make a joint. If you could weld the rails together, or if you could solder them, I think possibly it would work; but I do not believe you could make the joints in any other way that would carry a large volume of current without heating and corrosion.

MR RICHARDSON: Would that joint or joining need to be by copper plates?

MR. PEARSON: I think that would be a poor construction, as the iron and copper would form an electrolytic element, and cause corrosion even if no current was passed through the joint. The passage of current would also heat the joint and cause further oxidation. We attempted in the early days of electric railroading to use the rail for the return conductor, not putting in supplementary wires, and found it almost impossible to maintain a joint of any sort. Where you drive a large volume of current through the joint, oxidation takes place, and the joint soon becomes worthless. This condition will exist no matter how large the joint is made, and if you used dissimilar materials or metals, a local electrolytic action will also take place. With steel in contact with iron, the effect will be produced in a lesser degree than with copper, and it will take longer for the trouble to develop. It does not seem to me practicable to use old rails for conductors.

MR. BAUMHOFF of St. Louis: Have you compared the relative consumption of fuel with the trolley wire connected with the positive pole of the generator and the consumption of fuel when the trolley wire is connected with the negative pole of the generator?

MR. PEARSON: No, sir, we have not; it would be rather a difficult thing to do. I cannot see why it should make any difference, as the total resistance of the circuit is equal to the sum of the resistance of the various parts, and the loss in potential is proportional to the total resistance. I do not see what difference it could make whether the resistance is greater on the negative or positive side of the circuit; it is merely a question of driving the current through a certain resistance.

MR. RAMSEY of Pittsburg: I would like to ask Mr. Pearson in this connection whether or not he thinks it worth while to consider the use of old cables, discarded from cable roads, for the purpose mentioned? They weigh about two pounds to the foot, or about five or six tons to the mile, and may be purchased at about $50 per mile.

MR. PEARSON: We used considerable cable, old steel and iron cable in getting across the rivers and connecting our supplementary wires from one side of the track to the other, but it cuts away very fast. For instance, in one place we put in seven ropes or cables, and soldered the joints thoroughly at each end, and in less than four months they were entirely gone. If you had soil which was comparatively dry and sandy it might do for a time; in a place where the soil was moist and salty I doubt whether you would get enough life out of it to pay for putting it down.

MR. RICHARDSON: There was one thing the gentleman referred to I would like to know, why there should be any more difficulty because of using copper plates and rivets in connecting the rails for a mile or less in length; for instance, laying eight center-bearing rails, each thirty feet long, and connecting them as specified, why should there be any more destructive electrolytic action between the copper and iron than there is with the copper bond wires which are used to connect our rails together on the surface?

MR. PEARSON: I think, as a rule, in track construction to-day we use supplementary wires as well as bond wires on the rails; the former having a low resistance as compared with the bond wires and joints, the greater current passes on the supplementary wire and does not go through the joint. If you cut the supplementary wire and compel all the current to pass through the bond wire there will be trouble, but as long as you have a good supplementary conductor, so that the current does not pass through the bond wire, the joint will remain cool, and there is no great tendency to oxidation, especially if tinned rivets are used.

F. S. HOLMES of New York: I asked an experienced engineer, a pioneer, I believe, in street railroad work, some days ago, what was his experience in ground plates, and he said that, in case there was a sufficient number of ground plates along the line, he found that the current divided about equally between the rail return and the ground wire. Now, in an ordinary battery, the positive pole is the pole that gives and is consumed, and the negative pole is the pole that receives deposit. The construction we have to-day where ground plates are used for return currents makes the trolley wire and the various plates and supplementary wire along the line of the railroad positive and the large ground plate at the station negative. This is wrong, because where this is done the supplementary wire and ground plates along the line are rapidly corroded and eaten away, while the negative plate at the station is uninjured. The conditions should be reversed, the station plate being made positive and the line plates and supplementary wire and trolley negative to it. Corrosion will thus be largely confined to the station plate, which can be easily replaced, and the plates and supplementary wire along the road will remain nearly intact. Of course, to accomplish this the current will flow out by the ground, which will be positive, and back by the trolley wire, which will be negative.

Rae's New Electric Railway System.

In the course of the experiments and trials during the development of the electric railway many radical improvements and changes of more or less merit were suggested by engineers engaged in this line, but it is probable none was more freely and generally criticised than the proposition to equip a railway with single motors geared to both axles. This was undertaken four years ago in the equipment of the Elkhart, Ind., electric road by Frank B. Rae of Detroit. In the system adopted at that time a rigid frame supporting the motor and countershaft was carried upon the axles, and the power was transmitted by bevel gearing from the countershaft to the car axles. This method of applying the power was criticised, and failure was predicted on account of the rigidity; but the advantage of a single motor driving both axles seemed sufficiently great to warrant a thorough test, and as a result some forty roads have since been equipped with the Rae system. In these experiments it was found that extreme rigidity of the motor carrying frame and perfect alignment were necessary to keep the bevel gears in proper mesh; at the same time it was demanded that sufficient spring must be allowed in the whole arrangement to avoid lifting one wheel of the truck on curves, and when this condition was not exact, broken gears and other troubles ensued. To more thoroughly overcome the difficulties and objections to the rigid method of driving both axles from a single motor and at the same time obtain the advantages of flexibility claimed by employing a motor on each axle, Mr. Rae has devised the improvements herewith illustrated. While the bevel gearing has been adhered to, all the other features of the Rae system have been greatly modified.

The frame heretofore used has been dispensed with, and the motor itself forms the frame and is directly supported on the axles, as shown in Fig. 1, which represents a plan view of a forty horse power truck equipment. In this arrangement the countershaft is dispensed with, as the motor is of the slow speed type and is geared directly between the armature shaft and car axles. At one end the bevel gear is directly upon the axle, while at the other it is mounted upon a sleeve or quill in bearings which are a part of the motor frame. This quill end of the motor frame rests upon springs, which relieves the jarring of the motor and consequent crystalization, and permits the axle within the quill to take any position without putting any twisting strain upon the motor. This construction is seen in Figs. 1 and 2.

The power is transmitted to this axle by means of a flexible coupling between the quill and axle, and will be understood by reference to Fig. 3, which is an isometrical drawing of the coupling. This device consists of three parts. The first, being clamped to the axle, is provided with two projections which fit loosely into recesses in the second part. Upon the quill is clamped a piece with two projections similar to that upon the axle, the projections also fitting into the second part, but at right angles to the other.

It will thus be seen that the axle may take any position in relation to the quill and still drive without altering the angular velocity between the quill and axle and without cramping the motor frame or affecting the gears; the work upon the gears being in proportion to the duty at any point of rotation.

Upon the rear axle, or the one to which the gear is directly attached, the motor bearings are held from movement endways by a thrust bearing, formed directly upon the axle, similar to that used upon propeller shafts, which effectively prevents any shifting of the motor upon the axle.

The field magnets of the motor are of round wrought iron, to which the pole pieces, each formed of two parts, are bolted. The magnet yokes, which also form the supports upon the car axles, as well as the boxes for the armature shaft, are in one piece. This construction reduces the entire motor to eight distinct pieces plus the armature and gears. These eight pieces are put together with twelve bolts, and the locked nuts for these bolts are all upon the top and accessible through the traps of the car. As will be seen by the side elevation, Fig. 4, the clearance between the motor and ground is greater than is generally found in single reduction equipments.

The first road to equip with the new Rae system was the Toronto and Mimico electric railway, a suburban line along the lake shore near Toronto, Ont., operated only during the summer months. Double deck cars are used and are mounted upon McGuire trucks. A view of one of these cars is presented in Fig. 5. Thus far this road has been operated to the satisfaction of all concerned.

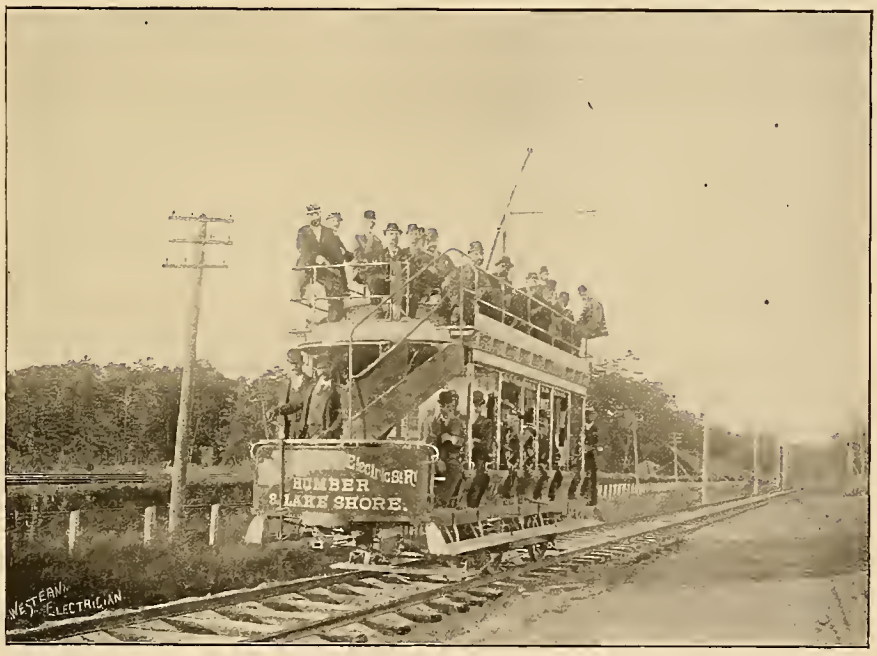


FIG. 5. RAE'S NEW ELECTRIC RAILWAY SYSTEM.

At the Roby race course, near Chicago, a jockey named Kuhn was recently discovered to be using spurs charged with electricity. Under his jacket he wore a broad belt with cartridge-shaped attachments, each of which formed an electric cell. From these wires ran down the jockey's legs to his spurs. No rule had existed to cover this particular misdemeanor, but the judges at once prepared and passed the following: "No jockey shall use anything on his mount but whip and spurs, and any one found using an electric battery or similar contrivance shall be promptly ruled off the track. This rule shall apply to owners or others instigating or assisting jockeys to use such contrivances."

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CORRESPONDENCE relating to electricity, or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

PAGE.

An Electric Excavator. Illustrated 281, 282
National Electric Light Association 281
Keep the World's Fair Open Evenings 282, 283
Electric Signaling Through Fire Hose 283
Johnston Elevated Electric Road. Illustrated 283
The Compound Winding of Generators From a Practical Standpoint. By M. Willis. Illustrated. (Chicago Electric Club) 284
Return Circuit in Electric Railway Work. (American Street Railway Association) 284, 285
Rae's New Electric Railway System. Illustrated 284, 285
Editorial 286
Electricity at the World's Fair 287
French Electrical Manufacturers and the Tariff 287
Extending Chicago's City Lighting Plant 287
The Electrical Habits of Iron 287
Women Toot Horns for an Electric Railway 287
Oil Versus Air as an Insulating Medium. By James Bowstead Williams, M. D. Part II. (American Institute of Electrical Engineers) 288, 289
The Carpenter Car Heater. Illustrated 289
Galvanometer and Potential Indicator. Illustrated 289
Starkweather's Boston Car Fender. Illustrated 289
The Acme Expanding Wire Guard. Illustrated 289
Cutters' Suspension Streethood. Illustrated 289
Heavy Duty Electric Railway Engine. Illustrated 289, 290

DEPARTMENTS.

Correspondence 290, 291
New Incorporations 291
Electric Lighting 291
Electric Railways 291
Telegraph 291
Telephone 291
Miscellaneous 291
Trade News 291, 292
Business 292
Electrical Patents 292

IN the list of prospective exhibitors in the electricity building at the World's Fair, published in the last issue of the WESTERN ELECTRICIAN, there appeared the names of several persons and concerns who have long been known as electrical quacks and "magnetic healers". Why these persons should be assigned space in the electricity building does not appear. They have no standing in the medical profession and are not identified with any legitimate electrical industry. Yet the World's Fair authorities have assigned these fakirs space in the building devoted to the industry which they have done much to bring into disrepute in the public mind. On behalf of the electrical fraternity the WESTERN ELECTRICIAN protests against this outrage upon legitimate electrical enterprises.

AMERICANS are not the only people who have been troubled over the tariff question. Just now the French manufacturers are wrangling over proposed reductions in the duty on Swiss machinery, and the electrical interests are taking a prominent part in the discussion. It is asserted that there are at least 4,000 persons engaged in the manufacture of electrical apparatus in France, and that the annual output is valued at 30,000,000 francs. Electrical machinery, it appears, has been among the favored articles of manufacture that have been protected, but now it is proposed to remove this duty, and the French manufacturers are fearful lest the industry be ruined by the competition thus invited. The protest which the representatives of the industry have presented the government reads like a campaign document issued by high protectionists in this country. The protest severely criticises the minister of commerce, who evidently failed to consider the arguments against the proposed measure. The protestants, therefore, appeal to their representatives in the legislative branch of the government to protect their interest. They say: "To your sentiments of impartiality, of which you gave so striking an example at the time of the discussion of the tariff duties, to the recollection of your former decisions, the result of inquiries and deep discussions, we intrust ourselves with the entire faith in the protection of our interests and the triumph of our just cause." Surely this should touch the heart of the most fanatical free trader.

To judge from the more recent reports on the progress of rapid transit matters in New York it would seem that the city is still a long way from the end. While the commission was at work formulating its plans and the public only knew of the scheme in a general way, the prevailing impression was that capital would become enamored of the project and that investment would follow immediately the presentation of the detailed plans. Moneyed men, however, have had a chance recently to consider the scheme in all its details, and according to the majority of opinions that have been expressed, the bidders that will appear at the New York city hall on December 29th with $1,000,000 checks will be few if any. Various reasons are given for this backwardness. It is urged, for instance, that whoever bought the franchise would need to be in close touch with the city officials, because upon their attitude toward the builders would depend millions of expense. In the moving of gas, water and sewer pipes, the accumulation of material in the thoroughfares, the shoring up or rebuilding of foundations and the like there would be a serious difference dependent upon the feeling of the department of public works toward the enterprise and its promoters. And doubtless this would be the case. There are many perhaps who would bid for the privilege of buying or operating the completed road, but the thought of placing such an amount of money virtually into the hands of the politicians has its effect upon wary capital. The suggestion is made, too, that private capital might be induced to enter the underground scheme if the ten-cent fare were allowed at first and reduced, as was the case with the elevated roads, to five cents when the property became a paying investment. This, of course, is mere street talk, but it is valuable as showing the light in which the new enterprise is generally viewed in the metropolis. It will not be known definitely before December 29th just what capitalists think about the project as an investment. It is safe to say that the syndicate which wants the big franchise, if such a syndicate exists, will just now have the most to say against the scheme. New York sees that the underground railway is the only practical solution of the vexatious rapid transit problem. It is not to be expected then that in a city where the demand for such facilities is so pronounced, and so much has been accomplished in the work of bringing about the much desired end, some way will not be found through which capital may be induced to invest.

WHAT the electrical fraternity asks at the hands of the management of the World's Fair is a definite understanding in relation to the lighting of the exposition after dark. Will the park gates be open on one, three or six nights a week? There is no one who will return a direct answer to this question. What portions of the grounds and buildings will be lighted on the nights when the public is admitted? Nobody knows. And yet it is of the greatest importance to all connected with the electric lighting industry of the World's Fair that both of these uncertainties be settled immediately.

In regard to the first the impression is general that the fair will be open on every week-day evening, but as there is no guaranty of this the electrical interests should not relax their efforts until the unofficial "Why, of course, the fair will be open evenings" is transformed into something tangible. The written rule says that the gates must close at 7 o'clock except in the case of special evening entertainments, and it has been shown that this is very distasteful and burdensome to the electrical fraternity. The rule, it now appears, was adopted by the commission at the request of the directors, and it is suggested that the idea was to close the fair at 7 o'clock and open again at 8 o'clock for an extra half-dollar from every visitor, the expectation being to hold as many of these extra evening sessions as would attract a profitable attendance, with the hope, of course, of having six every week. This theory seems to account for the vague language of the rule, but the idea will hardly meet with favor from the general public. But, whatever the decision in relation to one or two admissions on one day, the fair should be open every evening. If it is not, the national commission will confront an electrical exhibit that will be a failure compared with what is now planned.

The phase of the subject brought up by the second question is in still greater confusion. The grounds will certainly be open part of the time in the evening, but nobody can tell what portions will be effectively lighted. It is not to be presumed, of course, that each one of the 150 buildings on the ground will be brilliantly lighted every night. Nobody expects that. But will the large exhibit buildings all be lighted, or only those that would be particularly attractive at night, like the electricity, horticultural and fisheries buildings? Will the Midway Plaisance, with its popular attractions, be lighted? Will the exhibits in the great manufactures building be lighted, or will general illumination only be provided in this building, so that it could afford a shelter to the people in case of a sudden storm? And how about the state and foreign buildings in the northern end of the park? These are some of the considerations that should have been settled months ago, but nobody knows what will done.

The electrical industries of the United States have a right to demand that these two questions be promptly and decisively disposed of.

ANOTHER victory for the electric railway has been recorded. This time the companies operating steam interurban lines between St. Paul and Minneapolis have been obliged to acknowledge the supremacy of the trolley and the inability of steam to compete with it in such service. When the electric road between the Twin Cities was projected it was believed by many that it would be operated at a loss for several years, and that it could not hope to compete with the steam lines, as it was supposed it would not offer anything like the service which the established roads were giving then. Much was heard in those days about the "unreliability" of the proposed method of propulsion; the dangers attending the employment of electricity were grossly exaggerated, and the old story about discontinuing the service during the stormy winter months was related by opponents of the proposed improvement. The advocates of the project were not dismayed by such tales and predictions, however—they were determined to give the electric railway a trial. A franchise was secured, consents from property owners followed, and soon an electric road was in operation between the Twin Cities. The people readily perceived the advantages of the new system. Cheap fares were adopted from the beginning, and passengers were supplied with transfers—another point in favor of the new line. Managers of steam lines expressed the belief that when the novelty wore off the people would desert the electric cars and the steam roads would once more receive the great bulk of the traffic. They were doomed to disappointment, for the popularity of the electric line grew daily, and the old railroad companies, finding it unprofitable to drag empty cars back and forth between the cities, began pulling off trains. This was continued until, at last, the short line service has been entirely discontinued. The only trains between the Twin Cities now are the regular through trains, and these of course carry very few interurban passengers. In the meantime the electric company has continued to improve its service with the increase of patronage, and now the company is making arrangements to put in another line. This is found necessary at this time by reason of the fact that there are many suburban points without proper transportation facilities since the steam lines discontinued their interurban service. The present electric line does not touch these points, but branches will be built in some instances and independent lines in others, it is believed, and it is hoped by spring that a complete electric suburban service will be ready. Throughout the war between the steam and electric roads, the latter had a decided advantage. The old road had compelled the people to pay exorbitant fares, and the electric line established a popular fare. Then, again, instead of being crippled by snowstorms the electric company kept its line operating throughout the winter and had its cars running on schedule time when the steam lines were blockaded. On the whole the electric line provided vastly superior service to that of the steam lines and deserved the victory it achieved.

Electricity at the World's Fair.

In New York there is a newspaper man who writes letters to the *Chicago Tribune* over the signature, "H. Allaway." It pleases this gentleman to bestow considerable of his attention upon electrical subjects, and, although he often displays amusing ignorance in this direction, he not infrequently gets hold of interesting items of news. In a recent letter, for instance, he says:

I hear that bad blood is brewing touching the World's Fair contract which was awarded to the Westinghouse company. The Edison crowd seems to be trying to get even by trotting out a specious scheme intended to embarrass the Westinghouse rather than to be valuable to anybody. It is proposed by these amiable schemers to impose an arc light system upon some parts of the exposition—the arc light with its dangerous current playing tag with death and destruction round among exhibits and exhibitors.

Inasmuch as it has always been the intention to light the grounds almost entirely and the buildings very largely by arc lamps, it is now rather late in the day to talk of the "imposition" of arc lights on "some parts" of the exposition. The conductors will all be underground, and the installation is being carefully made by competent engineers. Of course the talk about the "dangerous current playing tag with death and destruction" is simply nonsense. However, it must be admitted that there seems to be some foundation for the item in the widely extended belief that the exposition authorities propose to substitute arc for incandescent lighting in many localities originally planned for the latter. No specific instances of this intention are given, but as the idea is so widespread it is fair to mention it. The management should be careful to give both systems a fair chance, not attempting to make one do what the other can accomplish better. The fields of arc and incandescent lighting to best advantage are quite distinct and can be easily observed. Let both have fair play.

The inexplicable and costly delay in the work of completing machinery hall has several times been commented upon in this paper. Referring to this subject, the *Chicago Tribune* of recent issue well says:

Delay in the work of completing the machinery building at the World's Fair is becoming a matter of serious moment if the opinions of those who have made a comparative study of the progress on other buildings and the lack of advancement on machinery hall may be relied upon. This building is the one in which will be located the power, heating and lighting machinery of the exposition. At present it is the farthest behind and the opinion is expressed that unless Mr. Burnham hastens the work more in future than he has hitherto the power, light and heating system of the exposition will be far from completed when the fair opens next May. The contractor stipulated when he was awarded the building to have it completed by the first day of last June. Notwithstanding this he hasn't even finished the roof on the structure. Engines and boilers are running in the rain, and a force of men is necessary to keep the still machinery from rusting. Every shower that comes along floods the power plant, and great expense is contracted in keeping machinery in order. Steam coils have been laid in order to keep warm the broken stone which forms a part of the concrete foundations. In the foundations for the heavy machinery there will be train loads of this stone, and the expense of artificially warming it will be considerable. It has to be borne, however, to prevent the concrete mixture freezing before it can be placed. Then another danger arises. It is said that if the place where this important work is going on is not shortly roofed over the ground under the foundations will freeze, and so injure them as to render it necessary to build new ones. Meanwhile massive engines are being installed on these same foundations.

The foundations alluded to are mostly those for the engines and dynamos of the electric lighting and power station. Another structure which has been greatly and unnecessarily delayed is the electricity building. It is now almost completed, although a mass of hideous scaffolding still disfigures the southern end. It was to have been finished by July 1st.

Work has been begun on the excavations for the electric fountains in front of the administration building.

A large part of the elevated structure for the intramural electric railway is now up. One loop has been completed, and work is now being prosecuted on the other. The uprights are of timber, but the girders are iron. A few of the latter have already been placed in position.

A serious accident occurred on Friday of last week, by which William J. Reilly, assistant superintendent of the Westinghouse installation, may be laid up for some time. Mr. Reilly had left the office to drive in the direction of machinery hall, using a horse belonging to Superintendent Keller and which Mr. Reilly had often driven. The animal was attached to a two wheeled sulky, and for some cause became unmanageable, throwing Mr. Reilly to the ground squarely on his back. Picking himself up, Mr. Reilly went back to the office and did not seem to be seriously injured. Shortly afterward, however, he began to talk at random, and was removed to his home, where a physician discovered that the spine had been injured. Mr. Reilly has since been delirious, and the injury may prove a very serious one, although it is impossible to predict the outcome at present.

It has been decided to abandon the elevated railway structure for stringing arc and incandescent conductors, although the telephone, telegraph and power cables will be supported on it, as originally intended. The trunk lighting mains that were to go on the railway will be laid in thirty pump-log ducts, which will extend north from the machinery annex to the transportation building, thence west to the fence on Stony Island avenue and north to the end of the park. These wires will supply current for lighting the transportation, service, photographic, horticultural, woman's, art and state buildings, as well as for the Midway Plaisance. Some 250,000 feet of pump-log has been ordered for these ducts, and 12,000 feet has already been laid. Separate systems of man-holes and hand-holes are provided for the arc and incandescent conductors.

The Japanese commissioners have announced that they will provide paper lantern shades for the incandescent lamps in the structure that their funny little countrymen are building on the northern end of the wooded island. This will make the lights in keeping with the strictly Japanese character of the building.

An isolated Thomson-Houston incandescent plant will light the battleship Illinois, the "brick steamboat," in which the government's naval exhibit will be shown.

The work of the electrical section of the department of works, which is under the general control of Frederick Sargent and the active supervision of R. H. Pierce, has been subdivided into several departments by Mr. Pierce for more effective work. Mr. Neiler is the second assistant electrical engineer, and the other members of the staff are:

Engineers—Arc lighting, Geo. B Foster; incandescent lighting, Mr. Lounsbury; power, Mr. Boggs; subways, Mr. Gaylord.

Heads of departments—Inspector, Prof. Dodge; superintendent of construction, L. A. Scovil; superintendent of operation, J. H. R. Ward; head draughtsman, Mr. Mayer.

Among the errors noticeable in the names on the frieze of the electricity building are "Orested" for "Oersted," and "Sommering" instead of "Sömmering." Chief Barrett should see that these mistakes are rectified.

French Electrical Manufacturers and the Tariff.

The French electrical manufacturers are up in arms against a proposed reduction in the tariff on Swiss electrical apparatus. In reading over their recent protest addressed to the national legislative body one runs across many an old friend in the shape of an argument in favor of the "protection of home industries." The reductions contemplated in the proposed agreement involve practically "the ruin of the electrical industry in France," at least the protest so reads. When the tariff bill of 1889 was arranged by the government the electrical interests were wholly omitted, although, as the protest asserts, there are 4,000 workmen employed in the industry, and the annual output is valued at 30,000,000 francs. Influenced by the protest of manufacturers the legislative body subsequently imposed a series of tariffs "to protect our manufactures against foreign competition." It is further remarked that at the present time "Switzerland of all countries in Europe has the most flourishing electrical industries, and their competition in our market is the most dangerous to French manufacturers." Again the protest says: "At the very moment when the lot of the workingmen and the improvement in their condition are matters for the constant consideration of parliament, the stroke of the pen of the minister of commerce condemns 4,000 of them to idleness or to misery by granting this astounding premium to goods manufactured on the other side of the frontier. * * * We have been able to procure a schedule of the wages paid in the most important Swiss electrical manufactory, the Oerlikon works. * * * It is obvious from comparison that the workman here is paid almost twice as much as in Switzerland." After much detailed argument against the new arrangement the protest concludes as follows: "We have presented in this note only the principal arguments which have inspired this protest against the Franco-Swiss agreement. These arguments, these figures that support them, we would have gladly furnished to the minister of commerce if he had been willing to consult the authorized representatives of an industry before sacrificing it. He has not thought he should do so. To your sentiments of impartiality, of which you gave so striking an example at the time of the discussion of the tariff duties, to the recollection of your former decisions, the results of inquiries and deep discussions, we intrust ourselves with entire faith in the protection of our interests and the triumph of our just cause."

Extending Chicago's City Lighting Plant.

The ordinance for an extension of the municipal electric lighting system now pending in the Chicago city council provides that hereafter all local improvements "for furnishing electric light for municipal purposes," except "cost of power houses, real estate for power houses and necessary machinery," shall be "paid for by special assessment levied upon the property benefited." The real estate, power houses and machinery will be paid for as heretofore by general taxation. There has been much objection to this ordinance, and at the last meeting of the council, after prolonged debate, it was referred to the finance committee for further consideration. An amendment has been introduced providing that as soon as possible the city of Chicago shall furnish electric light to private persons located on streets where the city electric light lamps are placed, upon the payment of a price to be fixed by the council.

The Electrical Habits of Iron.

It is strange how little is known about the loss of power in iron under reversals of magnetization. It has been known for many years that energy was lost when iron was magnetized and demagnetized, but, says London *Industries*, the builders of dynamos had no clear idea on the subject. Seven years ago Professor Ewing and Dr. Hopkinson called attention to the loss of energy by hysteresis, apart from Foucault currents; but since then no information of any practical importance has been added. It seems as if everything connected with alternating currents is doomed to go through a period of barren quasi-scientific treatment before being studied and utilized by electrical engineers. The quasi-scientific method of treating iron is to take curves with a ballistic galvanometer. This is a cumbrous method, and does not give the information required. The engineer really wants to know what kind of iron gives least loss by hysteresis, what maximum induction does it pay best to employ, and how much energy is wasted per cubic centimeter per cycle. To test a given sample the obvious way is to make a little choking coil of it, and to measure the power lost by means of a wattmeter. This gives the information at once as regards that sample. If readings are taken at different electromotive forces, the losses at different inductions are obtained. The ballistic galvanometer method is merely an indirect and perhaps inaccurate way of arriving at the same result. Finding the qualities of different samples is a very small matter. The chief difficulty is to find good qualities of iron at reasonable prices, and what is wanted is the knowledge of the causes that go to make iron and mild steel good or bad. Makers of iron do not generally know anything about hysteresis, and electricians know little about iron, but it is no use shirking the subject and reading papers to scientific societies about curves belonging to specimens obtained at random from unknown sources. Reams of paper have been covered with researches on curves of random samples, and they are absolutely useless. They may be of scientific interest; if so, well and good, but they are generally supposed to be for the benefit of the benighted and ungrateful practical man. So far all the information the dynamo maker has is that soft iron has comparatively little loss by hysteresis, and he pins his faith on some particular merchant who supplies him with a metal which he calls "best Swedish charcoal iron," but which is not generally labeled "Made in Sweden."

A few investigators have given the analyses of their samples; but we do not know whether the percentage of carbon is the salient quality, or whether minute traces of other substances increase or decrease the loss of power. Neither do we know how the treatment of the iron in rolling and annealing affects the magnetic properties. If investigators could only be induced to consider what practical people want to know, instead of what "looks deep in print," some useful information might be obtained.

Women Toot Horns for an Electric Railway.

The western suburbs of Cincinnati, Price Hill, the two Fairmounts, Westwood, and some others have been at a great disadvantage in the matter of street car service. Recently a betterment of the situation has been agitated and much feeling has been stirred up. This feeling has been intensified by the offer of a Cleveland company, headed by Al Johnson, to build an electric line to these suburbs, and the bitter opposition of the home company. Several ordinances were tied up in the hands of the Board of Affairs, which legislates on all such matters. A few days ago the rooms of the Board of Administration presented a novel appearance, for there was present a delegation of about 200 women. They represented the citizens of North Fairmount, and came to urge some action in the matter of rapid transit to that suburb. After they had explained the object of their visit, which was to request that the pending ordinance be immediately passed, President Herrmann explained that the board had the matter under consideration, would decide on it this afternoon and report to-morrow morning, and that there would be no need of the women staying any longer. The women had come to stay, however. Then President Herrmann again explained and said the Cincinnati company had agreed to an amendment to the ordinance and it would be acted upon to-morrow. This explanation was too complicated for the women and they started on a new tack. Every woman produced a tin horn and in a moment the

room was a tempest of noises. The women marched and counter marched. They circulated among the desks and surrounded each particular member. At last the leaders were made to understand the situation and drew off their forces, promising to call again.

Oil Versus Air as an Insulating Medium.[1]

By James Bowstead Williams, M. D.

Part II.

It was first ascertained, by testing, that the quadrants used and the disks were absolutely insulated. Each separate experiment is designated by a number.

1. Paraffin oil was then poured into the cup and the disks separated one-ninth of an inch. The discharge key was not used in these tests in order to save time, a wire fastened to the gas pipe being used to ground the lower disk. The connections were properly made and the quadrants fully charged. As soon as the image of the cross-wire had become stationary, the electrode of the lower disk was touched with the ground wire. The image immediately flew down the scale, apparently as fast as if the upper disk had been touched with the ground wire. That this sudden flight of the image was not due to the "drop" —*i. e.*, to absorption of the charge or the sudden rush of the electricity into the oil and not through it—was proven by repeatedly charging the quadrates and then discharging them through the oil. In fact, the amount of leakage was so great that while the lower disk was kept grounded, the quadrants could not be charged.

If leakage through a very thin layer of any good dielectric be not too excessive, the quadrants can always be recharged, wholly or in part, even while the leakage is going on; but, in this case, the leakage was too great even when sparks were rapidly poured into the quadrants.

2. The disks were next separated one-fourth of an inch but no better results were obtained than at first.

It is evident that there must have been less leakage through a layer one-fourth of an inch thick than through one one-ninth of an inch thick. But, in both cases, the movements of the image were too rapid to be timed.

3. The cup was then emptied of the oil and a few drops introduced between the disks, and still no different results were obtained.

4. The oil was then heated to about 280° F., to expel any moisture that might be present. But this made no difference in the tests; there was still great leakage, even after the oil had cooled.

5. Resin oil was then subjected to the same tests as the paraffin oil, but no better results were obtained from it than from the paraffin oil.

6. All oil was removed from the disks and a layer of air one-eighteenth of an inch thick tested. The drop was about five divisions, but after that the image remained stationary, thus showing that the insulation resistance of the air, at the potential used, was absolute.

7. A piece of the insulated wire before referred to, about five inches long, was connected with the quadrants and the quadrants charged. The edge of a pocket knife blade was then held transversely upon the dielectric, when the image passed rapidly down the scale. This experiment was repeated and the same result obtained. The ends were then paraffined and the specimen again tested. Result almost the same as before paraffining, thus showing that there had been some surface leakage at first.

Many of the insulated wires now in use yield the same results when tested exactly as this present sample was tested. But there are also many which give excellent results when thus tested, and there are a few in which there is very little leakage even when several feet are formed into a condenser and tested at this same potential.

It is important to remark that tests of different sections of the same wire, having a vulcanized dielectric, may not always give the same results. For example, a three-inch piece of a certain wire may have a very high indicated resistance, while the next three inches may have an indicated resistance much lower than that of the first. Where this is the case, it will almost always be found that the dielectric of the second sample contains some flaw, or else has particles of wood, metal, etc., embedded in the mass.

By using this method of testing, the superiority of one insulated wire over another, whenever samples a few inches long can be obtained, can easily be demonstrated. It will readily be seen that this fact may become of great importance in legal or other cases in which the comparative insulation resistance of wires is involved. Decisive results can be obtained in many cases from lengths of two or three inches only.

The second set of experiments included tests of all five oils, paraffin, wax, ordinary air, and steam. The temperature was 80 degrees F., and the humidity 75.

In the second set, the layers of oil were formed between an upper disk nine-sixteenths of an inch in diameter, and a lower disk 1¼ inches in diameter. This lower disk was the flat bottom of a tin box. Its sides were covered with a thick layer of paraffin wax, so that no leakage could take place except through the layers of oil. The disks were mounted the same as the larger disks, and were absolutely insulated from each other and from earth.

1. Paraffin oil was first tested in a layer ¼ of an inch thick, but the falling of the image was too rapid to be accurately noted. A layer ½ of an inch thick was then tested and gave a fall of 207 divisions in one minute.

2. Rosin oil tested in a layer ¼ of an inch thick gave a little better result than the paraffin oil; but when a layer ½ inch thick was tested, the fall was 177 divisions in one minute.

In these two tests of the two oils all effects due to the drop were eliminated by repeated chargings, so that the fall due to leakage alone was noted.

3. Linseed, cotton-seed and castor oils were each tested in ½ inch layers, but as the fall of potential was so much greater than that of the other two oils no further tests were made of them.

Of the three, castor oil had the lowest specific resistance; and there was but little difference between the linseed and cotton seed oils, what little difference there was being in favor of linseed oil.

4. A layer of paraffin one-sixteenth of an inch thick and free from air bubbles was next formed between two tin disks, each 1⅝ inches in diameter, and tested like the layers of oils. When the ground circuit was closed the drop was just 5 divisions. The quadrants were again fully charged, and the falling of the image noted. This fall was one division in two minutes, or 30 divisions in one hour.

5. A brass tube 10 inches long and five-sixteenths of an inch in diameter was next used for a receptacle for oil. In the center of this tube was a straight copper wire one-sixteenth of an inch in diameter, the wire being kept concentric with the tube by means of two hard rubber plugs with holes through their centers. The tube contained rosin oil. The wire was connected with the quadrants, and the tube absolutely insulated from the earth and neighboring objects.

The quadrants were then charged and the tube grounded. The image passed down the scale too rapidly to have its rate of falling timed. The hard rubber plugs were carefully paraffined so that all of the leakage took place inside the tube.

A torrent of sparks was poured into the electrometer, but it could not be charged on account of the rapid leakage through the oil.

6. Three plates of glass, each 3 by 4 inches and one-eighth of an inch thick, were carefully cleaned and then dried over a lamp. Before they had cooled one was covered with a film of resin oil, one with a film of paraffin oil, each film having an area of about two square inches, and the third had a film of paraffin wax about one inch square formed on it. A No. 20 copper wire was fastened to the quadrant electrode, and its free end placed in contact with the center of the film on the glass. The glass was insulated and the quadrants charged. The image remained stationary as long as the glass was insulated, but as soon as any conducting body, the hand for instance, came in contact with any portion of the glass plate, leakage over the film of the material on the glass occurred. In each case there was a slight drop, but the quadrants were immediately recharged. The rate of falling of the image with the glass plates covered with the oils was practically the same, the fall being about 5 divisions to the second; but with the paraffin wax the image remained stationary.

Repeated charging failed to alter the rates of falling of the image.

7. The last tests were made with air and steam, and in both tests the layers were formed with the device used to ascertain the potential of the fully charged quadrants. In the first of these tests, the disks were separated a trifle more than .03 of an inch.

The drop in this test was just two divisions, but after that the image did not move in 20 minutes. The writer has made this same kind of test in former years, and has allowed the instruments to stand for hours, and yet there would be no leakage through the layer of air.

The last test was made with a layer of steam of the same thickness as the layer of air in the test just described.

The quadrants were fully charged and the ground circuit closed. Steam was then generated in a test tube and the mouth of the tube held directly beneath the disks. This enveloped the disks in steam and also formed a layer of steam between them. As soon as the layer of steam was formed, leakage took place through it, and the leakage increased as moisture was deposited upon the disks (thereby reducing the distance between them) until a bridge of water was formed, when, of course, the quadrants were immediately discharged. From many tests, the writer found that, as nearly as he could determine, the rate of fall, when the layer was composed entirely of steam, was about 20 divisions in one second.

He would state, however, that he was entirely alone during these experiments upon steam, and as his attention was necessarily divided between several parts of the apparatus, each of which required continual watching, he cannot vouch for the accuracy of these figures; but he has every reason to believe that they are approximately correct.

Several times during the tests, oil was accidentally smeared upon the surface of the paraffined hard rubber, and in every case the rubber would have to be recleaned and reparaffined before its surface insulation was restored. From a careful consideration of the foregoing tests, the results thereof appear to the writer to prove when continuous high tension currents alone are concerned:

1. That air, even when it has a humidity of 80 per cent., is infinitely superior to oil for insulating conductors carrying such currents.

2. That pure paraffin is far superior to oil, both for insulating conductors and for preventing the escape of the current across the surface of glass.

3. That air having a humidity of 80 per cent. is superior to paraffin as an insulating medium.

4. That oil will not prevent leakage of the current across the surfaces of glass.

5. That whenever oil covers the surface of hard rubber, even when the latter is paraffined, it destroys the high surface insulation of the paraffined hard rubber, that is, the low surface insulation of the oil has been substituted for the higher surface insulation of the hard rubber, when used bare and clean, or when covered with paraffin.

The writer would state that the results of the present tests, which were made in New York city, correspond substantially with the results obtained by himself and brother, R. W. Welty, while they were making the investigation of insulating material and its applications, which is now being described in the serial before referred to.

A few words relative to the use of the oils in practice may not be amiss here. To use oil for insulating conductors, there must be an enclosing vessel of iron, or its equivalent, for the oil and conductors. If long tubes are employed for the purpose, two things are indispensable—plugs in the ends of the tubes and means for keeping the wire or cable concentric with the tube, and the individual wires of a cable separated from each other. For the latter purpose, fibrous material is probably the most convenient means. Jute, when pure and dry, is an excellent fibre, both for the oils when used alone and when thickened with resins, etc., for by reason of the peculiar nature of the fibre, a larger amount of insulating material can be placed within a given space than if a closely lying vegetable fibre is used; and there will also be fewer points of contact of fibre between the wires and the inside of the tubes. Experiments made by the writer show that there is but little difference in the specific resistance of different kinds of vegetable fibre when the fibre is clean and absolutely dry. The resistance of such fibre is high as long as it remains in this condition. But it is almost impossible to keep it so. It may be a matter of surprise to many to learn that cotton which has been dried, and which therefore possesses good insulating properties, loses these properties in less than ten minutes if exposed to a damp atmosphere.

Whatever means are used for the purpose last above stated, they should have a high specific resistance and allow the use of oil as much as possible.

The plugs must be formed of insulating material which is not injuriously affected by the oils. The best hard rubber, or some special vulcanized rubber or gutta percha compound, appears to be the best for this purpose. Paraffined wood is very apt to be of little use in a short time, for no matter what kind of soft porous material is paraffined by allowing it to absorb the melted wax, the wax rarely hardens in a solid form, but usually contains numerous small spaces and these spaces absorb moisture by capillary attraction. It is for this very reason that a dielectric which is formed of fibre saturated with paraffin soon loses its high insulation when exposed to the air. The microscope will demonstrate the presence of these minute air spaces.

All oil should be carefully heated, sufficient to expel all moisture and air, before it is used. If paraffin oil is used, it is better to subject the oil to a comparatively low temperature and exhaust the air by means of a vacuum than to heat the oil to a high temperature. After the moisture has been removed, the oil must be kept excluded from the air or it will again absorb moisture.

If oil is used as a covering for insulators made of inferior glass or porcelain, to be of value it must contain no moisture or dirt; and if used in damp and dusty localities, means must be provided for the self-renewal of the oil, so that fresh surfaces of oil may constantly be exposed. But if insulators had surfaces formed of glass which contained a large proportion of pure silica, better insulation would be effected, if these surfaces were not covered with oil. The writer once found a molded glass vessel, having about the same dimensions and area as the "pony" insulators, which had a surface insulation vastly superior to that of the "pony" insulators. If insulators were made wholly or in part of such material a covering of oil would be worse than useless, for experiments have shown that when glass or other material does prevent surface leakage, covering it with oil at once ruins the high surface insulation.

Experiments made upon the expansion of paraffin and resin oils show that when paraffin oil is heated to 280 degrees F., a column of it 3⅛ inches long and three-fourths of an inch in diameter expands one-half of an inch; and that if a column of resin oil of the same dimensions is heated to the same temperature, it expands three-eighths of an inch. These facts should be taken into consideration when using these oils in pipes, for if the pipes are full and the oil gets heated, it will expand and probably either expel the plugs or exude at the ends. If it exudes, dust and moisture will collect upon the film of oil and cause surface leakage. This leakage at the ends of pipes containing telephone or telegraph wires might not be detrimental to the working of the lines, but if the pipes contained wires carrying high tension currents, serious trouble might arise.

The efficiency of oil to fill holes in dielectrics depends greatly upon circumstances. If the holes or gaps should be formed in dielectrics of wires conveying weak currents, the oil, if not too sluggish, would have plenty of time to move into and fill such spaces; but if in the dielectric of wires conveying strong currents the oil must move very quickly or a disastrous burn-out is the result. And not only this, but the oil, becoming hot, expands, and the pipes, if of lead, are apt to be strained or broken by the increased pressure from within outward. If the burn out occurs near the ends of the pipes, the plugs may be expelled. If the filling of spaces were the only thing required of the oils, the lighter ones would accomplish this purpose better than the denser ones. But the heavier oils—*e. g.*, heavy and light paraffin oils—are much better for insulating purposes than the lighter.

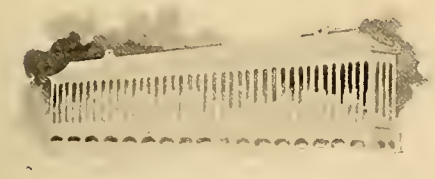
In conclusion, the writer would state that he feels warranted in believing, unless the contrary can be demonstrated, that dry air, if employed to form a portion of the dielectrics of insulated conductors, and if the conditions upon which its highest efficiency depends are fulfilled, is an insulating material superior to oil and even paraffin. In making this statement, he takes it for granted that his method of testing—a method which he does not remember ever to have seen published before his use thereof over five years ago—yields results, the accuracy of which can be relied upon. This belief has been established after several years of experimental work upon insulating materials and the manufacture of different kinds of insulated conductors. Certainly air is cheaper than any other insulating material, and it is not destroyed or injured by intense currents. Burn-outs do not affect it, and if it can be kept dry, which is the great difficulty attending its use, the conductors which it insulates will have a high insulation resistance and a low electrostatic capacity—two things which are of the greatest importance in electrical engineering.

1. Read at the general meeting of the American Institute of Electrical Engineers, Chicago, Ill., June 8, 1892.

The Carpenter Car Heater.

The illustration presented herewith represents one of a set of four Carpenter heaters. These heaters are being made by the Carpenter Electric Heating Apparatus company, of St. Paul, for the Electrical Supply company, Chicago. The construction of this heater is such that the air is brought in direct contact with the heated enamel surface, so that no time is lost waiting for a mass of auxiliary material to warm up before the heat in the car is felt.

Provision is made for a rapid circulation of the car atmosphere, and a switch is arranged for controlling the amount of current so as to obtain either of two degrees of temperature.



CARPENTER CAR HEATER.

Galvanometer and Potential Indicator.

Queen & Co., Philadelphia, are introducing a new ballistic galvanometer, shown in Fig. 1. The coil frames, two in number, are supported by polished corrugated hard-

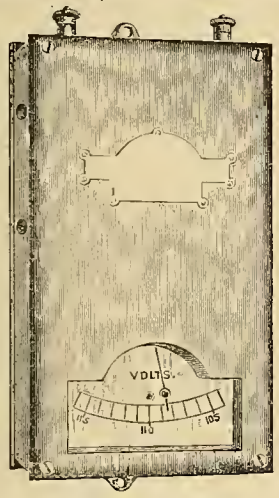


FIG. 2. GALVANOMETER AND POTENTIAL INDICATOR.

rubber pillars $2\frac{7}{16}$" high. The coils are graded, having five changes of wire, and they are arranged to be joined in series, multiple, differentially, or singly by means of the flexible cord connectors, *R*. The coil frames are also made strictly to gauge and are interchangeable. It is only necessary to loosen one screw upon each frame to remove them for others of different resistance. Both coils are hinged and may be swung open by raising the milled screw nut, *V*. Supported upon the rubber pillars are brass rods carrying the torsion head, *T*, divided into 15 degree divisions. It has a screw by which to raise or lower the system without twisting. The binding posts, *B* screw into studs attached to the coils and are thus perfectly insulated from the base. Where the posts pass through the

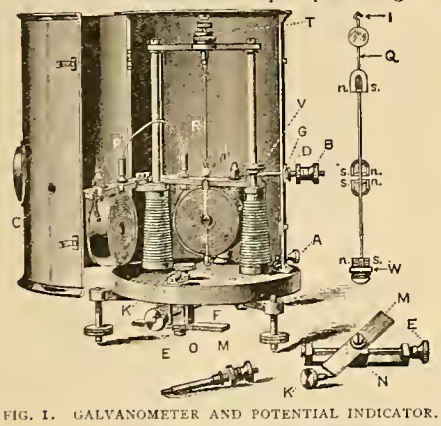


FIG. 1. GALVANOMETER AND POTENTIAL INDICATOR.

case, holes, *G*, are bored which are filled when the instrument is not in use by the rubber washers, *D*. The instrument embodies an important improvement in varying sensibility within the widest limits, without "drift." This is accomplished by altering the magnetic moment of one or more of the magnets of the system, by strengthening or weakening their fields by means of a device attached to and moving with the system itself. The system shown at the right of the figure consists of four bell magnets, the upper and lower making one set and the central pair another. If the weight is raised the lower magnet will have its lines partially short-circuited and the system will become astatic.

In Fig. 2 is shown a new potential indicator which Queen & Co. are placing on the market. This instrument is built upon the general plan of the Queen magnetic vane voltmeter, and is mounted in a handsome mahogany case with open scale divisions, so that very close readings can be made. No permanent magnets of other parts which change with age are used in its construction, so that constancy is assured. The indicators, as kept in stock, are adjusted for 110 volt circuits but special ranges will be made to order.

Starkweather's Boston Car Fender.

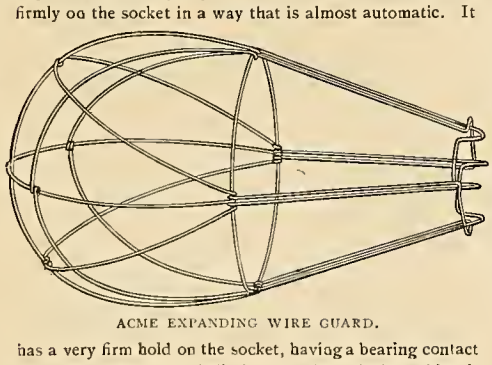
The frame of this fender, which is an invention of M. S. Starkweather of Boston, is made of two hardwood one-inch boards, bolted into iron or metal sockets. It is designed to be fastened to the underside of the platform of a car, or to the frame of the trucks in front of the wheels, so as to extend downward to within about four inches of the road bed. Referring to the accompanying illustration it will be seen that the fender proper consists of four bars or rollers carried by a center and two end castings. These three hanger castings have together a rise of three inches. The hangers are connected to the frame by bolts passing as indicated through holes in the castings and slots (not visible) in the frame casting. The bolts are fastened from the back. The end hangers ride close to the rails, and the rollers are as low, within about one inch, as the hangers,

STARKWEATHER'S BOSTON CAR FENDER.

thus rendering it practically impossible for any one to get under them; they will not rise, it is claimed, when forcing an object off the track. It should be explained that the rollers are hollow and revolve on nipples about two inches long that extend from the sides of the hangers. The nipples are small enough to allow the rollers to rise and fall at each end without a corresponding rise at the other end. The front of the fender is comparatively smooth and is free from nuts, rough bolt-heads, or sharp corners which could catch clothing or mutilate a body.

The Acme Expanding Wire Guard.

The Acme expanding wire guard, for the protection of incandescent lamps, differs from other devices in that it requires no auxiliary clips or catches, but secures itself firmly on the socket in a way that is almost automatic. It



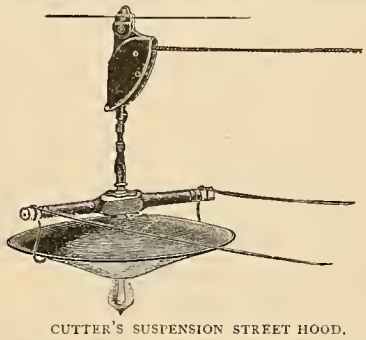
ACME EXPANDING WIRE GUARD.

has a very firm hold on the socket, having a bearing contact longitudinally on the shell of over half an inch, making it almost impossible to force it against the lamp with a blow. The guard itself is also made particularly strong and rigid. In appearance it is symmetrical, as will be seen by reference to the accompanying illustration. The Acme guard is placed on the market by the Electric Appliance company, Chicago.

The superstructure of the Toledo, O., Electric Light company's new station on Water and Locust streets has been commenced. The building is to be completed by January 1st. Probably no other building in Toledo has such a substantial foundation as this building will have. Piles are driven, two feet apart, over the entire ground. These are covered with two feet of concrete.

Cutter's Suspension Street Hood.

Street lighting with incandescent lamps is getting to be quite a common practice in all parts of the country, and in many places the lamps are hung over the center of the street. This plan is adopted on shady streets where the foliage would cut off much of the light from a lamp placed at the corner. In order to get a proper distribution of the light it is necessary to have a specially designed reflector, which can be combined with

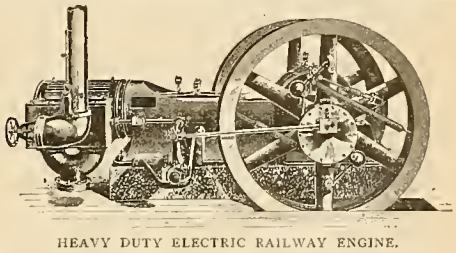


CUTTER'S SUSPENSION STREET HOOD.

the protecting hood. In many cases the hoods, hooks and pulleys used have been picked at random from the nearest stock, the result being a combination which neither looks neat nor is well adapted to the purpose. George Cutter of Chicago has arranged for this purpose the suspension street hood shown in the cut, which embodies a number of novel features. The hood is designed so as to thoroughly protect the socket from the weather, while a unique spring catch and hinge allows it to be opened when desired. The nozzle which supports the socket is arched so that it can be readily wired, and the tin parts are separable, so that they can be nested for shipment. Another feature is the method of clamping the parts of the cross arm, whereby the hood itself is insulated from the suspending cable. The pulley used with this hood is known as "Cutter's Petite," and is a small size of the lamp-supporting pulley designed for arc lamp practice, holding the hood safely, even if the hoisting rope should slip. The same suspension outfit may also be used on alternating circuits with the transformer hung just above the hood.

Heavy Duty Electric Railway Engine.

In selecting an engine for electric railway service it will be found that it should be adapted for heavy duty, varying load and long continuous runs. It should, therefore, have great weight and strength, with sufficient metal so distributed as to receive the various strains and thrusts of moving parts without deflection or vibration. The engine shown in the illustration was designed by the Ball Engine company, Erie, Pa., especially for electric railways and electric welding. The frame of the engine is massive and heavy and internally ribbed. The crank shaft is forged out of a solid steel ingot, and is of large diameter and great strength. The connecting rod and straps are forged out of steel ingots and are of a new design, combining strength with efficiency. The main bearings are unusually large, and are so arranged that both the vertical and side wear of the liners may be taken up. The main bearing



HEAVY DUTY ELECTRIC RAILWAY ENGINE.

liners are genuine babbitt, carefully scraped and fitted, and as they are made removable they can be quickly and easily taken out and replaced with new ones if necessary. The crank pin boxes are lined with genuine babbitt. The crosshead boxes are made of pure

copper and tin. The crosshead is a steel casting with very large bearing surfaces, and is babbitted on the four faces with genuine babbitt. The crosshead pin is tool steel, and the piston rod a fine quality of crucible steel. The oiling devices are of the most improved form, and all fittings are complete and of the best description. The regulation by means of the improved governor is such that the engine has shown in practice, it is claimed, perfect regulation under the conditions where the variation in load on the generator from zero to the full capacity has occurred in less than five seconds of time.

CORRESPONDENCE.

New York Notes.

NEW YORK, November 26.—From all that could be gathered during the last week one would be inclined to believe that when December 29th arrives the bidders for the Rapid Transit franchise can be easily counted. In fact there are some people who think there will be no bidders at all, and there has been no little curiosity expressed as to who will be the man that will be courageous enough to make a bid to Secretary Bushe in the City Hall rotunda and put down a cool million dollars as a forfeit in case he shall fail in any way to carry out his part of the agreement. The main points are these: It is generally agreed that it will be a difficult matter to find investors who will be satisfied to have their money locked up for at least five years and then to run the chances of getting dividends out of a road costing $100,000,000, which must carry passengers fifteen miles for five cents. Then again investors do not quite fancy the idea of having to be so dependent upon the city politicians. It seems to be the general opinion that whoever bought the franchise would need to be in close touch to the city officials, because upon their attitude toward the builders would depend millions of expense. In the moving of gas, water and sewer pipes, the accumulation of material in the thoroughfares, the shoring up or rebuilding of foundations and the like there would be a serious difference dependent upon the feeling of the Department of Public Works toward the enterprise and its promoters. So, taken all in all, the outlook is not encouraging. One gentleman who was interviewed said, "I think that we will wait until two or three receivers have been appointed. The original investors in such projects rarely get anything out. The cheapest part of the bargain, I am afraid, would be the million dollar forfeit."

Another point that has been made was in reference to the 5 cent fare. It is believed by some that the fare should be made ten cents at first. The "L" roads had that privilege and were only made to come to five cents after they had begun to be paying properties.

The Postal Telegraph-Cable company over the signature of its president has issued a circular contradicting the rumors to the effect that the Western Union Telegraph company has purchased, or would soon purchase or control, the Postal Telegraph-Cable company. A portion of the circular read as follows: "This is to assure our patrons and the public that no consolidation, purchase, or any other arrangement by which the Postal Telegraph-Cable company ceases to be an absolutely independent and competing telegraph system has been made or is contemplated. The Postal company has during the past five years had an unprecedented growth. It has pursued a business-like and straight-forward policy. It has not only greatly improved the handling of its own business, in speed, accuracy and form, but it has made it necessary for its great and only competitor, the Western Union company, to adopt similar methods in order to hold business. All this is greatly in the interest of the public, which has hitherto recognized these facts and has favored us with a liberal patronage. We are striving to retain and to increase this by the merit of our work, not by tricks in rates and rebates which mean certain ruin, and we rely upon our friends of the past, and the public in all its branches, for its continued support."

Here is a chance for the electric motor salesman. It has been agreed to operate the draw of the Madison avenue bridge by electricity. On Wednesday the Huckleberry road was given permission by the park board to run its line over the Madison avenue bridge over the Harlem river. In return for the privilege the road stipulates that it will furnish the necessary electric power to operate the draw of the bridge.

New York will have to wait a short time for its storage battery cars. The Waddell-Entz company, which has the contract for supplying these cars for the Second avenue surface line, is making reasonable progress with the work, but many details must yet be attended to before the new system can be put into operation. There will be ten new cars, and they will be put on the Harlem end of the second avenue road at the start. Along in the spring and summer of next year the horse cars on the down-down section of the line are to be withdrawn, and replaced by the electric cars. W. F. O.

New England News.

BOSTON, November 26.—The advocates of municipal ownership of electric lighting plants will soon have an opportunity to put their theories to practical test in Peabody, where the municipal electric lighting plant is ready to begin operations. It will be the first one in the state under the new law. The Citizens' Gas & Electric Light company of Wakefield has brought suit to compel the town to buy its plant according to the provisions of the new law, under which a town wishing to establish a municipal plant must buy out the one in existence if there is any. Wakefield wishes to establish a plant, but refuses to buy the old one, now operated by the Citizens' company.

A Philadelphia syndicate has purchased all the street railway lines of Worcester with one exception. The roads have a total length of twenty-eight miles. It is proposed to consolidate them.

It is reported that the Postal Telegraph company has purchased the Commercial Union company, which operates lines through New York and the West, with direct lines to Boston and the East. About a year ago the Commercial Union of New York obtained a 55 year lease of the Commercial Union of Maine and it is said that the latter company goes into the bargain.

The long distance telephone line from Bangor, Me., to Dover, N. H., has been completed.

W. I. Barker, Boston correspondent of the *Electrical Review*, dropped dead at his room in the Quincy house Wednesday evening of apoplexy. He was 43 years of age.

The Magoetic Electric Railway company has been organized in Salem to introduce E. H. Brown's system. These directors were elected: L. G. Burnham, Boston; Benjamin W. Russell, James F. Almy, Arthur L. Huntington, George W. Williams, Walter S. Dickson, Edward H. Brown, Henry W. Peabody and Joseph N. Peterson, Salem; David J. Lord, Lynn.

The Massachusetts railroad commissioners have before them a petition for the incorporation of a street railway company which wishes to operate a line of street cars in Cambridge by storage batteries. The West End company of Boston opposes the grant, and the hearing has been set down for November 28th.

Citizens of Haverhill, Mass., are earnestly discussing a project for an electric railroad from Salem depot to Haverhill, passing through Ayers village. A committee of five property holders with C. H. Tarleton, chairman, has been appointed to consult with the managers of other electric railroads concerning the propriety of extending their lines to Salem, N. H.

Electric lighting is steadily increasing in popularity throughout New England, and many isolated plants are being installed. The Bates mills of Lewiston, Me., are to be lighted by electricity, two 400 light machines furnishing the current. P. Lenox & Co., of Lynn, will use two 450 light machines in their mills. Jones & Mortimer, shoe manufacturers of Hudson, Mass., are putting in a 500 light machine. The factory of John P. Squire, pork packer, Cambridge, Mass, is to have a 1000 light Mather plant. The Coffin Valve company of Neponset, Mass., has installed a 100 light plant. D. Webster King & Co., of Boston, will use electric lights in three buildings in Fort Hill square. They have a 40 horse power generator which will operate several motors. H. A. Southwick, tanner, of Peabody, Mass., is about to contract for a 250 light machine. The Forbes Lithograph company of Boston will put in 600 lights in its buildings at Revere. A proposition has been made to establish an electric light plant in Henniker, N. H., if the town and citizens will guarantee 1000 lights at one cent an hour per light.

The New England Electric club entertained a number of prominent local electricians Tuesday night last. This was the inauguration of a series of entertainments to be held during the winter. Next Tuesday the club will have a dramatic entertainment.

The annual meeting of the Lynn and Boston railroad resulted in the election of the following named officers: Directors, Amos F. Breed, Lynn; John S. Bartlett, Lynn; Chas. H. Newhall, John H. Cunningham, Chelsea; E. Francis Oliver, Boston; E.E. Denniston, Philadelphia; John P. Ilsley, Philadelphia; Eugene Griffin, Boston; Chas. O. Billings, Boston; H. G. Nichols, Boston; H. P. Moulton, Salem; E. C. Foster, Lynn. Amos F. Breed was chosen president; E. Francis Oliver, vice-president and clerk, Chas. Williams, treasurer. The offices have been moved from Boston to 333 Union street, Lynn. The directors were authorized to petition the railroad commissioners for permission to increase the capital stock by an amount not exceeding one million dollars, in addition to the amount already authorized. They were also authorized to petition for permission to issue a consolidated mortgage on the property of the company to secure bonds to the amount of $3,000,000 to run 20 years and bear interest at the rate of 5 per cent.

The Worcester & Millbury Street Railway company has begun running cars. The road begins at Main street, in Worcester, and extends 7½ miles through Millbury. The company owns eight box cars nineteen feet long, which are heated and lighted by electricity. It also has fifty passenger cars and two snow plows, all built by the Newburyport Car company. These cars are all equipped with 25 horse power Thomson-Houston motors. The power plant consists of four 135 horse power Thomson-Houston generators and two 250 horse power compound condensing engines built after a special design for railroad work. They have a ten and a half inch shaft, 24 inch bearings and all other parts are made especially strong. There are three 125 horse-power high pressure steam boilers. The power station is built of brick, 100 feet by 60 feet, and has one story and a heavy roof. The company has taken for its site the old Berlin mills property, which includes 45 acres of land and ample water power. The capital is $150,000. Hon. Samuel Winslow, ex-mayor of Worcester, is the president of the company.

Practical talks for workingmen on electricity are being given in the Lowell course, Boston, this winter. These are free and arranged both for beginners and advanced students. Practical experiments accompany them.

Manager Smith of the Springfield street railway says the people of that city are almost unanimously in favor of the trolley system. The road has been running for some time now and its advantages over the old system are fully appreciated. The only fault found is that the line is not long enough, and extensions are asked. Nearly every part of Springfield is now reached and Chicopee and Indian Orchard accommodated by separate lines. The cars are all heated by electricity. J. C. E.

Northwestern Notations.

MINNEAPOLIS, November 26.—There are now 2,050 telephones in use in Minneapolis, an increase of 100 during the year. The Northwestern people have had a busy season of it making extensions. About $25,000 has been expended. A line has just been completed to Shakopee, a distance of twenty-two miles; another was built from Minneapolis to Anoka, eighteen miles; another to Excelsior, twenty miles; one from St. Paul to Stillwater, twenty miles; St. Paul to Faribault, sixty miles; St. Paul to Hastings, twenty-two miles. Next year the company will extend the Anoka line to St. Cloud, sixty miles; the Hastings line to Winona, eighty-five miles; the Shakopee line to Mankato, sixty miles. Hudson, Wis., Jordan and Chaska Minn., are calling loudly for telephone connections with Minneapolis. The longest speaking distance in the state is 120 miles —to Mankato via Northfield, Faribault and Waterville.

Speaking of the plan of running a telephone central office without young lady operators, Manager J. W. Christie, of the Northwestern Telephone exchange says: "It seems to me too complex and cumbersome for a large exchange. I should want to see and know of its practical operation first. In our office we have 1,900 wires going to all parts of the city, and under the new system there would have to be three times as many."

At Dillon, Mont., the Northwest General Electric company has purchased a site for an electric light plant. The franchise called for the completion of the work by December 10th. The company thinks a twenty-day extension will enable it to complete the work.

The new electric light plant at Mitchell, S. D., is practically completed.

The Western Union Telegraph company has contracted with the Yankton & Norfolk railway for the construction of a line. It will probably get the contract for a telegraph line along the Sioux Falls & Yankton road, now being graded.

The telegraph offices and newspaper men of the two cities were greatly bothered by last week's big storm, although there were no visible signs of atmospheric disturbances.

The new electric line to St. Louis Park is nearly ready for operation. Three cars will be run, giving twenty-five minute service.

Local capitalists are talking of utilizing some extensive peat beds near St. Louis Park for making fuel to be used in running elaborate electric power plants.

At New Richmond, Wis., failure of the poles to arrive postponed work on the electric light equipment till after the freeze up.

Chris Gorder, of Oakes, N. D., has been in Minneapolis

investigating the electric light business. He proposes putting in a plant at Oakes.

Charles Fiedel, employed at the St. Paul Electric Light works was instantly killed by getting caught in the belting

The Saperior, Wis., Rapid Transit company distinguished itself by keeping its tracks clear and cars running all day during a recent heavy storm.

A new engine and boiler have been added to the electric light plant at Hastings, Minn. H. C. C.

PERSONAL.

W. C. Clarke, general agent and assistant treasurer of the Westinghouse Electric & Manufacturing company, Pittsburg, Pa., was in Chicago for a few days last week.

Alexander Dusenbury has been appointed general manager of the Wilder Duplex Electric Burglar Alarm & Messenger company of New York to fill the position held by A. M. Sloss, who recently resigned.

W. E. Moore, who, since the consolidation of the Thomson-Houston and Edison companies, has been manager of the supply department of the western district of the General Electric company, and who was formerly head of the supply department of the Edison General company for the district controlled by the Chicago office, has been compelled permanently to leave Chicago on account of ill health, and will take up his residence in El Paso, Texas. Mr. Moore had seriously considered going south a year ago, but was induced to remain in the hope that the climate of Chicago would not prove too severe for him. All who know Mr. Moore personally will share the general regret that his health has compelled him to leave Chicago. Mr. Moore leaves a host of friends among the electrical fraternity in Chicago, and all unite in the wish that he may find the relief that the balmier air of the South can offer. He will be succeeded by William F. Brewster, who was early identified with the original Edison interests and who later has been active in the railway department of the Edison General and General Electric companies.

NEW INCORPORATIONS.

Lexington Light & Power company, Lexington, Va.; capital stock, $50,000; electric plants and power.

New Pedrara Onyx company, Alexandria, Va.; capital stock, $1,000,000; telegraph and electric plants, etc.

New York Development & Manufacturing company, New York, N Y.; capital stock, $20,000; to manufacture and sell electrical apparatus.

Kennedy Electric company, Chicago, Ill.; capital stock, $100,000; to manufacture and sell devices and appliances used in electrical locomotion; Evans & Arnd, 95 Dearborn street, Chicago, Ill.

F. P. Little Electrical Construction & Supply company, Buffalo, N. Y.; capital stock, $100,000; the manufacture, purchase and sale of electrical machinery, construction of electrical work.

Electric Railway & Improvement company of Staten Island, Jersey City, N. J.; capital stock, $200,000; to purchase, own and operate electric light, heat and power works, etc.; Lowthorp & Oliphant, Trenton, N. J.

Elberton Improvement company, Elberton, Wash.; capital stock, $6,000; to construct, operate and control water works, street railways and electric light plants and deal in and improve real estate; Anderson Wait, Elberton, Wash.

Kirkwood, Webster & St. Louis Railroad company, Kirkwood, Mo ; capital stock, $2,500; to construct a railroad from St. Louis to Kirkwood, to be operated by electricity or horse power; Geo. W. Taussig, Laclede building, St. Louis, Mo.

Martinsburg Electric Light & Power company, Martinsburg, W. Va.; capital stock, $50,000; constructing and maintaining electric plants and lines, to furnish light, heat and power to the inhabitants of Martinsburg and all things pertaining thereto; Arian C. Nadenbusch, Martinsburg, W. Va.

Pacific Bear Electric & Power company, Los Angeles, Cal.; capital stock, $1,000,000, to acquire exclusive right of patents owned by Bear Electric company and Columbian Light, Heat & Power company of Chicago; to manufacture, sell and lease apparatus, and deal in and distribute light, heat and power, construct and operate railways, etc.; A. M. Stephens, Los Angeles, Cal.

ELECTRIC LIGHTING.

The Electric Construction company of New York may build an electric light plant at Glasgow, Ky.

John S. Ham is endeavoring to organize a stock company to erect an electric light plant at Covington, Va.

Electric lighting is to be adopted in the carriages on the Berlin Metropolitan railway. The carriages are at present illuminated by oil gas on the Pintsch system.

An ordinance is pending in the city council of Dennison, Texas, binding the city to a contract with the Light & Power company for 40 arc lamps at $12 per light per month for ten years.

The city of Anderson, Ind., is preparing to build a $35,000 electric light plant. Specifications have been submitted to the city council, and the intention is to proceed at once with the work.

In Chicago the residents of the west side complain that the city does not furnish them with enough arc lights. At present the west side has 337 lights; south side, 335; north side, 278. Extensions now in progress, however, will give the west side 393 lights.

A report by Herr Cuno states that Berlin is now lighted by 2,916 electric arc lamps and 67,459 incandescent lamps. In addition to these there are 253 private installations—170 driven by steam and 83 by gas, which supply 3,287 arc lamps and 40,801 incandescent lamps.

J. Frank Morrison is interested in a project to organize the General Electric company of Baltimore. The proposed capital is $2,000,000. A reorganization of the Maryland Electric company would be secured, and it would be consolidated with the new concern.

The Rock Island, Ill., Brush Electric Light company has purchased the Rock Island gas works, the entire plant passing into the Brush company's possession for a consideration of $75,000, and that company will operate it in the future. The ultimate end of the transaction will be the consolidation of the Brush and gas illuminating plants in Rock Island.

The Cincinnati & Suburban Electric Light company has entered suit against the city of Newport, Ky., for $14,000, that being the amount said to be due it for light furnished the city from July 1, 1891, up to the present date. The case will be heard at the next term of the circuit court at Alexandria. The bills for each month were rendered to the city council, and each time the bills were referred to a committee, where they were pigeon-holed. The present suit was expected, as litigation alone will settle the right of the electric company or the gas company to furnish the light.

The Winona, Minn., Heat, Light & Power company and the Winona City Railway company, both of which are under the control of the Northwest Electric company, have completed plans for their new buildings. The street car storage shed will have a frontage of 50 feet on Johnson street and will run back 120 feet. The cars will be run into the building from the front end on Johnson street. The south end east walls of the present electric light building will be torn down and the building enlarged so as to occupy the rest of the two lots not taken up by the car sheds. It will be 120 by 140 feet in size. Both buildings will be of brick, with metal roofs, so that they will be fireproof. These improvements will be begun early in the spring.

ELECTRIC RAILWAYS.

The city council has granted a franchise to J. M. Gardiner for a complete street railway system at Portland, Ind.

An underground electric railway is proposed to connect the Leopold district in Brussels, Belgium, with the exchange.

The Key West, Fla., street railway has, it is stated, been purchased by capitalists who will operate the road by electricity.

The South Chicago City Railway company will begin at once the extension of its tracks on Seventy-ninth street and Stony Island avenue.

An electric road five miles in length is to be built from the Cottage Hill cemetery at Brazil, Ind., to Harmon, with branches to the Vandalia depot.

A company has been organized to construct and operate an electric line in Lancaster, O. A power house is to be erected and six miles of road built at once.

J. C. Chaffer, representing a syndicate, has purchased the lines of the Citizens' Street Railroad company, at Indianapolis, which embraces 25 miles of electric road.

The California Electric Railway company has been incorporated and will build a line from Stockton to Woodbridge and from Lodi to Wallace. The main line and branches will be 32 miles in length.

Several business men of Rochester, N. Y., have formed a company to construct and operate an electric street railway to Summerville, Windsor Beach, Sea Breeze and Glen Haven, which are neighboring summer resorts.

Herr Kostler recently read a paper before the Society of Austrian Engineers and Architects on a proposed electric railway for rapid communication between Vienna and Budapest. According to the scheme a speed of 125 miles per hour would be attained, thus reducing the journey between the two capitals from five hours to one hour and a half.

TELEPHONE.

The length of the wires used by the various telephone systems in Switzerland is given as 13,340 miles.

The new telephone exchange building in Paris is now completed, and the work of installing the instruments is in progress.

The worth of the telephonic communication, which was established some time ago between the different life-saving stations along the coast of England, was well proved during the recent storm. At Brancaster the lifeboat was called out by a telephone message from the coast guard at Thornham and saved five lives. At Hunstanton the lifeboat crew was promptly assembled in response to a telephonic message, but the necessary assistance was given by another boat; while at Winterton the telephone was successfully used to secure the services of a tug from Yarmouth to tow out the lifeboat to assist a wreck on the Happisburgh Sands.

TELEGRAPH.

It is reported that the Postal Telegraph company has purchased the Commercial Telegraph company's property. The two companies have been practically one for some time. The Commercial company operates mostly in the New England states. The Postal company claims to have 3,000 offices and 125,000 miles of line exclusive of its late purchase.

It has been the custom for a long time for business houses to send telegraphic messages in cipher to their traveling agents and vice versa. The telegraph companies charged one cent a word, the same rate as exacted for ordinary messages. The enterprising drummer soon hit upon a scheme to beat the telegraph company. He arranged a cipher code in which several words would be run into one, very often sending an entire message in one word, or, at any rate, sending ten times as much matter in a message as was really paid for. The telegraph companies stood it as long as they could, but when the Chicago dressed beef concerns, with 400 agents in all parts of the country, began sending messages in words of twelve and fifteen letters, beside which Hebrew or Russian would be intelligent, the patience of the telegraph managers gave out. The new cipher rule adopted by the Western Union and Postal Telegraph companies provides that all words not found in the English dictionaries will be reckoned by the letter, allowing three letters to a word. Thus an unintelligible word of eleven letters will be charged as four words, instead of one as formerly.

MISCELLANEOUS.

The General Electric company gave each of its married employes of the western department a turkey for Thanksgiving day.

The stock of the Allen-Hussey company, manufacturers of annunciators, electric bells, etc., at 211 and 213 Randolph street, Chicago, was slightly damaged by fire on November 23d.

The Compagnie de l'Industrie Electrique of Paris has the contract for a plant to utilize available water power at Frinvilliers (Jura Bernois), and to transmit the same electrically a distance of about 17 miles.

Captain Alexander Johnston of Washington, D. C., has invented an electrical invalid chair, a model of which is now running in Baltimore. The chair is mounted upon a case which contains the motor and storage cells. The guiding apparatus is like that of an ordinary low-seated tricycle, and at one side of the seat is a lever connected with a resistance box for controlling the motor. At the other side of the chair is the brake handle, which is an ordinary lever friction brake. The motor is wound for a low electromotive force, and is of the slow speed design, connected to the driving shaft by a single reduction gearing. Captain Johnston gives the following details of the chair: "Five and one-half ampere hours to each pound of weight. Speed, eight miles an hour for five hours, though at lower speed battery will last for fifty miles of travel. Total weight, 150 pounds."

TRADE NEWS.

The American Electrical Works, Providence, R. I., are still running day and night as they have been doing since last April.

George Cutter has been appointed western agent for Pass & Seymour of Syracuse, N. Y., and will carry a stock of their China goods at Chicago.

W. W. Jones has opened an office at 620 Atlantic avenue, Boston. Mr. Jones will represent W. R. Fleming & Co., engineers and contractors of New York.

A. $ J. M. Anderson, Boston, Mass., manufacturers of the Æ·na insulating material, report that they have under consideration plans for increasing their output.

The Rhode Island Tool company of Providence, R. I., is making a specialty of furnishing drop forgings to order and also square and hexagon nuts for street railway work,

The Whitney Electrical Instrument company, of Boston, is pushed to fill its orders for ammeters and voltmeters. One order for twenty-six large ammeters was recently received from Chicago.

The Central Electric company, Chicago, has just taken the agency for a combination tin shade, both flat and cone shaped. These shades were devised by F. H Soden, and will be known as the Central combination shades.

A. C. Tibbe is installing an arc and incandescent plant at Washington, Mo., for street and commercial lighting. On November 22d a popular vote was taken on a proposition to grant Mr. Tibbe a 20 year franchise, resulting in his favor by the overwhelming majority of 459 to 14.

C. S. Knowles, of Boston, Mass., is having an unusually large demand for the new armature paper which he recently offered for sale. Duplicate orders have been received from many manufacturers of electrical apparatus. Mr. Knowles is now making a specialty of press board paper of superior quality.

The Bay State Belting company, of Boston, Mass., is sending to the trade a very neat pamphlet, giving a detailed description of its new brand of Indian tanned belting. This company has several orders where high speed is required, a number being for cone belts. A special feature of this belting is that it is well adapted to run in damp places.

The Sawtell company, of Boston, is offering to the trade a new incandescent lamp known as the "Diamond S" lamp. The company recommend this lamp as one that has an unusual brilliancy and gives a pure white light. It is warranted not to blacken, and is made for all voltages and candle powers. The company is also prepared to furnish colored lamps in any quantity.

The Enterprise Electric company, lately at 315 Dearborn street, Chicago, has moved to 307 Dearborn street where it will be better able to handle its large trade.

It occupies the entire main floor and basement of the new store, which is 25x150 feet. The increasing demand for the specialties handled by the Enterprise company made this change of location necessary.

The Brown & Sharpe Manufacturing company, of Providence, R. I., is offering an extensive line of gauges, which are warranted to be absolutely accurate and suited to the needs of electricians desiring something which they can depend upon. This firm recently placed a number of its planers and other machine tools in the factories of several of the leading electrical concerns in the East.

W. R. Brixey, manufacturer of the famous kerite insulated wires and cable, of which F. W. Cushing is general western agent, is adding to his already large factory two extensive buildings, one 120x43 feet and one 60x45 feet. He is also putting in a new Abendroth & Root water tube boiler of 155 horse power, a Green horizontal engine of 125 horse power, and has just had constructed a 400 Edison electric light plant.

The Davis Electrical Works, of Springfield, Mass., is the name of a new concern which has entered the electrical field to make a specialty of renewing incandescent lamps After many careful experiments, extending over a year, the Davis works are in a position to make guarantees for this business. It is claimed that the renewed lamps will be found to be equal to any lamp now on the market, and sample orders are solicited.

Superintendent G. Wilfred Pearce, of the New Jersey Lamp and Bronze Works, New Brunswick, N. J., reports that he is compelled to run the factory overtime to meet the increase of trade. This firm recently made arrangements with Andreas Makart, Henry Belcher and Prof. C. McK. Smith, artists of national reputation, for ornamental designs of electrical fixtures. It has now several very large orders for public buildings.

The Gould Packing Company, of East Cambridge, Mass., is busy filling orders, a number of which have been received from the Pacific coast. This firm makes an unusual guarantee, allowing thirty days' trial, after which, if the goods are not satisfactory, they can be returned at the Gould company's expense. Recent improvements have been made in special adjustments for high speed engines, and steam pumps for use in electrical plants.

General Manager H N. Fenner, of the New England Butt company, Providence, R. I., reports that his company was never more busy than it is at present filling orders for braiders, winders and tapping machines. There is also a very strong demand for the measuring and stranding machines for which this firm has national a reputation. This company expects to make an extensive exhibit at the World's Fair, and work on it is now under way.

The Electric Appliance company, Chicago, has been engaged for the last few weeks in rearranging and enlarging its store and office to make room for the larger working force necessary to take care of the rapidly increasing business. The demand for its numerous specialties is on the increase. The call for the new Acme wire guards has been heavy. The company is making arrangements to largely increase its manufacturing facilities.

The Bradbury-Stone Storage Battery company of Lowell, Mass., is in receipt of a very gratifying letter from L. H. Phullen, electrician of the Leetonia, Ohio, Electric Light & Power company, in relation to the successful workings of its batteries upon a yacht. This boat was run at a pleasure resort for six months, and the batteries did their work most satisfactorily, far surpassing, it is stated, anything the company expected. The yacht measures twenty-five feet over all, with a six-foot beam; it is designed to carry sixteen persons, but forty passengers have been carried on one trip The battery consisted of thirteen cells, and had a capacity of 300 ampere hours. The Bradbury-Stone company expects to have a number of yachts running which it will also equip with its batteries.

The Porter-Leavitt Electric Motor company, of Providence, R. I., is placing on the market for the Christmas novelty trade the No. 1 "P. & L." fan motor outfit and battery, which contains many advantageous features. This company has adopted the Crescent battery for use with its No. 1 motors. The zinc in this battery can be raised when not in use, so that the cell may be kept charged and used when desired. This battery may also be used for running induction coils, electro-medical instruments, and small lamps. It will, it is claimed, run the motor about twenty hours with one change of solution. These motors are finely finished in black enamel with brass trimmings, and are provided with a grooved brass pulley. Already the sale for this complete little outfit has been extraordinarily large, and keeps this company working to its fullest capacity to keep pace with orders.

BUSINESS.

The Wilder Duplex Electric Burglar Alarm & Messenger company of New York, was awarded the contract last week for the placing of 21 fire alarm boxes in Cohoes, N. Y.

The Newton Rubber company, of 116 Bedford street, Boston, has recently moved to more commodious quarters in the John Haveok building on Devonshire street. Larger office room was necessary to meet the requirements of the business.

The General Electric company announces that it has made arrangements to handle the railway line material manufactured by the Lieb Machine Works, and that all communications on this subject should hereafter be addressed to the General Electric company.

The Knapp Electrical Works' business on Safety insulated wires and lamp cord has been so large that it has become necessary to double the present capacity of the factory. They also report heavy sales on sockets, lamps, transformers and the Ries regulating socket, for which they are general agents.

The Wilder Fire & Burglar Alarm company, of Kansas City, Mo., is now located in the Burlington building, as it found it necessary to have more room. On the ground floor is located the general office for district business. Of the four rooms on the second floor, three are used for operating, while the other is used as a battery room, and one room on the third floor is used as a dormitory by the patrolmen.

The Huyett & Smith Manufacturing company of Detroit, Mich., is making a very compact ventilating fan which is driven by a directly attached electric motor. In the "Smith fan," as the outfit is called, the motor is supported by the spider of the fan, the shaft of which is extended to form the shaft of the motor, so there is but one moving part. The speed of this blower is regulated by means of a switch only, and there is no resistance box of any kind.

The New York Insulated Wire company, through Manager Geo. H. Meeker, gives the Sperry Electric Mining Machine company, Chicago, a very flattering testimonial of the merits of the latter company's fuse wire. Mr. Meeker says: "In placing with you our order for fuse wire and links to be used in the Westinghouse, Electric & Manufacturing company's installation for the entire incandescent lighting of the grounds and buildings of the World's Columbian Exposition, we do so, as we believe your fuse wire and links are the best and most accurate in the market The conditions of our contract are such that it is necessary for us to have the very best."

The Railway Equipment company, Chicago, has just issued catalogue No. 18 of overhead parts. This concern, one of the pioneer houses in the furnishing of overhead equipment for electric roads, was among the first to recognize the superiority of hard rubber for insulating purposes. Having from the start used and advocated this material, it experimented with various compositions, and the special hard rubber composition now furnished by the company shows an astonishingly high degree of insulation. Having had such an extensive experience in this exclusive line it is able to appreciate the needs of the various systems. In offering therefore its new "type G" material it is with the belief that these fixtures are up to the highest standard.

In the issue of the WESTERN ELECTRICIAN of November 7, 1891, there was illustrated and described the successful trial trip made at Sioux City, Ia., of a storage battery car, equipped by the Bradbury-Stone Storage Battery company, of Lowell, Mass. Ever since then the line in Sioux City has been in operation. Some time ago the Bradbury-Stone company obtained permission from H. W. Burgett, treasurer of the Union Electric Railway company, of Dover, N. H., to place upon the tracks of that company a car fitted with the "B. & S." storage battery. The equipment consisted of one thirty horse power Detroit motor on McGuire trucks, the car body being furnished by the Ellis Car company at Amesbury. The battery equipment consists of one hundred and forty cells, and is fitted with all the modern improvements, such as electric bells and cash registers. A noticeable feature of the car is that the sides of it are divided into three panels, which open downward, and the batteries are slid into place on tables on each side of the track. As the tables slide in, the connection is automatically made with the batteries and motor. Recently a trial trip was made between Dover and Great Falls, a distance of about six miles. There were about fifty aboard, and the car with its heavy load made the ascent of the hills on the route, which are noted for their steepness in this vicinity, in the smoothest manner possible. The batteries in the Bradbury-Stone car will run the car for thirty miles without change, and it is stated can make a trip of fifty miles at a pinch. The company believes that the question after all between the two systems, trolley and battery, is one of economy and utility. The equipment of both cars is about the same, and it only remains to say whether the batteries cost more than the overhead system. The invention of Bradbury and Stone stands out as one of the most successful in existence. These gentlemen have spent years in perfecting the system, and can but feel gratified at the result of this trial.

ELECTRICAL PATENTS.

Issued November 22, 1892.

486,457. Incandescent Electric Lamp. Gustav A. Frei, Springfield, Mass.

The ends of the filaments are attached to platinum tubes which are placed over the ends of the leading in wires and soldered thereto by means of an electric current.

486,488. Electric Arc Lamp. William O. Meissner, Chicago, Ill.

A rack is provided for each carbon rod, and two pinions are provided upon a shaft carrying two oppositely faced ratchet wheels, which are adapted to be actuated by two dogs attached to the ends of a pivoted cross bar controlled by an electro magnet.

486,498. Lightning Arrester. Harry G. Osburn, Chicago, Ill.

This lightning arrester consists in a connection to ground provided with a generator of electro motive force equal to and opposed to that of the dynamo electric machine, whereby current from the dynamo is prevented from passing to ground, while an electric discharge will pass through the generator to ground.

486,506. Electric Switch-board. Charles E. Scribner, Chicago, Ill.

The switch-board consists of strips of insulating material provided with corresponding notches, metallic pieces being mounted in the notches, the strips being placed together to form rows of rectangular plug holes, each having two metallic connections on opposite sides thereof.

486,507. Test System for Multiple Switch-boards. Charles E. Scribner, Chicago, Ill.

A device adapted to give a suitable response upon cessation of current through it is combined with a source of electricity in a parallel circuit, and contact pieces are provided as terminals of the parallel circuit and adapted to be applied to the contact pieces of a spring jack, whereby it may be determined whether the contact pieces of the spring jack are short circuited or not.

486,524. Dynamo Electric Machine. George Baehr, Brooklyn, N. Y.

A Gramme ring armature is supported upon a disk in which are inserted metallic plugs, their ends being exposed on both faces of the disk, one end serving as a contact surface for the brushes and the other end having attached to it the ends of the armature coils.

486,563. Illuminated Time-piece. Benjamin Haas, Jr., and Gustav Trouve, Paris, France.

486,569. Electric Signaling Device. James J. Ross, Detroit, Mich.

486,575. Process of Electrically Reducing Refractory Compounds Thomas L. Willson, Leaksville, N. C.

The process consists in pulverizing the compound, impregnating it with a reducing agent by boiling it therein and then subjecting it to the heating action of an electric current.

486,583. Trolley Wire Hanger. David E. Lain, Yonkers, N. Y.

486,604 Suspension Device for Incandescent Lamps. Stephen Porter, Boston, Mass.

486,612. Electric Releasing Device. William R. Hewitt, San Francisco, Cal.

486,624. Electrical Method of and Apparatus for Forming Tubes. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass.

The process of forming a metal tube consists in heating a bar electrically to a higher degree at its core than upon its exterior, coiling the bar in its heated state upon a mandrel with its successive turns abutting against each other and permitting the coils to expand under the action of the internal heat, whereby their abutting edges are fused together.

486,625. Electric Metal Heating Apparatus. George D. Burton, Boston, Mass.

486,626. Electric Forging Apparatus. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass.

The apparatus is adapted to automatically feed the bar, heat a moving section thereof to a forging temperature by an electric current, and shape it into the desired form while retaining the heat developed by the current.

486,627. Electric Forge. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass.

486,634. System of Railway Signaling. Thomas A. Edison, Menlo Park, N. J., and Ezra T. Gilliland, Boston, Mass.

The invention consists in a grounded line wire, an external condensing surface upon the moving car a transmitting inductive coil and circuit controller, and a receiving telephone carried by the car and located in a ground connection from the condensing surface through the rails upon which the car travels.

486,643. Current Director. James F. McElroy, Albany, N. Y.

The director consists of a revolving armature having a series of radiating arms, a divided circuit, loop coils in the branches through which the extremities of the arms pass, and fixed curves for the coils.

486,644. Current Regulator. James F. McElroy, Albany, N. Y.

The terminals of the field coils are secured to fixed contacts and connected into circuit by a movable segmental contact plate actuated by two pawl and ratchet devices, each device having a controlling electro magnet adapted to throw it into operation upon becoming active by the operation of a regulating electro magnet.

486,656. Carbon Brush Holder for Dynamo Electric Machines and Motors. James J. Wood, Fort Wayne, Ind.

486,675. Pneumatic Fire Alarm. Anthony A. Lehmann, Baltimore, Md.

486,689. Electrical Measuring Instrument. Edward Weston, Newark, N. J.

The instrument consists of an electro magnet system having a field of force which is substantially constant, a loop conductor movable in the field under the influence of a current, a spring opposing the movement of the conductor, and an index actuated by the conductor, the parts being constructed so that a current due to a certain change of potential will cause the index to move to a definite position on the scale.

486,702. Successive Non-Interference Signal Box. William E. Decrow, Boston, Mass.

486,715. Electric Device for Vibrating Tables. William L. Imlay, Camden, N. J.

486,727. Thermostatic Regulator. Edwin C. Merrill, Allegheny, Pa.

486,729. Electric Lamp Shade. Charles J. Miller, Philadelphia, Pa.

486,757. Electric Arc Lamp. James Brockie, London, Eng.

The regulating mechanism consists of two solenoids, one having a coil of coarse wire in the lamp circuit and an integral core linked to one arm of a lever, the other having a coil of fine wire in a shunt to the lamp circuit and a divided core which is linked to the opposite arm of the lever, the lever being linked to the carbon feeding device.

486,807. Electrical Hose Signaling Apparatus. William Fowler, Colorado Springs, Colo.

486,818. Electrical Metal Working Apparatus. George D. Burton, Boston, Mass.

An electric converter is provided with two exterior rings of opposite polarity, electrodes mounted on arms attached to the rings and provided with contact rolls, a feed reel being disposed adjacent to one of the electrodes, and a pair of forging hammers adjacent to the other.

486,820. Electrical Annunciator. Franklin S. Carter, Burlington, N. J.

486,838. Electric Clock. Martin V. B. Ethridge, Everett, Mass.

EUGENE F. PHILLIPS, Prest. W. A. HATHAWAY, Treas. W. H. SAWYER, Sec'y.

AMERICAN ELECTRICAL WORKS,

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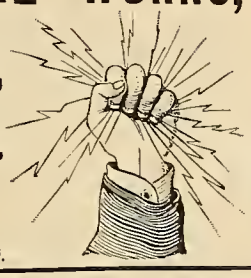
ELECTRIC LIGHT LINE WIRE,

Incandescent and Flexible Cords,

AMERICANITE. MAGNET. OFFICE AND ANNUNCIATOR FARADAY CABLES. WIRES.



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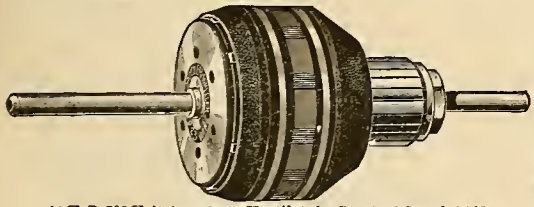

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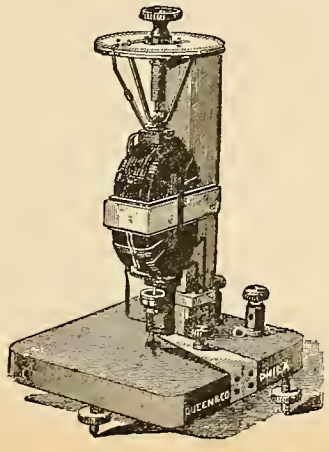

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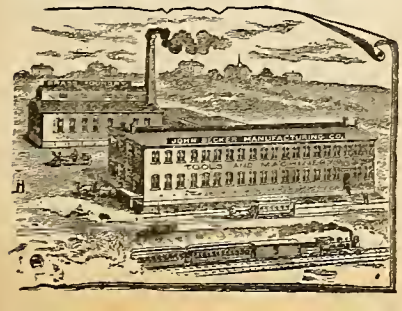

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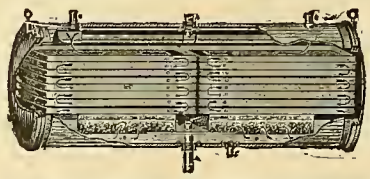

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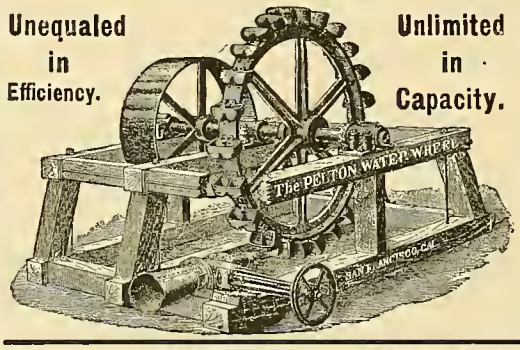

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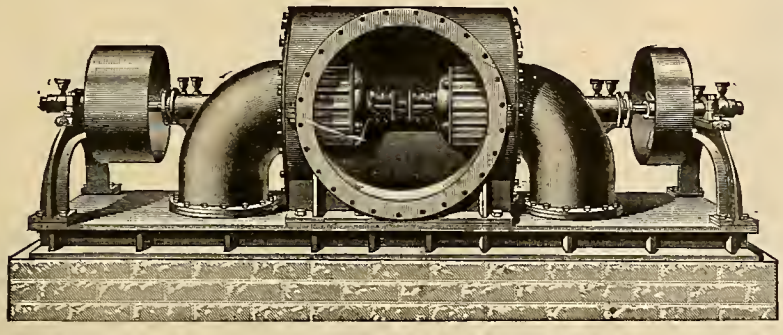

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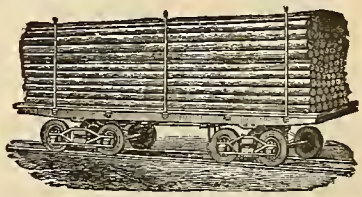

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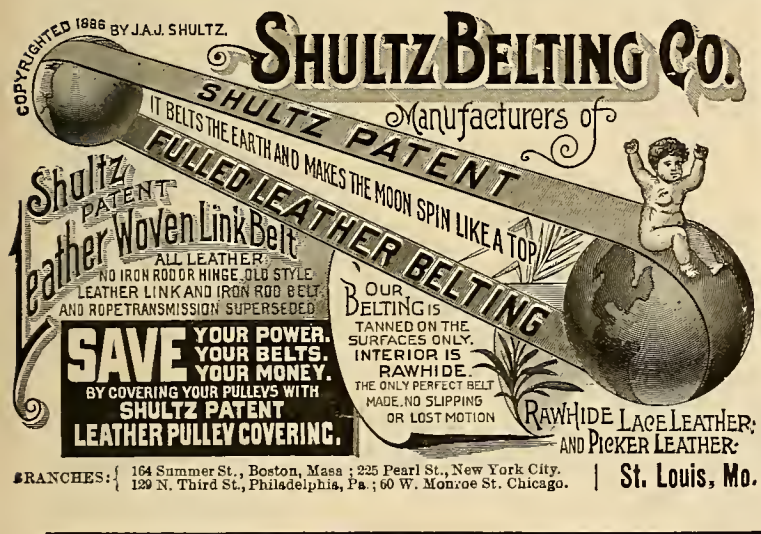

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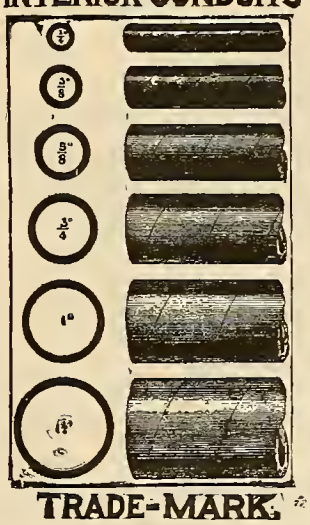

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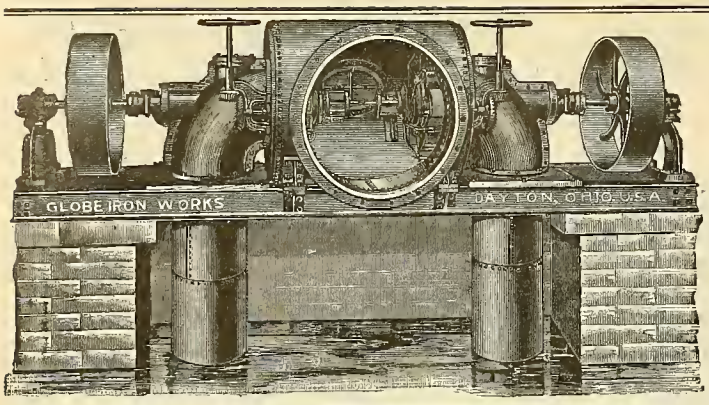

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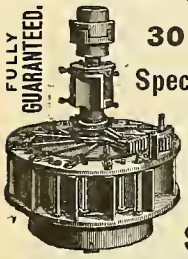

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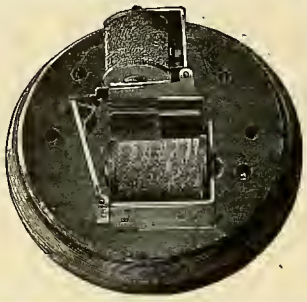

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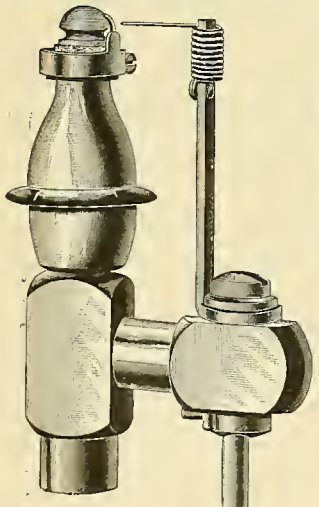

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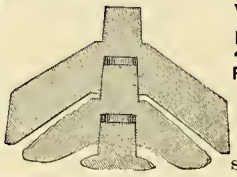

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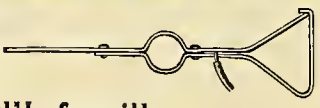

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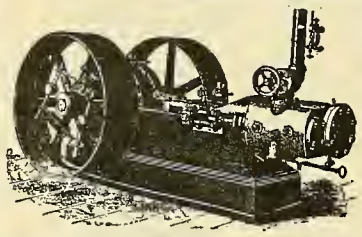

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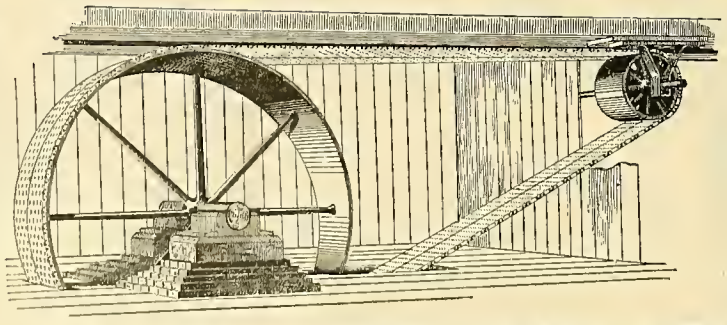

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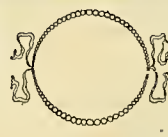

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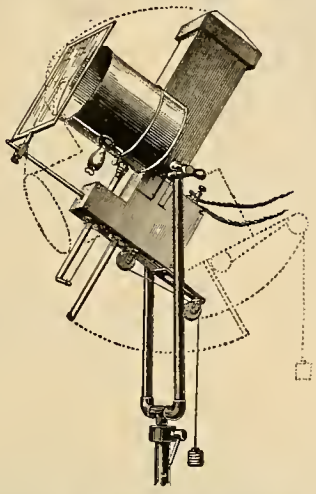

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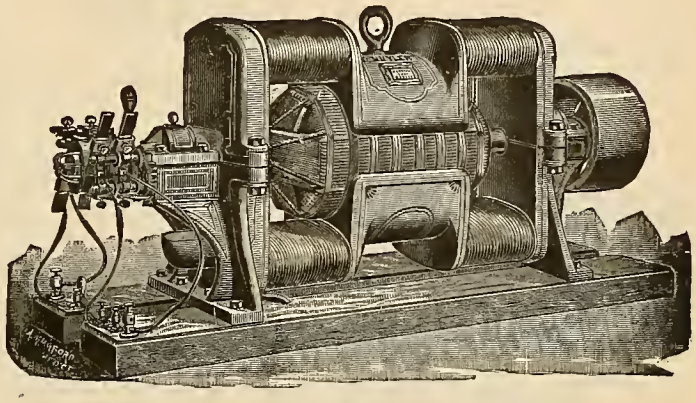

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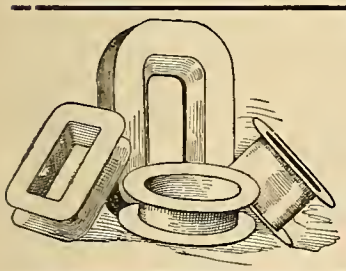

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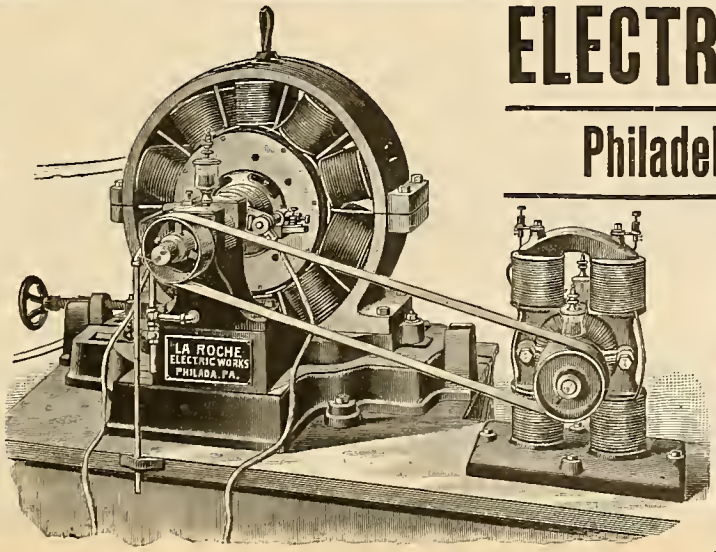

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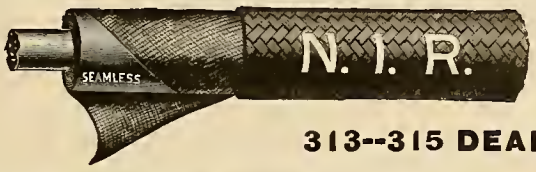

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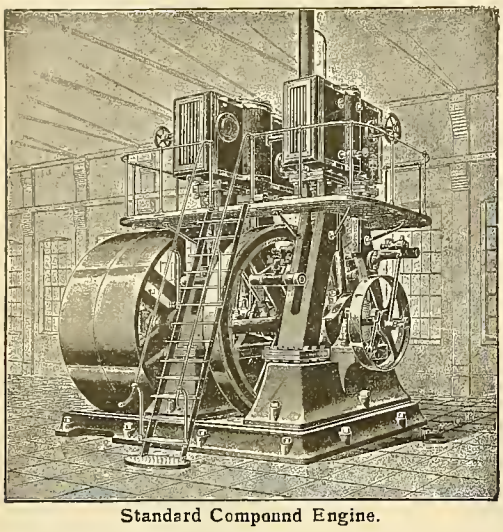

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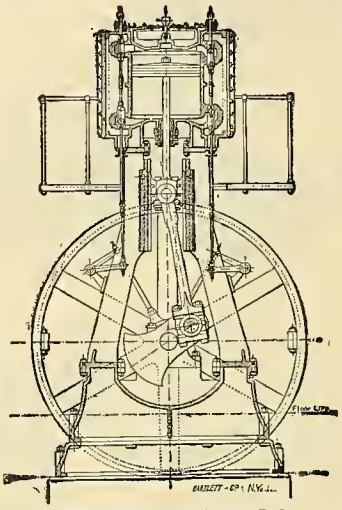

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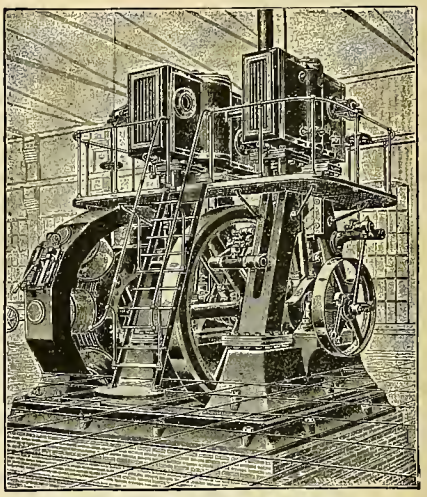

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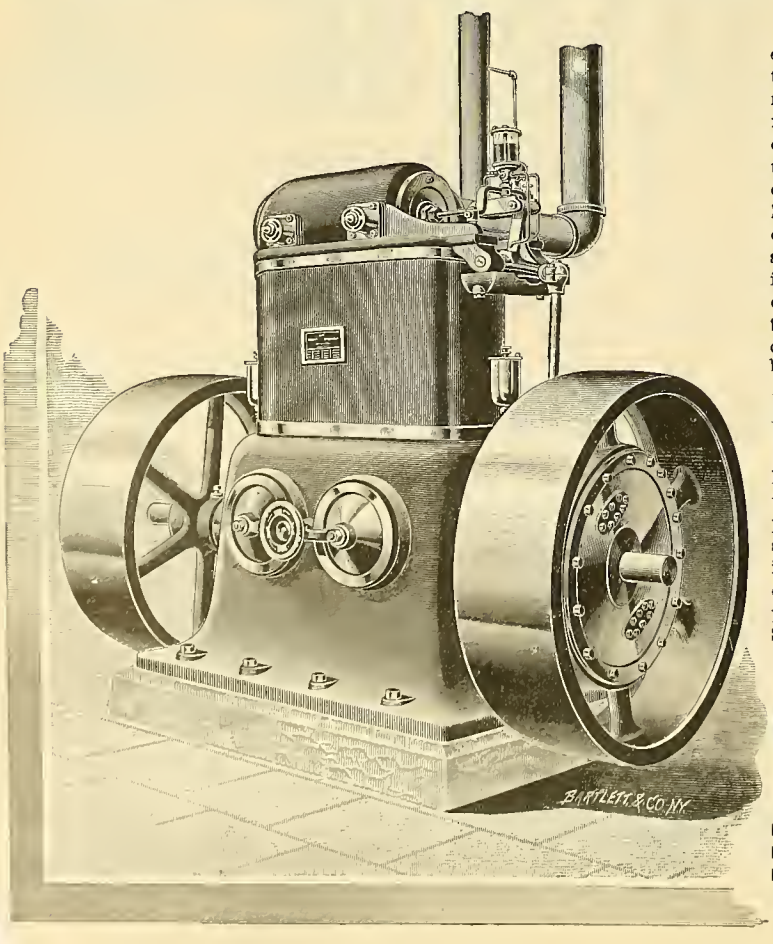

The Compound Engine, when non-condensing, so far from possessing an economy superior to the Simple Engine, has been decisively proven, "much to the disgust of the stockholder," to show normal economy only at or about its rated power, and to fall off in economy faster than a Simple Engine as the load falls off; moreover, very much faster under the extreme light loads that are common in Electrical Generation. This point is at last reluctantly admitted by the more candid builders of such engines, most of whom now advise against compounding for variable loads. The reason is in their inability to divide the load and range of temperature proportionately and automatically between the cylinders at all points of cut-off. Hence, the low-pressure cylinder expands its steam below atmosphere under a moderately early cut-off, thus converting itself into an Air Pump, and becoming a load upon the high-pressure cylinder instead of a co-laborer with it. This point was distinctly foreseen by the designers of the Westinghouse Compound Engine, and an entirely new principle was worked out, making expansion below atmosphere impossible under any load, however light. **For the first time in the history of Steam Engineering, either Simple or Compound, is built an Engine which maintains essentially uniform economy, irrespective of load,** and hence for the first time the Compound Non-condensing Engine has been made practicable. The results, demonstrated by test, show that where an ordinary Compound will range from 25 lbs. to 70 lbs. water per H. P per hour from full to quarter load, the Westinghouse Compound, between the same limits, will range from 23 lbs. to 29 lbs. We have not deceived ourselves in this matter, and propose that the facts shall be understood. To those interested in the nicer points involved, we will be pleased to send a reprint of the paper read by Mr. F. M. Rites on this subject at the late meeting of the American Society of Mechanical Engineers, at San Francisco.

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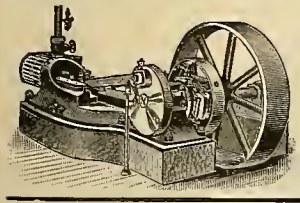

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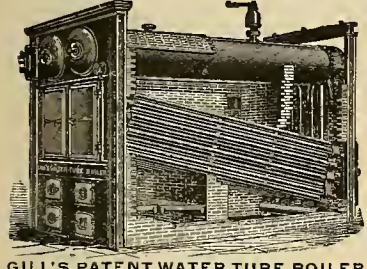

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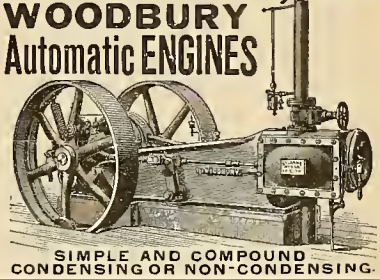

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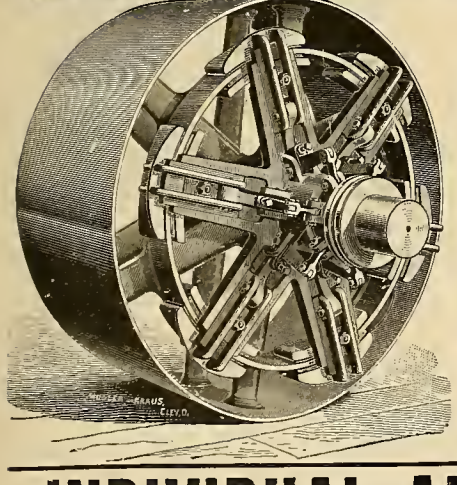

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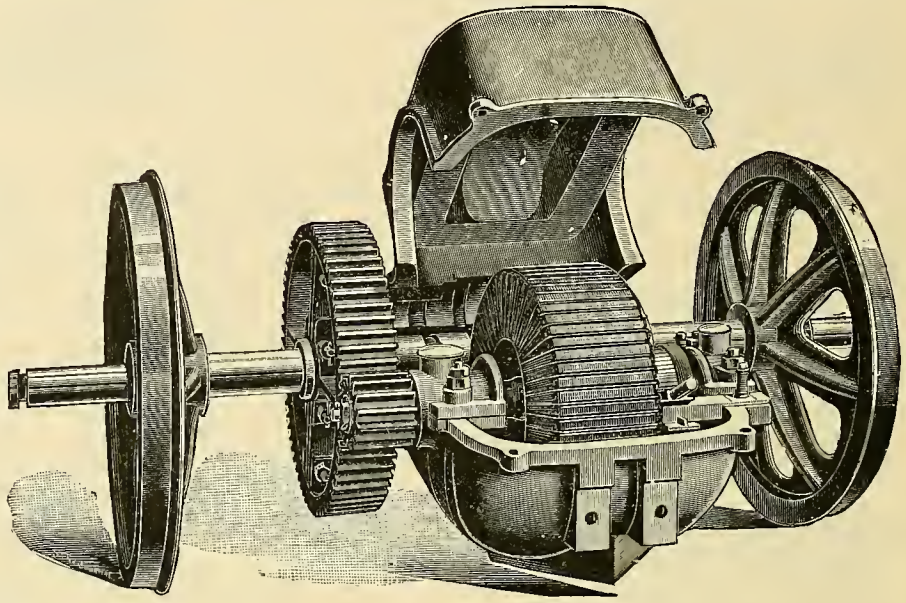

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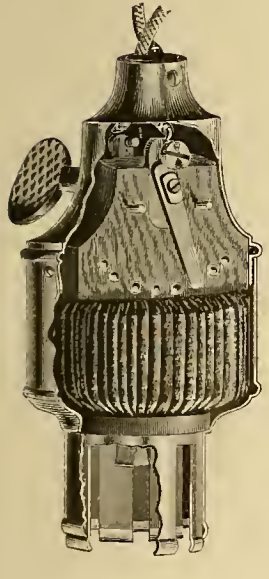

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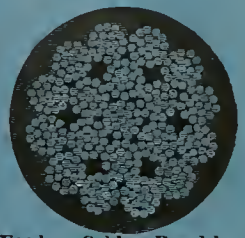
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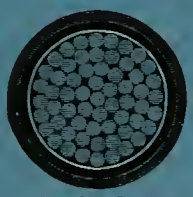
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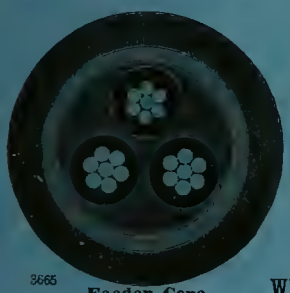
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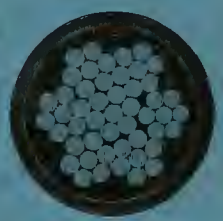
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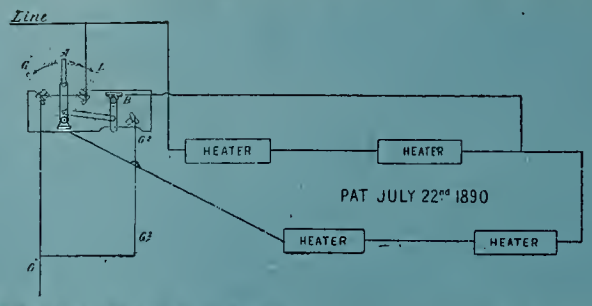
Diagram showing location of heaters in car,



and method of wiring. Heaters are placed under car seats.

Extracts from the Report of the Committee on Science and the Arts of the Franklin Institute of Philadelphia, on the merits of the Burton Electric Heater.

"It is well known that a unit of electrical energy when converted will develop a certain definite and well-known quantity of heat, independently of how it is converted, provided only that there is no induction, counter electromotive force, leakage, or electrolytic action, conditions which are very easily fulfilled in many ways. In such cases, therefore, *the cost of the electrical power actually consumed will be the same for all electrical heaters for heating the surrounding air.* Your committee, therefore, need not consider this point nor the actual cost of heating air electrically, as that must evidently *be the same for all good electrical heaters.*"

"The points about which your committee is to report are, therefore, whether the powdered fire-clay of the Burton Heater performs the functions claimed, namely, of enabling a greater current to be passed through the same wire without injury to that wire, and whether this form of heater has other advantages."

"Your committee made a test of this heater in the electrical laboratory of the Philadelphia Manual Training School, and obtained the following results. They found—

"1. That the same current, about 5 amperes, which heated exposed parts of the wire to a cherry-red heat, heated the covered parts only to a degree of heat at which oxidization begins, which, of course, is very much less.

"2. That the greater part of the heat was dissipated at the bottom of the heater. In these two features, therefore, the claims of the inventor were sustained.

"3. That it required only a few minutes after the current was turned on, before the heater began to give off large quantities of heat.

"The opinion of your committee is that *the addition of the fire-clay is a valuable improvement* for the reasons given above, and that the model submitted is in a practical form.

"They recommend the award of the Scott Legacy Medal."

[Signed] CARL HERING, *Ch'm'n*,
" JAMES WILSON.
" RICHARD O. HEINRICH,
" N. H. EDGERTON.

Sept. 4th, 1889, adopted.

[Signed] S. LLOYD WIEGAND, *Chairman.*

Certified to be a true copy from the records.

[Signed] WM. H. WAHL,
Secretary Franklin Institute.

In an article on electric heating, which appeared in the September, 1892, edition of *Electrical Industries*, page 233, a gentleman well and favorably known in electric railway circles, and a pioneer in electric heating, states as follows:

"In point of efficiency, convenience and economy, the electric heater claims superiority, and its claims seem to be well established. It is now some six years since the first experiments were made on an electric road. While it was found that certain changes of minor importance were necessary, yet it was fully demonstrated that the electric heater was a commercial success; in fact some dozen heaters of the first lot are still in perfect condition after some six seasons of constant use.

Improvements have been made and the success of the parent company has led others to invent new heaters, but up to the present time **the original style of Burton Heater, which was first used on the Sprague Road in Richmond, is perhaps warranted in claiming that it is the only commercially successful heater on the market. The fact that over one hundred electric roads in this country and Canada were using the heaters last season, and the further fact of large numbers of duplicate and triplicate orders being received, would seem to warrant such assertions."**

Prospective buyers, wishing further information, are invited to write us for descriptive catalogue containing claims, testimonials, diagrams and directions for wiring.

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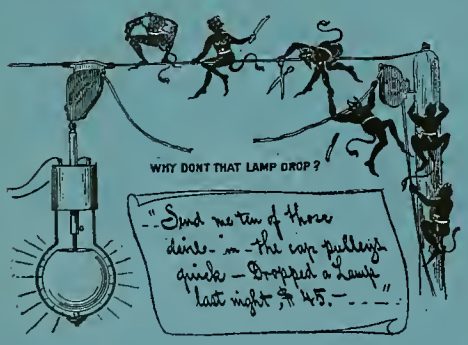

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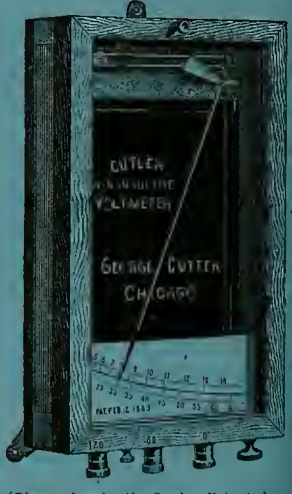

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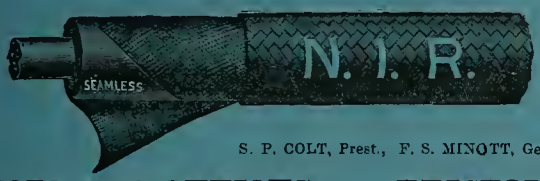

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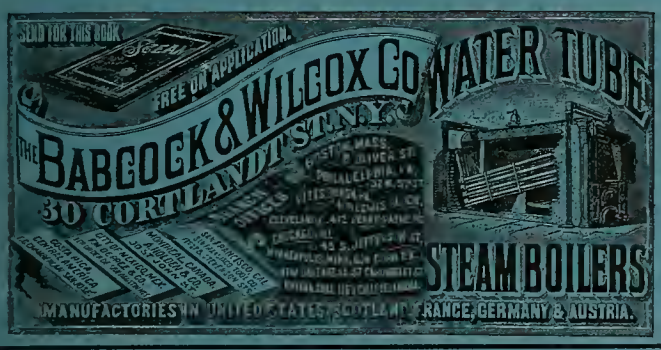

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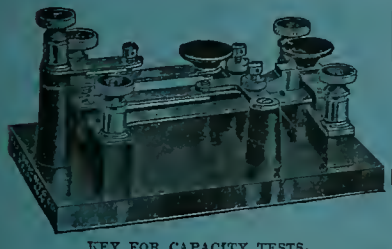

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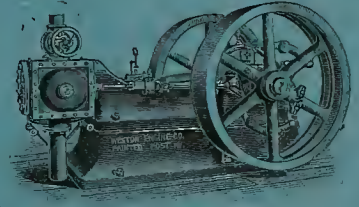
PAGE VI.

WESTON ENGINES.



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Pittsburgh, Pa.
Baltimore, Md.
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INDEX AND CLASSIFICATION OF ADVERTISEMENTS.

ALPHABETICAL LIST.

American Battery Co..... iv
American Electrical Mfg. Co..—
American Electrical Works.... xiii
American Engine Co..... xii
Atwood, A. H..... xxiv
Babcock & Wilcox Co., The.... i
Baggot, E..... xiv
Baker & Co..... xii
Ball Engine Co..... xix
Ball & Wood Co., The i
Beacon Vacuum Pump & Elec. Co. i, vi
Becker Mfg. Co., John.....—
Beggs, J. E., Mch. & Supply Co. xiv
Bernstein Electric Co..... iv, xiii
Blanchard, Albert..... xix
Boston Braid Mfg. Co..... xiv
Bowers Bros..... xiii
Bridgeport Mach. Tool Wks.. xii
Brookfield, Wm..... xii
Brush Electric Co xvii
Bryan, W. H..... xvii
Bryant Electric Co.....—
Buckeye Electric Co., The..... ix
Cabell, L. Breckinridge..... ix, xv
Carpenter Enamel Rheostat Co. xvii
Central Electric Co..... v
Chicago Rawhide Mfg. Co.... iv
Columbia Inc. Lamp Co..... i
Crescent Ins. Wire & Cable Co. xiii
Crocker-Wheeler Electric Co.. xiii
Cushing, F. W..... vii
Cutter, Geo.....—
Cutter Electrical & Mfg. Co... ix
Dayton Globe Iron Works Co.. xvi
Densmore Typewriter Co.....—
Diamond Electric Mfg. Co.....—
d'Infreville, G..... xiv
Dixon Crucible Co., Jos..... xv
Duplex Electric Co., Ltd..... xii
Eastern Electric Cable Co..... xiii
Eastman Kodak Co..... xiv
Edwards, W. S. Mfg. Co.....—
Electric Appliance Co..... xii
Electric Cons. & Supply Co.. xv
Electric Engr'g & Supply Co.. iv
Electric Secret Service Co.... xix
Electrician Pub. Co.....—
Electrical Construction Co., The. xiii
Electrical Eng. & Supply Co. The. v
Electrical Mfg. Co., The..... iv
Electrical Supply Co., The ... xxii
Elektron Mfg. Co.....—
Empire China Works..... xix
Enterprise Electric Co..... xvii
Falls Rivet & Machine Co..... ix
Ferracute Machine Co..... —
Ford-Washburn Storelectro Co.—
For Sale Advs..... xiii, xiv
General Electric Co..... ii, xx
Great Western Elec. Supply Co. ix
Greeley & Co., The E. S..... 1
Gregory, Chas. E..... xiii
Hart & Hegeman Mfg. Co.....—
Heisler Electric Co..... viii
Hill Clutch Works.....—
Hine Eliminator Co..... xii
Holmes, Booth & Haydens.... xiv
Hood & Co., Wm..... iv
Hughes Bros. Mfg Co..... xii
India Rubber & G. P. Ins. Co. xiii
Innis & Co..... xiii
Institute of Technology..... xvii
Interior Conduit & Insulation Co. xv
International Okonite Co..... i
Jewell Belting Co..... i
Johns Mfg. Co., H. W.....—
Kartavert Mfg. Co..... xvii
Klipstein, A..... xiii
Knapp Electrical Works..... xxi
Lake, J. H. & D., Co.....—
Lake Erie Engineering Works. xviii
Lane & Bodley Co..... x
La Roche Electric Works.....—
Leclanche Battery Co., The .. xiv
Lefmann, Julius xv
Leffel, & Co., Jas..... xvi
Link Belt Machinery Co..... xv
Loud, H. M. & Sons Lumber Co. xiv
Manz & Co..... xiv
Mass. Chemical Co..... x
Midland Electrical Wks.....—
Moore, Alfred F..... i
Morse & Co., A. M..... xii
Munsell & Co., Eugene..... xii
National Electric Mfg. Co.... v
National India Rubber Co.... i
New York Insulated Wire Co. xvii
N. Y. Safety Steam Power Co. xix
New York & Ohio Co..... 1
Otto Gas Engine Works..... xix
Osborne Steam Engineering Co. xii
Ostrander & Co., W. R..... xix
Page Belting Co.....—
Partrick & Carter Co..... x
Pearson & Co., W. B..... xviii
Pelton Water Wheel Co..... xiv
Penn. Electric Engineering Co x
Perkins Elec. Switch Mfg. Co. x
Phoenix Glass Co.....—
Porter-Leavitt Elec. Motor Co.—
Queen & Co..... xiii
Racine Hardware Mfg. Co.... xii
Railway Equipment Co..... lx
Redding Electric Co..... xvi
Roebling's Sons Co., J. A iv
Rose Elec. Light Supply Co...—
Samson Cordage Works. xii
Sawyer-Man Electric Co..... xviii
Scott Electrical Mfg. Co..... viii
Sechrist, Albert..... xvi
Shawmut Fuse Wire Co..... xv
Shultz Belting Co.....—
Siebert, G..... xii
Siemens & Halske Electric Co.—
Sioux City Elec. Supply Co... xv
Sioux City Engine Works.... xix
Smith, A. T..... xiv
Smith, Thos. G. Jr..... xiv
Sperry Elec. Mining Mach. Co. xvii
Standard Electric Co..... xxiv
Standard Paint Co x
Stanley Electric Mfg. Co.....—
Stearns Mfg. Co..... xix
Steuben Lamp Works..... xiii
Sterling, W. C..... xv
Stilwell & Bierce Mfg. Co. xiv, xv
Sunbeam Incand. Lamp Co.. xxiii
Taylor Engine Co..... xix
Union Hardware Co..... xiii
Utica Elec. Mfg. & Supply Co. x
Vulcanized Fibre Co..... xv
Waddell-Entz Company..... xii
Washburn & Moen Mfg. Co..—
Western Electric Co..... x
Westinghouse, Church, Kerr & Co..... xvi
Westinghouse Elec. and Mfg Co..... viii, xi
Weston Engine Co..... i
Worthington, Henry R.....—

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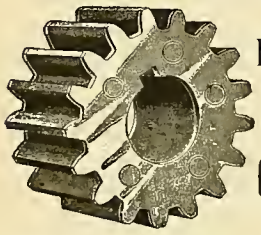

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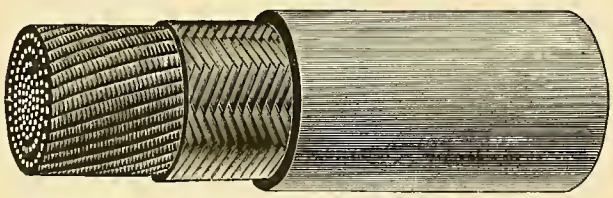

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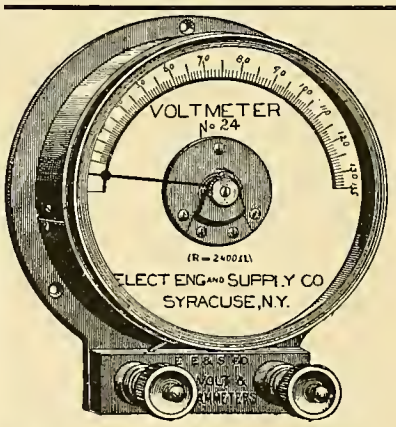

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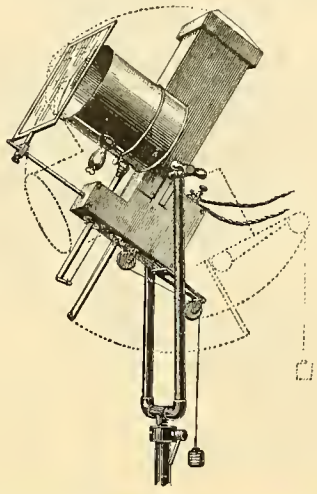

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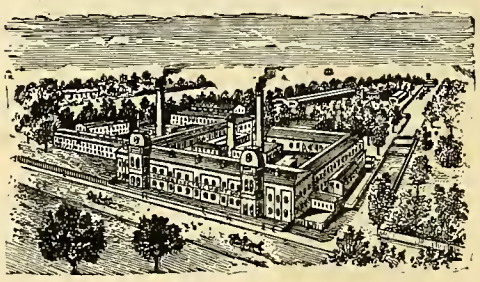
MANUFACTURING AND CONSTRUCTING
ELECTRICAL ENGINEERS.



WORKS, GLOUCESTER, N. J.

Transformer and Direct Current Apparatus.
Series Lamps for Arc Circuits.
Long Distance Series Incandescent Apparatus.
Motors for Alternating and Direct Current Circuits.

STORAGE BATTERY INSTALLATIONS FOR ALL SERVICES.

OFFICE, DREXEL BUILDING, PHILADELPHIA.

WESTINGHOUSE ELECTRIC & MFG. CO.,

PITTSBURGH, PA.,

MANUFACTURERS OF APPARATUS FOR

Arc Lighting, Incandescent Lighting,

LONG DISTANCE TRANSMISSION OF POWER,

Street Railway Generators, Motors and Appliances.

Our alternating current incandescent apparatus is in use in 430 central stations. 1,000 isolated plants. Our arc apparatus is in use all over the world.

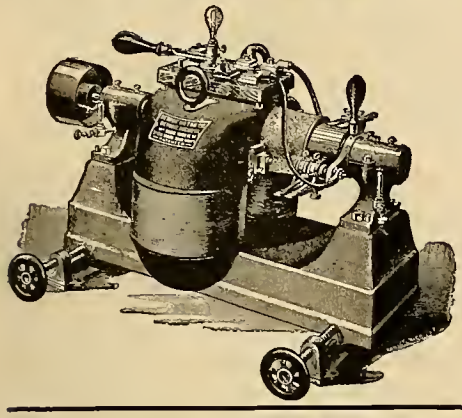
We are now transmitting light and power various distances up to 28 miles from the source.

Our multipolar railway generators and noiseless single reduction motors have worked a revolution in the electric railway field in two years.

Orders for APPARATUS, REPAIRS and SUPPLIES formerly furnished by the United States Electric Lighting Co., Newark, N. J., should now be sent to this Company, where they will receive prompt attention.

BRANCH OFFICES IN ALL THE LEADING CITIES.
AGENTS FOR CANADA: AHERN & SOPER, OTTAWA, ONT.

GREAT WESTERN ELECTRIC SUPPLY CO.,



195--207 South Canal St., CHICAGO, ILL.

CENERATORS AND MOTORS.
INCANDESCENT LIGHTING.
ARC LIGHTING.
ELECTRIC POWER.

COMPLETE EQUIPMENTS
FOR CENTRAL STATIONS
AND ISOLATED PLANTS.

Manufacturers of { ELECTRIC SUPPLIES .. AND FIXTURES .. } of every description.

Dynamos, Motors, Lamps, Sockets, Wire, etc.

Gas, Electric and Combination Fixtures.

Complete Electric Railway Station and Line Appliances.

Batteries, Push Buttons, Bells, etc.

WRITE FOR CATALOGUE AND PRICES.

RICH GOLD MINES.

I have in my hands two gold mines easily accessible, in the United States of Colombia, South America, with ore of the most extraordinary richness, some of which carries as much as three thousand dollars ($3,000) in gold to the ton, and all being of high grade.

These mines are of ancient discovery, and were worked with great profit for a long period, being only abandoned on account of political troubles before and after the War of liberation.

These troubles have been happily settled for over a quarter of a century, and the Colombian Republic is based upon the theory of and similar to our own government, with civil and religious liberty and equal rights to all, and is as stable as any government in the world.

These mines are so richly endowed with auriferous material, from the easily-worked sand, gravel, and dirt (carrying virgin dust and nuggets), to the fissure veins of free milling quartz, that when properly equipped a profit of ten thousand dollars ($10,000) a day, or over three million dollars ($3,000,000) annually is a very low and conservative estimate.

There is an abundance of timber and unfailing water power, with a genial and healthy climate.

It is proposed to organize this property on a basis of five million dollars($5,000,000), upon which there can be dividends earned of 60 per cent. or more, and the parties furnishing the original capital, in small or large sums, for this organization, which will be about twenty-five thousand dollars ($25,000), will be let in on a basis of two and a half cents (2½c.) on the dollar, with the privilege of purchasing pro rata at five cents (5c.) on the dollar, a sufficient amount to give them a controlling interest if they so desire.

There is also the right of prior possession to double the amount of contiguous land.

The poverty of the owners of this property, being land poor, is the reason of this unusual offer, and they will retain as much of the property as they possibly can, parting with only what is necessary in order to work it.

Situated in the Jurisdiction of Simite, District of Guamaco, Province of Mompos, State of Bolivar.

An experienced miner who has been over and thoroughly examined the property, says more gold is there than in the entire State of California, while another says so great is the evidence of mineral wealth I sometimes doubted my own sanity, and were I to tell California and Colorado miners even a tithe of what I actually saw, I would be branded as a foolish liar or raving maniac.

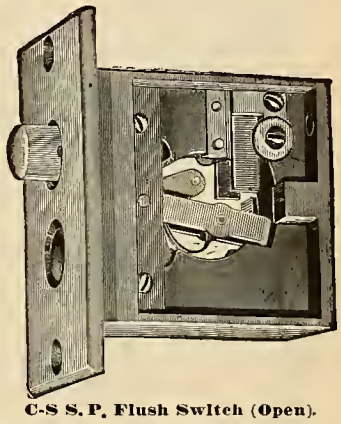
L. BRECKINRIDGE CABELL, 53 Broadway, NEW YORK, ROOM 17.

C-S Specialties.

C-S Double Push Flush Switch.

Single Pole. Double Pole. 3-Wire.

Electrically
Mechanically
Artistically
PEERLESS.



C-S S. P. Flush Switch (Open).

THE CUTTER ELECTRICAL & MFG. CO.,

27 So. 11th Street, PHILADELPHIA, PA., U. S. A.

RAILWAY EQUIPMENT CO.,

Pullman Building, Michigan Avenue, CHICAGO.

Electric Railway Supplies

—EXCLUSIVELY.—

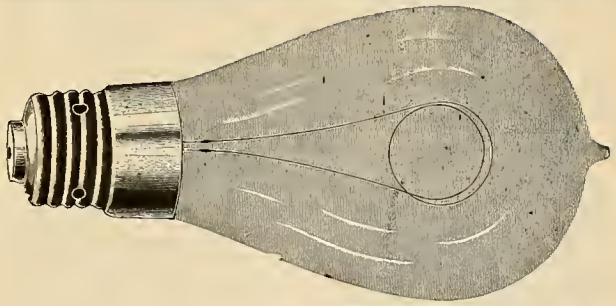
Prompt Shipments.

CATALOGUES AND ESTIMATES FURNISHED.

RAILWAY EQUIPMENT CO.,

CHICAGO.

W. R. MASON, Gen'l Mgr.



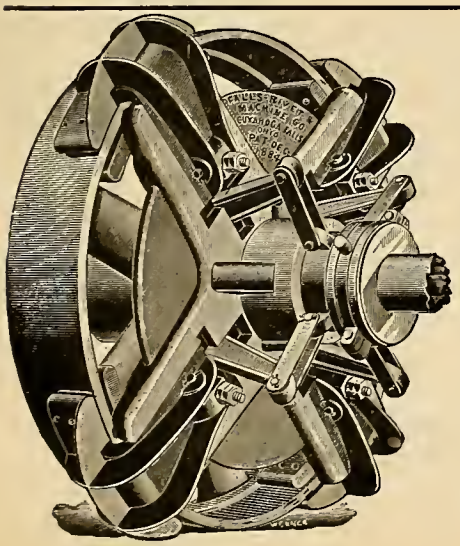
WELL! WELL!! WELL!!!

HOW these COILED Filament Lamps do *loom up* these DARK DAYS.
A beautiful white light; no discoloration; 1,000 to 4,000 HOURS

THE BUCKEYE ELECTRIC CO., Cleveland, O.

437 "The Rookery," CHICAGO.

611 Mail and Express Building, NEW YORK.



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Rivet & Machine Co.,

CUYAHOGA FALLS, OHIO.

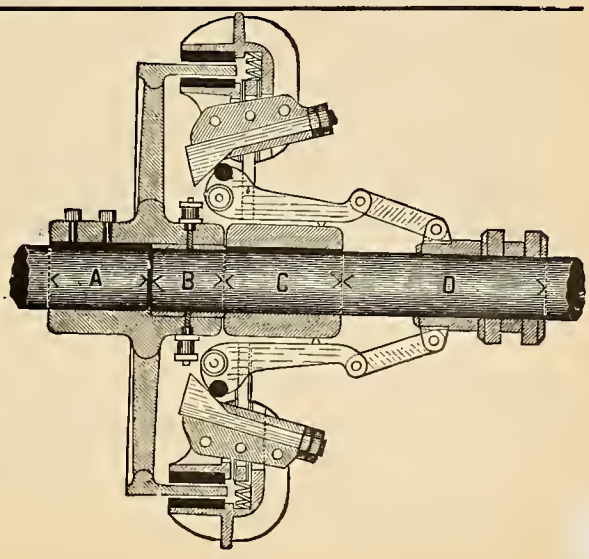
MANUFACTURERS OF

Friction Clutches,

SHAFTING, ETC.

Special attention given to the Complete Equipment of Electric Plants.

BRANCH OFFICES: { 8 So. Canal St., CHICAGO. 520 Olive St., ST. LOUIS. 18 Cortlandt St., NEW YORK.



ESTABLISHED 1867.

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ELECTRICAL SUPPLIES

OF ALL KINDS.

HOUSE GOODS A SPECIALTY.

WRITE FOR PRICES.

Utica Electrical Mfg. & Supply Co.,

UTICA, N. Y.

MANUFACTURERS OF

"HERCULES" SWITCHES for Arc and Power Circuits.
"UTICA" QUICK BREAK—ABSOLUTE LOCK-KNIFE SWITCHES for any voltage and amperes.
AUTOMATIC MAGAZINE FUSE BOXES.
SIMPLEX, DUPLEX and QUADRUPLEX LIGHTNING ARRESTERS for Power, Telephone and Lighting Circuits.
MAST ARMS and POLE STANDS.
CARBON BRUSH HOLDERS for Generators, Motors and Dynamos.
CARBON HOLDERS, CIRCUIT JUMPERS and CONNECTORS.
Also General Dealers in ELECTRIC LIGHT and POWER SUPPLIES.

ANYTHING IN A NAME?

Yes, take **INSULLAC** for example. This word, simple as it seems, is the name of the highest grade of insulating varnish made to-day. For armature and field winding it cannot be approached. If you are doing anything in this line it will pay you to correspond with us. Our goods are guaranteed.

Massachusetts Chemical Co.,

134 Pearl St., NEW YORK. 8 Oliver St., BOSTON.

P. AND B.

Insulating Compounds, Tape and Armature Varnish.

MANUFACTURED BY

THE STANDARD PAINT CO.,

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Chicago Office: 542 "The Rookery."

SOLD BY

THE ELECTRICAL SUPPLY CO., Chicago.
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PETTINGELL-ANDREWS CO., Boston
And Supply Houses Everywhere.

You Will Oblige

Both Advertiser and Publisher by mentioning the WESTERN ELECTRICIAN when writing to advertisers.

THE PENNSYLVANIA LAMP.

ACKNOWLEDGED TO HAVE THE HIGHEST MERIT IN ALL THE RECENT COMPETITIVE TESTS.

INCANDESCENT LAMPS, 8 TO 300 CANDLE POWER. ALL VOLTAGES AND BASES ALWAYS IN STOCK.

Offices:

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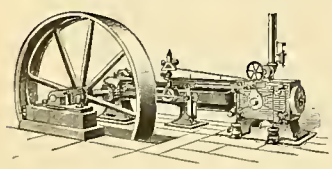
WESTERN ELECTRIC COMPANY, CHICAGO.

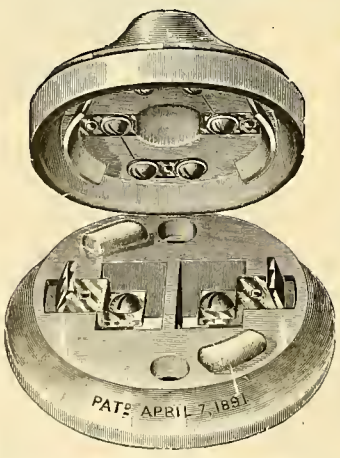


CORLISS ENGINES

Slide Valve Engines, Shafting, Hangers, Pulleys, Belt Elevators, Saw Mills, Etc., Etc.

The Lane & Bodley Co.,

CINCINNATI, O.



No. 102. Concealed Work.

A NEW LAMP SOCKET

With Every Advantage.

Durable and Effective Contact.
Plenty of Room for Knot in the Cord.
Strong on Fixtures; the Cap, with Bayonet Lock, Projecting over the Shell.

The Dovetail Ceiling Rosette.

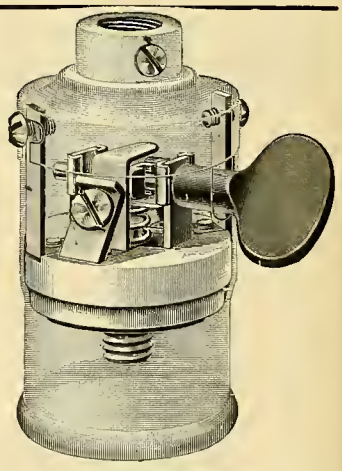
For Moulding, Cleat and Concealed Work.

No screw driver used in adjusting cap.

For Sale by Supply Houses, or by

The Perkins Electric Switch MFG. COMPANY,

P. O. Box 816 Hartford, Conn.



T.-H. and Westinghouse Styles.

WESTERN ELECTRIC CO.,

Electrical Apparatus.

CHICAGO:
227 to 275 South Clinton Street,
242 to 258 South Jefferson Street, 37 to 45 West Congress Street.

NEW YORK:
Thames and Greenwich Streets.

LONDON:
79 Coleman Street, E. C.

ANTWERP:
Bell Telephone Manufacturing Co.,
33 Rue Boudewyns.

BERLIN:
Telephon Apparat Fabrik,
Engel Ufer 1.

PARIS:
Societe de Material Telephonique, 46 Avenue de Breteuil.

Westinghouse Electric and Mfg. Co.,

Pittsburgh, Pa.

Nov. 30, 1892.

Lamps.

EFFICIENCY, LONG LIFE, NO DECREASE IN CANDLE POWER.

Sockets.

SIMPLE, ORNAMENTAL, RELIABLE, CHEAP.

OUR NEW LAMPS not only do not infringe the Edison Patent, but they are fully covered by patents of our own.

BY MEANS OF AN IMPORTANT DISCOVERY THE BURNER IS RENDERED STABLE, ITS EFFICIENCY INCREASED, ITS LIFE PROLONGED AND ITS NORMAL CANDLE POWER MAINTAINED.

PRICES.

By reason of economies effected in the manufacture of our new lamp in large quantities by the use of special machinery, we are able to

Quote the following Low Prices:

25 and 20 candle power lamps, - - - - $0.35 List Price.
16, 10 and 8 candle power lamps, - - - - $ .30 " "

DISCOUNTS.

Central Stations 10 per cent. discount, and to all others 2½ per cent. to 10 per cent. according to quantity.

ALLOWANCES.

A credit of ten cents will be given for every unbroken burned out lamp, delivered at the factory of the Company.

The saving by decreased cost of lamps and renewals should equal nearly one per cent. on the capital stock of any Central Station.

The constant effort of the agents of the General Electric Company to induce our customers to exchange Generating Apparatus of our make for Thomson-Houston Generating Apparatus is fully explained by the fact that

THE THOMSON-HOUSTON COMPANY PAYS US

through the Consolidated Electric Light Company Five Cents for every Incandescent Lamp it makes, for the right to sell such lamps for use in connection with Generating Apparatus of its own manufacture only.

While we do not sell our new lamp for use in connection with Thomson-Houston Generating Apparatus, the present users of the same may avail themselves of our new lamp by substituting our Generating Apparatus, the quality and efficiency of which will fully warrant the cost.

NOTE: A dealer came to our office and stated that he had **the exclusive sale** of second-hand apparatus for the **General Electric Company**; and he offered five of our Number One Alternating Current Generators for sale, to be delivered a few weeks hence as they are still in use. **We can of course Commend this apparatus if in good order.**

An official of a central station lighting company approached us recently for the exclusive right to the use of our apparatus in his town, stating that his company had already entered into a contract, Form D., with the General Electric Company, for the exclusive use of their apparatus. He frankly avowed that his purpose was, by securing a contract with us, to have a monopoly of electric light and power in the district covered by his station.

We thought it better to leave that place open for competition.

We have also been informed that one other Company had executed Form D contract of the General Electric Company. These three are the only instances we have discovered, where they have succeeded in doing business in the direction of inducing users of our apparatus to discard it for apparatus made by members of the Trust.

Although we have many tons of apparatus made by the various members of the Trust, taken in the course of trade, we have not cared to offer it for sale, for we believe the sale of inferior apparatus does great harm to the electric trade in general.

We have perfected devices that can be inserted in the various sockets now in use, thereby making them standard, for the use of our new lamps. The manufacture of these in sufficient quantities to meet the demand has been unexpectedly delayed, so that the delivery of lamps, and these attachments, will be made only from and after January 1st.

WESTINGHOUSE ELECTRIC AND MFG. CO.

STANDARD SCREW GLASS INSULATORS

MANUFACTURED BY

WM. BROOKFIELD,

BUSHWICK GLASS WORKS. 83 FULTON STREET, NEW YORK.

WE ARE JUST STARTING IN ON

OUR NEW YEAR

and with increased facilities for taking care of your supply business. We look for a larger share of your orders. We are

HEADQUARTERS

for first-class specialties in every line. We

SHIP ORDERS COMPLETE

promptly on receipt, supplying only first-class material.

WE ARE AT YOUR SERVICE.

ELECTRIC APPLIANCE COMPANY,

242 Madison Street, Chicago.

RACINE-HIGH-SPEED AUTOMATIC ENGINES

SUPERIOR REGULATION AND ECONOMY FOR ELECTRIC LIGHTING AND GENERAL PURPOSES

16 SIZES CARRIED IN STOCK

WE TEST EACH ONE OF OUR ENGINES BEFORE SHIPPING

FOR PRICES AND CATALOGUE ADDRESS ENGINE DEPT.

SEND FOR CATALOGUE C.

RACINE HARDWARE M'F'G CO. RACINE WIS.

The Osborne Steam Engineering Co.,

ENGINEERS,

Rooms 714-715, 167 Dearborn St., - Chicago

Representative work now in course of construction, 2 000 H. P. Heat, Light and Power Plant for the Pabst Heat, Light & Power Co., Milwaukee, Wis.

Those who contemplate the construction of similar plants on improved and economical lines will do well to communicate with us. First, be sure you will get the best, then go ahead.

HUGHES BROS. MFG. CO.,

MANUFACTURERS OF

Cross Arms, Insulator Pins and Brackets,

And Electrical Molding.

Correspondence Solicited.

CHATTANOOGA, - TENN.

MICA All Sizes and Qualities

For Electrical Purposes.

EUGENE MUNSELL & CO.,

218 Water Street, New York.

W. H. SILLS, 86 Lake Street, CHICAGO, ILL.

PLATINUM

For all kinds of Electrical Use. Sheet or Wire of any Degree of Hardness.

Special Attention given to Platinum for Incandescent Lamps.

WE CARRY THE LARGEST STOCK IN AMERICA.

G. SIEBERT, HANAU, GERMANY.

ADDRESS, 171 and 173 GREENE ST., NEW YORK.

SAMSON BRAIDED CORD.

Is the most durable for hanging Arc Lamps, Trolley Cord, Covering Field Magnete, Sash Cord, etc., etc.

Send for Samples and Prices.

SAMSON CORDAGE WORKS,

115 CONGRESS STREET, BOSTON.

THE LATEST AND BEST

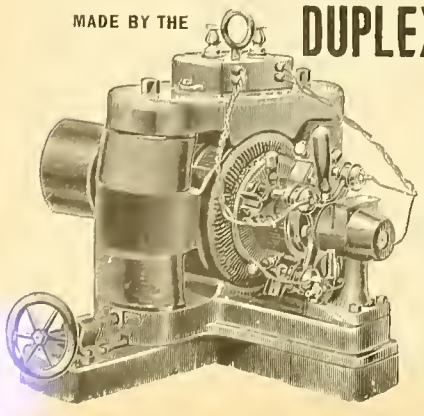
SLOW SPEED, MULTIPOLAR DYNAMO.

ADVANTAGES: Slow speed, small floor space, direct driven, self-oiling bearings, little external magnetism, etc.

MADE BY THE **DUPLEX ELECTRIC CO.,**

Limited,

CORRY, PA.



Boston Office—H. C. Hawks, Manager 620 Atlantic Ave.
Chicago Office—Archer & Rusling, Managers, 1325 Monadnock Building.
Kansas City, Mo., Office—L. C. Bair, 806 Walnut Street.
New York Office—W. H. Gordon, Manager, 115 Broadway.
Philadelphia Office—Chas. E. Russell, 18 South Broad St.

AGENTS:

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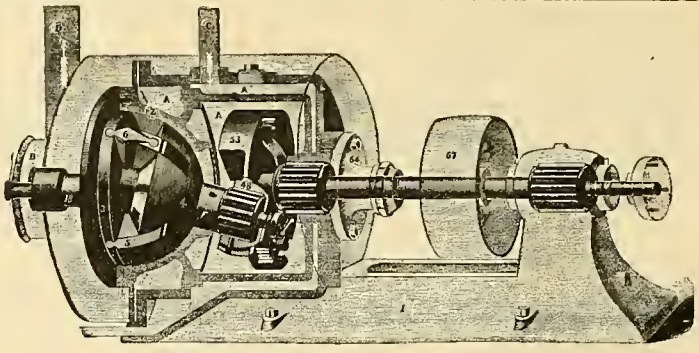
Lincoln, Neb.—Bigelow Electric Supply Co., 112 S. 13th St.
Providence, R. I.—Drake, Payson & Whittier, Cor. Washington & Eddy Sts.
Tarpon Springs, Fla.—W. D. Wilson.



The above illustration shows the working parts of the only steam engine worthy of being called **high speed.** It is known as the

American High Speed Engine.

It has no competitors.
Runs easily and smoothly

1000 REVOLUTIONS and more, in small sizes, and proportionally fast in larger sizes.

Unsurpassed for Economy

and close automatic government.

DYNAMOS,
CIRCULAR SAWS,
FANS, BLOWERS,
THRESHING MACHINES,

etc., run by **direct coupling** without belts.

It's the acme of simplicity. There's great saving in foundations, little or none being required, also in oil consumed and attention required.

For high speed machinery it saves many shafts, counter-shafts, hangers, pulleys, belts, and great loss of power incidental to their use. Speed readily reduced for slow running machinery.

This Engine is

NOT A "ROTARY,"

as its piston does not revolve; runs standing on either end, or placed horizontally, equally well; is *wholly* self-contained. Takes up but little room.

MARINE TYPE

is very light, and has simple, effective reversing mechanism. Especially well adapted for high speed Launches and Yachts. Its position in bottom of boat is most favorable for ballast.

Engines of 2 to 200 Horse Power can be furnished on short notice.

☞ If you want to know more, send address and 10 cents in stamps for Large Illustrated Catalogue, to

AMERICAN ENGINE CO.,

BOUND BROOK, N. J.

No. 44 Raritan Avenue.

PLATINUM

For all Purposes.

Scrap and Native Platinum Purchased.

BAKER & CO., 408-414 New Jersey Railroad Ave., Newark, N. J.

A. M. MORSE & CO. 520 OLIVE STREET,

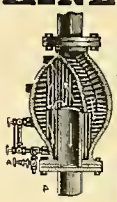
BUCKEYE ENGINES 50 TO 1000 H. P. ST. LOUIS.

Over 3000 in Service. Simple or Compound. Send for Cir

HINE'S ELIMINATOR.

THE ACKNOWLEDGED SUPERIOR OF ALL

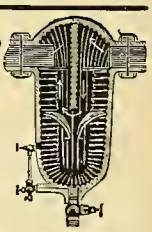
Steam Separators and Oil Extractors.



VERTICAL.

In twelve trials in the "Cornell" Separator test, it averaged 98 7-10 per cent Dry Steam. Outstripping all competitors.

Send for Circular and Cornell test report.



HORIZONTAL.

HINE ELIMINATOR CO., 106 Liberty St., NEW YORK.

This advertisement appears every other week.

BORING & TURNING MILLS

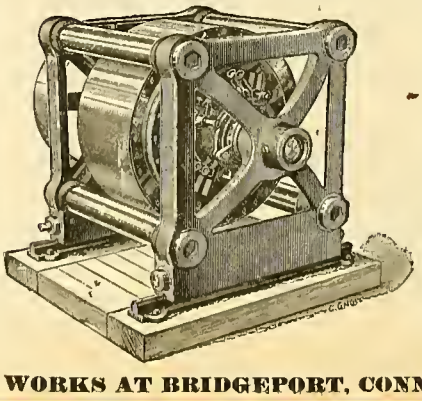
BRIDGEPORT MACHINE TOOL WORKS

E. P. BULLARD Prop'r

BRIDGEPORT, CONN.

The WADDELL-ENTZ COMPANY,

203 BROADWAY, NEW YORK.



Improved Slow-Speed Generators and Motors. "DIRECT-DRIVEN" Slow-Speed Generators for Electric Lighting and Power. Low Running Expense. Insulated Wire and Flexible Cords. Estimates furnished. Isolated Plants a specialty.

PHILADELPHIA, 501 Girard Building.
BUFFALO, 50 Terrace.

WORKS AT BRIDGEPORT, CONN.

Western Electrician.

EVERY SATURDAY.

Vol. XI. CHICAGO, DECEMBER 10, 1892. No. 24

Electricity at the World's Fair.

Although the northern end of the electricity building at the World's Fair has been practically completed for some time, the southern front, represented in Fig. 1, has only recently been finished sufficiently to give a fair idea of its ultimate appearance. Even now, as a glance at the illustration will show, the interior of the hemicycle, which is to contain the statue of Franklin, is a mass of scaffolding. And this is the building that Contractor Johnson was to have finished by the 1st of last July! The portion of the building shown in the picture may perhaps be considered as the principal facade, if a building of this character may be said to possess a dominating front. The southern end of the building, however, faces the administration building and the grand basin, and this portion of the grounds forms the center about which all the larger buildings are grouped. The interior of the building, a view of which is given in Fig. 2, is now nearly ready for the wiring, the work of the original contractor being about finished. The photograph from which the illustration was reproduced was taken from a point looking toward the southern end, and includes the center of the building and a portion of the galleries. The work of tearing up the flooring of the lower story in order to lay the foundations of the machinery installed as exhibits will soon be begun.

What is said to be the first incandescent lighting plant turned out of Edison's shops at Menlo Park will probably be on exhibition in the electricity building at the World's Fair. It is now used in lighting the steamer Columbia, plying between San Francisco and Portland, Ore., where it was placed in position in May, 1888. It has been in satisfactory operation ever since, with no alterations.

Assistant Superintendent Reilly, of the Westinghouse installation, is recovering from the injuries he received by being thrown from a buggy, and will probably be able to resume his duties on the grounds in a few days.

A large quantity of the iron girders for the intramural railway has been bolted in position on the southern end of the line, near the forestry building. Work on the machinery foundations for the power house is nearly completed, and the work of erecting the walls of the building has been begun. The generators are now on the way, and as some of the locomotives and cars are now ready in the eastern shops it is possible that a train may be running in three or four weeks. The conductors will be between the rails, and the girders will be used for the return circuit.

The World's Fair will not be without a high tower after all, but it will be built on a plan totally different from that of the Eiffel tower at Paris. Ground has already been broken for the structure, and considerable progress has been made on the foundation. The tower will be located at the eastern entrance of the Midway Plaisance, opposite the woman's building, and will be 560 feet high, with a diameter of 200 feet. The ascent to the summit will be made in cars propelled by electricity, to be run on a track which winds about the tower eight times in making the entire ascent. The grade is calculated at eight per cent., and the sensation of returning to earth will be as exciting as a toboggan slide. On the top of the tower will be an observatory where the visitor can overlook the grounds. In the evening Japanese lanterns, illuminated by incandescent lights, will be strung all along the track from base to summit, and the sight of the great building ablaze with lights will doubtless be one of the most interesting at the fair. The foundation of the structure will be of stone and of the strongest character. The tower is to be constructed of iron and steel, which will be painted a light color to make it attractive and at the same time in harmony with the surrounding buildings. The promoters of the enterprise calculate that the electric cars will have a capacity of 12,000 passengers an hour, and confidently expect the patronage of 100,000 people per day.

The C. & C. 220 volt generator for the electric elevators in the administration building will be installed temporarily in the plant now running in machinery hall and which

FIG. 1. ELECTRICITY AT THE WORLD'S FAIR.

proudly boasts of what is probably the most antiquated Edison machine in Chicago.

Large Lighting Contract.

After a spirited competition, in which the General Electric, Siemens & Halske, Western Electric, Mather and Chicago Edison companies took part, the contract for the lighting plant for the handsome new building that Marshall Field & Co. are erecting at Wabash avenue and Washington street, Chicago, has been awarded to the Chicago Edison company. The building will comprise eight stories and a basement, and will be used mainly as an addition to the great retail department store of the firm named, the upper floors being divided into offices. The building will be wired for 4,000 lamps, those on the first four floors being supplied from the local plant and the lamps on the upper floors being connected with the downtown station of the Chicago Edison company. The plant will be installed in a separate power house 300 feet north of the building. The dynamos will be located on the second floor and the engines in the basement. Current will be generated by four 100 kilowatt machines of the standard Edison compound wound type. The contract for the engines has not yet been awarded. A subway will be constructed under the alley, through which the cables will be run to the Field building. The work of fitting up the power house is now in progress, and the wiring of the big building will be begun soon. The contract was secured for the Chicago Edison company by L. A. Ferguson.

Taxation of Electrical Manufacturing Corporations.

An important question of taxation has been decided by the Supreme Court of Pennsylvania, in the case of the Commonwealth against the Westinghouse Electric & Manufacturing company. This company, organized under the laws of Pennsylvania, claimed that it came within the provisions of the statutes of that state, exempting from taxation the capital stock of corporations "organized exclusively for manufacturing purposes." During the tax year of 1890 it had an average capital stock of $6,502,405, but declared dividends amounting to seven per cent. upon an average capital stock of only $4,798,164.10. Upon this last named amount, it was sought to recover a tax of three and one-half mills. During the tax year, and for some time previous thereto, this company was exclusively engaged in the manufacture and sale of electrical apparatus and appliances and machinery for the generation, transmission and utilization of electricity and in no other business. It conducted its principal operations in Pittsburg, where it employed between eight hundred and a thousand men. It also operated a manufacturing establishment in the city of New York and a similar establishment in Newark, New Jersey. Moreover, a considerable portion of its capital stock, namely, $4,217,530.34, was invested in, and represented patent rights granted by the United States, which patents were absolutely essential to enable it to manufacture and sell the electrical apparatus, machinery, etc., described. Upon this state of facts the Court of Common Pleas of Dauphin county held that this company was a corporation organized exclusively for manufacturing purposes, and actually carrying on manufacturing within the state, and, therefore, that no portion of its capital stock was taxable. The Supreme Court of the state, however, reversed the decision of the lower court on the important point that the Westinghouse Electric & Manufacturing company was not a corporation organized exclusively for manufacturing purposes within the provision of the statute which exempts from taxation. Looking to the acts under which the corporation was organized, it was found to be empowered to engage in enterprises so vaguely defined that it would be unsafe to say what it was not authorized to do, except the issues of its own obligations as currency. It was expressly authorized "to make purchases and sales on investments in the securities of other companies," and to do many other enumerated things which were not manufacturing. A corporation is organized when the agents or officers by which alone it can perform its appropriate functions have been appointed, and have taken upon themselves the burden of their offices, and it is then or-

ganized for the purposes authorized by the law of its creation. It is necessarily organized for all of its lawful purposes, because until organization it cannot, from mere incapacity to perform any corporate act, abdicate or surrender any of its franchises. Whether it could lose by mere non-user or abdicate or surrender any part of its franchise, after organization, was not a question of any moment in this cause. Neither the loss, or surrender of franchises granted, nor the usurpation of others not granted, could change the fact that this corporation was organized for the purpose, among other things, of making purchases and sales of investments in the securities of other companies, and the Westinghouse Electric & Manufacturing company could not, therefore, be said to have been organized exclusively for manufacturing purposes, and hence was not entitled to the exemption from taxation desired. But it could not have this exemption, part of its capital stock being invested in patent rights that were not taxable by the state, a patent right being a privilege emanating from the federal government, with which the state cannot interfere, neither was it taxable in Pennsylvania upon that other portion of its capital stock which was invested in manufacturing plants situated in New York and New Jersey.

Chicago Electric Club.

Following the presentation of Mr. Willis' paper on compound winding of generators before the Chicago Electric club, November 21st, an interesting discussion took place, of which the following is a stenographic report:

GEORGE CUTTER: Some years ago I had realized some of the difficulties that Mr. Willis has mentioned in his paper, and that with a machine which is compounded for a certain percentage of drop in its circuit, it cannot be taken for granted that it will always give the right voltage at the lamps under different conditions. The suggestion appears to be rather a good one to vary the series windings of different machines running in multiple, according to the number of those machines that are left in multiple, if mechanism for doing this is not found to be too complicated.

L. A. FERGUSON: Mr. Willis spoke about the inability of two or more over-compounded machines, running in multiple successfully, and suggested a method for overcoming that difficulty. I think that most of the over-compound machines are built with a fixed shunt on the series field. There is one machine, however, the Edison, that is built with a variable shunt on the series field, and two or more or any number can be run in multiple and still take care of the variable load and maintain the proper pressure at the center of distribution. The machine takes care of the load very nicely when one machine is running. The shunt on the series field is arranged to give nine different resistances while the machine is in operation, so that it is possible to take care of almost any change of load and maintain proper pressure, even when one machine is running, although it has been adjusted beforehand for two or three or four or more machines in multiple. I think the statement that Mr. Willis brought out that over-compounded machines are expected to do a great deal more than they can do, is very true; and part of the lack of success in the use of over-compound wound machines has been due to the attempt to do more than the machine could possibly take care of. Beside the variable shunt on the series field, there is another method, however, which can be resorted to; I don't know whether it has ever been tried or not, but there is no question of its success. I have not had occasion to try it, as I have always used the variable shunt on the series field. This method is to divide each pole of the feeders into a number of parts. For instance, take a fourteen or sixteen story building, such as we have in Chicago, wired for say 2,000 lights. Probably the method of wiring the building would be to use a feeder system which would give the most even distribution of pressure. Say that you run a main from the basement to the top floor of the building, with feeders at two points, say the fourth and ninth floors; this would furnish an even distribution of pressure without varying the size of the wire too much. We will assume such a case, arranged say for 1,000 lights on each feeder. That would take a 400,000 circular rail cable, which would have to be made in the east; nobody carries it in Chicago, and as a rule when you want to buy your wire you have to place your orders two or three weeks ahead in order to get it, and most contractors have so much on hand that they cannot place orders that far ahead, so that it is a natural thing to put in several 00 000 or 0000 wires, which would increase slightly the cost over using the large sized cable. We will divide each pole into three or four parts, say three parts. That will give you three number 00 B. & S. wires. Suppose you put a switch in each one of those wires, and then have one, two or more dynamos all running in multiple, with their fields adjusted for a 5 per cent. loss. As Mr. Willis said, each machine takes its share of the load, and each machine is over compounded to deliver under the full load the proper pressure, 5 per cent. above the pressure under no load at the terminals. When the machine is running alone of course with its full load it would generate five per cent. more at its terminals than under no load, and the pressure on the system throughout the building would be too high on account of the reduced loss due to the light distributed load. Now if you simply cut out one of the wires, or two of them, in each feeder then you will get five per cent. loss, and will deliver the proper pressure at the center of distribution, and your machines will not have to be changed at all.

MR. WILLIS: I do not think any great difficulty is experienced in isolated buildings with any difference in potential of the lamps caused by cutting out machines, because in isolated buildings the loss is usually so low that it does not cut very much of a figure. But when we come to transmission over considerable distance where we have 10 per cent. loss or more, then of course splitting up the feeders would create additional expense in construction, would it not?

MR. FERGUSON: It would not create additional expense except the additional cost of switch-board connections and two small wires instead of one large one, and that does not amount to very much. Of course you would have the same loss in the line at all times, and when you were running under light load you could not take advantage of the light loss which you would naturally have otherwise. It would be better to design the machines with variable shunt on the series field. But if you have a standard make of machine whose series field you cannot vary without going to expense, that is simply another method of getting round the difficulty.

MR. WAITE: I don't know whether the curve shown by Mr. Willis was intended to reflect on the series machine, but it may be said that almost all the factors there would apply to any other machine as well. That is, the belt creepage would affect a shunt machine and the engine speed and the heating of the dynamo would all affect a shunt machine. Now, the belt creepage of course you would not be likely to have in a direct coupled machine in a small isolated plant, and that could be done away with altogether, and the engine speed would be something, of course, that was entirely unaccountable and likely to drop. But these things can hardly be laid up against the compound machine.

C. G. ARMSTRONG: I have had some experience with a thing which is going to disturb us a great deal in our voltage, and that is the electric elevator. I find that the crying need is not so much for a compound wound machine as it is for a compound wound engine. You can get the dynamos all right, but you must have an engine to drive it that will stand the work varying from no load to 50 amperes or 80, and after two or three minutes no load, and then back to 250 amperes again; this is repeated a half dozen times every minute. We haven't found an engine yet that will stand it. Generally speaking, even with a large Corliss engine, having a very heavy fly-wheel, one electric elevator will reduce the pressure on a 220 volt system eight volts. I do not know how this can be avoided unless it is with a large number of very heavy fly-wheel engines to be used in that kind of service. This service is growing very rapidly all over the country, and is one of importance. The compound wound machine as compared with the shunt machine is a necessity, of course in that case, and compound wound motors assist very much. But with everything the best that modern science can furnish, I find that we have to sustain a loss of from five to ten volts when the elevator cord is pulled.

ALEX. DOW: I observe in this chart, as I have observed in other cases, that the drop due to heating is not, as you would suppose, proportional to the load; but in the ordinary commercial dynamo reaches its lowest point somewhere about three quarters load. I have not heard a good explanation of that, and I would like some one who is thinking of such matters to figure out what it is. I have an idea that at a certain point of load the heating extends so generally to the iron of the dynamo that the value of the radiation goes up. I have noticed the same peculiar bend time and again in the heating, curve that it goes down, and that its lowest point is not full load. Now about the engine. I fully appreciate the remarks made by Mr. Armstrong, that we want an over-compounded engine. I endorse everything he has said on that subject. I have tried every one of them, and I don't know one that will stand such work and keep its speed. I think that we are too much dependent, in American practice, on the constant speed engine with shaft governor, and that it would sometimes be economy to have an engine in which the speed was variable by hand. It would not do to have the engine dependent upon hand regulation, but it would be very good if we could have an engine in which we could adjust the speed, say 5 per cent., and which would stick wherever it was put. If it were set at normal would stay at normal; if it were set at 2 per cent. high it would stay at 2 per cent. high. I have figured on half a dozen combinations of governors to work with. I cannot figure any on the shaft governor because it is not accessible. With such an engine it would not be necessary to resort to a rheostat or the cutting of feeders; we would simply raise or lower the speed a trifle as a higher or lower electromotive force was required. In regard to the operation of compound wound dynamos in multiple with one another, and the effect produced by cutting out one or two more of the set, there has been quite a little figuring done to obtain a device to meet the requirements of these cases. This one, of which I will give a diagrammatic explanation, is due to Mr. Field, I think, of Brooklyn, or some one of the Brooklyn-Edison station. It is not used there to compensate for cutting off dynamos, but to compensate for loss in a long feeder, but it is applicable to the first named case. Assume these [indicating] to be the bus bars, assume that you have a machine here [indicating] and another machine here. Assume that these [indicating] are your machine bus bars, not the feeder bus bars. This arrangement exists in a good many large stations. Let there be connected one conductor going to the feeder bus bars [indicating], a small dynamo, series wound, driven by a closely regulated engine. Let your dynamo be so proportioned that its electromotive force will be practically proportioned to its current. The current will depend upon the output of the station, because the whole output of the station goes through it. Of course such a dynamo will not have a high weight efficiency. It will be necessarily worked on the straight part of its characteristic, as after it goes past the knee of its characteristic, it won't regulate. But by putting in plenty of good iron, and by keeping armature reaction and armature resistance small, such a machine would compensate for feeder drop by raising the voltage exactly in proportion to the total output. I think you will see just what it is. It is used at Brooklyn on a long feeder. I should be driven independently of course. The Brooklyn machine was driven by a motor, from bus bars. Here is another [indicating]. In this drawing I must show the fields. Two machines, working on bus bars; their fields are separately excited by the same exciter. The total current of the station is sent around a series coil on the fields of the exciter. That is one of the prettiest schemes I have ever seen. It means that a very few turns on the field of the exciter will compensate thoroughly. Here [indicating], instead of running the whole current through a series machine, you run the whole current around the series winding on the exciter and raise the voltage of the exciter and

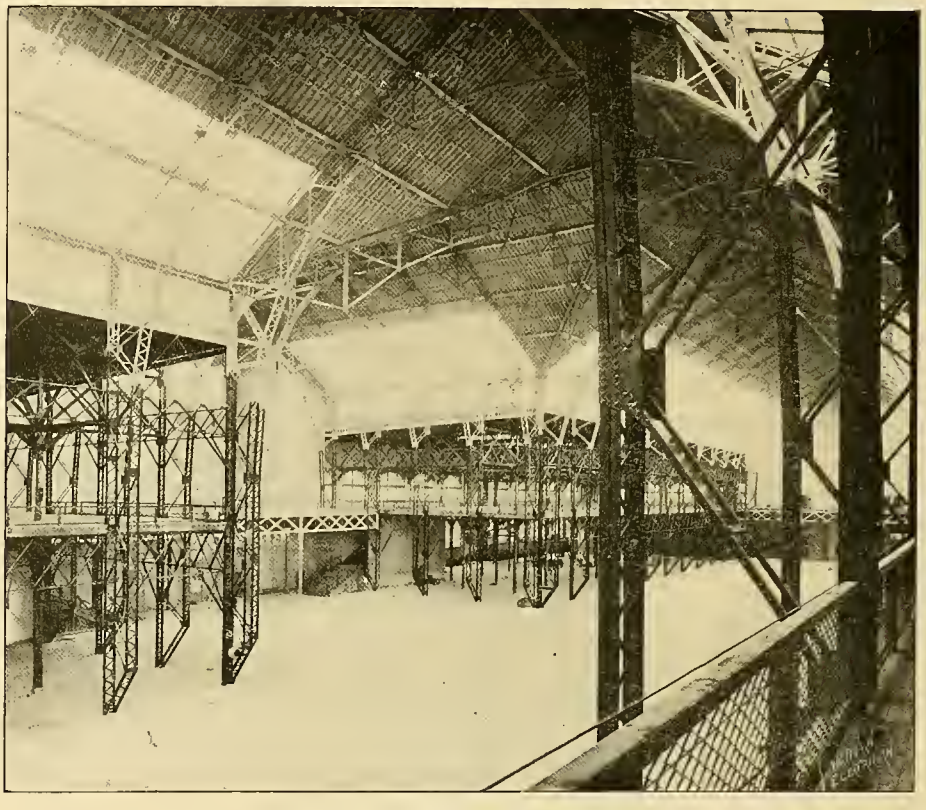


FIG. 2. ELECTRICITY AT THE WORLD'S FAIR.

therefore of the dynamos. This is patented by Mr. Sellon or Mr. Morde of England, I don't know which.

This one that I will give you now is not patented. It is only applicable to two machines. I published it some time ago, not as applicable to this particular case, but it will serve this purpose very well. Part of the rise of electromotive force on the over compound wound dynamo is due to the shunt winding; it is not at all due to the series winding. The shunt winding is connected either to the brushes or to the terminals of the dynamo, and therefore the rising voltage of the dynamo affects the shunt winding. Now the relative value of the series winding and the shunt winding of a compound wound dynamo differs very much with different manufacturers. In general you may say

FIG 1. ELECTRICITY IN JAPAN.

that the ring armature machine has more series winding and less shunt; the drum armature the other way. But taking the run of commercial machines, you may say that half the increase of potential is due to the increased current in the shunt and the other half to the current in the series. If you can so arrange your shunt that the current in it will not increase, the dynamo will not over compound to the same extent. Assuming that the shunt winding is reponsible for half the increase of potential, cutting off its effect will reduce the over compounding one-half. Now if we have two machines running in multiple on a system adjusted for the output of the two machines, and it is desired that the overcompounding shall be reduced to one-half, when one machine is cut-off, you can do that by arranging the same switch that throws your first machine off to transfer the shunt winding of the remaning machine to your lamp mains, which are presumed to be kept constant. The value of the shunt winding will therefore be constant and the machine will over compound just half as much as it did before. I have tried that with a machine which was built to compound 10 per cent., and the resulting compounding was 6 per cent., which was close enough to give me the result that I wanted. I believe I got mixed up with compound machines as early as any one, or very nearly as any one who has spoken here to-night. I started in as an enthusiast in compounding, and was made so thoroughly sick of it in the first six months' work with badly governing engines that I very nearly declared that there was no good in compounding. I very thoroughly appreciate Mr. Willis' conclusion that too much is expected of these dynamos, and thank him for drawing the attention of the electrical public, and above all others the people who draw specifications for plants, to the fact that a compound machine is not going to regulate unless there is absolute regulation of the engine and absolute suppression of belt creepage behind it.

F. B. BADT: The question has been asked a good many times: Suppose the conditions are such that we cannot have perfect regulation of engine or water wheel, say within two per cent., which is the better dynamo to use, compound or shunt—or the compound with shunt separately excited by separate power?

MR. DOW: I have been trying for four years, for the benefit of salesmen, to answer that question with a general formula, and I have not answered it yet. Because the very next case that salesman runs into is one that don't fit the answer, and then there is trouble, and I have to straighten it out.

LEIUT. BADT: Let us take the case of an electric street railway station operated by water power in which overcompound generators are connected in multiple. Say each of the generators is driven by its own turbine wheel; all the machines are self-exciting. Then in a case of that kind, just when we have the maximum load, we usually have the minimum voltage because the turbine wheel slows down in speed and the governor doesn't govern. Now I tried the following experiment: I disconnected all the shunt fields of those dynamos and had them all connected to a separate exciter, and had that exciter on an independent water wheel. Now the independent water wheel always had a steady load and all the shunt fields of the various dynamos, were excited all the time up to their standard. I had a turbine wheel, running at an absolutely uniform speed. I had all the shunts of the various dynamos excited fully at all times, the variations of the external circuit would not kick back in the shunt fields. I found that 50 per cent. of all troubles were eliminated by making the compound machines simply generate their own current in the series windings; but have the shunt fields excited by an independent source, by an exciter run by an independent power.

In the case that Mr. Armstrong mentions, I should think that such an arrangement, while it would notreme dy the thing entirely, would help it greatly. In the case where he had steam power, he would have a separate engine run the exciter for the shunt fields of all his compound machines. I think he will find that his voltage will vary less by 50 per cent. than where the compound machines are self-exciting. I did it the first time about four years ago, when the thing suggested itself to me, and I know that in many large railway stations the practice has been adopted.

MR. DOW: I am glad to hear that Lieut. Badt was able to find a water wheel running presumably in the same flume and in the same tail race as his general wheels, and running at constant speed. I can't make a flume self-regulating. The fluctuations of one wheel seem to affect the others, reduce the head or increase the tail.

LIEUT. BADT: Well, It didn't in this case, because there was plenty of water. The wheels were not common turbine wheels, but what are termed vertical wheels, each connected directly with shafts, not belted or geared.

MR. DOW: Is it not possible that the regulation of a water wheel might be approximated to the regulation of a steam engine by the introduction of the same principle which makes the single valve engine govern so closely, namely, compression? You know, of course, that a four valve engine does not govern as closely as a single valve, The exhaust valves are set for constant compression, whereas in the single valve engine the governor regulates not merely by the cutting off of the steam, but also by compression. Now the equivalent of that in a water wheel would be to arrange the governor not only to cut off the water flume, but to choke up the tail race. I think it could be done, and I think it would be a good way; because the momentum of the water in the tail race is not a circumstance to that in the flume, as a rule, and therefore you haven't as much inertia to handle by means of your gates.

LIEUT. BADT: I know of one water power station where things were in such a condition that they could not get anything like uniformity in the exciter, and there they put in a small engine to run the exciter, where all the big dynamos were run by turbine wheels. Up to the time when they made this change the electric system was a failure; when they commenced to excite the dynamos separately it was a success.

MR. FERGUSON: A few days ago we put in the same apparatus which Mr. Dow has explained, at the Twenty-seventh street Edison station, Chicago, and it is running now and works splendidly. We have a feeder running from Twenty-seventh street to Sixteenth street, and from there long mains were run to Harmon Court, on the Lake Front park. Our business got ahead of us on the north end of our system, and in order to bring the pressure up there as much as we could without increasing the prussure on the bus bars too much, and thereby burning out the lamps in the other districts, it would cost $40,000 for copper and labor. So instead of spending $40,000 for copper we bought two Edison motors, belted them direct to two series Edison dynamos especially built for the purpose, each for 25 volts and 300 amperes, and put them in direct circuit with the feeder, and as a result we brought the pressure up so that we had as good pressure there as we had anywhere else in the system without increasing the bus bar pressure.

Electricity in Japan.

BY KUNIHIKO IWADARE.

The first electric lights ever used in Japan for practical purposes were Edison incandescent lamps installed in a cotton mill in the city of Osaka some time in 1885. Installations made by the Manchester, Edison (Mather and Platt), Siemens and Halske, Thomson-Houston, Edison-Hopkinson, Brush and Westinghouse companies followed rapidly. Still the total number of lights in isolated plants does not exceed 30,000 16 candle power lights, or their equivalent in lamps of larger or smaller candle power. Almost all these lamps are used in cotton weaving and paper mills, where no other mode of illumination is permissible. Ship-yards, iron works, foundries and other factories have not yet adopted electricity for their illumination to any extent, though a tendency in this direction is lately perceptible. Houses in this country are mostly two stories high and not large enough in their extensions to warrant the use of isolated plants. The Imperial University in Tokio, consisting of law, science, literature, engineering, medical, military and naval colleges, a few private houses in Tokio, and one or two hotels

FIG. 2. ELECTRICITY IN JAPAN.

in Yokohama, seem to be the only buildings lighted by solated plants.

The city of Tokio had the honor of having the first electric light station in Japan. This was completed in December, 1887, and the Edison three wire incandescent system and the Brush arc system adopted. That station then supplied current to the imperial palace, where there were 2,000 incandescent and 40 arc lamps; in addition there were several hundred lights in stores and private houses, and everything seemed promising. Other cities did no

hesitate to follow the example set by Tokio; they organized electric light companies and started central stations, all built on the direct current three wire system. It was in May, 1889, that a company in Osaka deviated from the usual track and started a station using the alternating current system. At that time almost all electrical engineers in Japan believed in the direct current system of distribution and they attacked the system vehemently.

In January, 1890, both Houses of Representatives in Tokio burned down. The origin of the fire could not be learned, but electricity had to take the blame for it. This was the first obstacle in the way of the development of the electric lighting business in Japan. The second and more serious one was the business depression in general the same year, and from which Japan has not entirely recovered yet. Nothwithstanding these difficulties twelve electric light companies were formed from December, 1887, to December, 1891, with the nominal total capital of $2,500,000 (silver), although not much over $1,700,000 has been actually paid in. Two companies are now exclusively using the direct current system, five the alternating current system, and the remaining five both the direct and the alternating current systems. There are now seventeen stations running about 40,000 incandescent and 300 arc lamps. All these stations are operated by steam. They all use the overhead system. The charge for one 16 candle power light from dusk to midnight for a month varies between 70 cents and $1.25. The cost of coal per ton ranges from $1.75 to $3.50 according to locality.

The engines used in these stations, with one exception, are of the high speed automatic cut-off type. They are of the Armington & Sims, Straight Line, Woodbury, New York Safety, Buckeye and Westinghouse makes Boilers are mostly of the multitubular type and only two stations tried water tube boilers, but unfortunately they did not give good results with respect to coal consumption, probably due to inefficiency on the part of firemen.

Nine companies out of the twelve electric light companies now in existence declared dividends, mostly between 2 and 3 per cent., for six months from January to June of this year, and only one or two 5 per cent. In Japan the usual rate of interest for money invested in most enterprises is 10 per cent. per year, and if a certain class of business does not pay 10 per cent. or over per year, people do not usually take it up, and that is the main reason why more electric light companies have not been started. However, since the early part of this year, all electric light companies were busily engaged installing a large number of additional lights in stores and private houses and some are increasing their station capacity so they will be able to declare the usual 10 per cent. dividend per year pretty soon.

The illustrations herewith presented show one of the central stations owned by the Osaka Electric Light company, which is the most successful electric light company in Japan to day. The station is a brick structure and is near a river; only one-third of the proposed building is now finished. This is now all fitted up and some time next year the second part will be built, leaving still one-third unfinished. The dynamos are exclusively of the Thomson-Houston type; engines and boilers of the Woodbury Engine company's make. The company has about thirty-five miles of pole line in the city and furnishes current for 10,000 incandescent and 100 arc lights. Fig. 1 shows the exterior of the station, which is certainly an attractive structure. The interior views, Figs. 2 and 3, give an excellent idea of the dynamo room.

The electric motor business has not been thoroughly exploited in Japan. There is only one central station—that in Kioto. It is owned by the city, and started for electric power business only; they have a water power amounting to 2,500 horse power, the head being 115 feet, but they are now utilizing only 400 or 500 horse power out of 2,500 horse power. They constructed a canal between Kioto and Lake Biwa, the largest lake in Japan; the canal is about fifteen miles in length and cost $1,600,000 (silver); it was constructed for the transportation of goods by water from Biwa to Kioto. The water in the canal is utilized for power purposes near Kioto, and therefore when boats from Lake Biwa arrive near the power station, they are set on cradles and allowed to slide down an incline of 1,500 feet overland. The cradles with boats are moved up and down by a 50 horse power electric motor; when the boats arrive at the foot of the incline they float again in the river, which takes them down stream to the city of Osaka, whence the goods are shipped to any part of Japan or to foreign countries by ocean steamers. In the power station there are Pelton water wheels. Edison 500 volt power generators and Thomson-Houston alternators are used, the latter being devoted to lighting the city of Kioto. They have been lately contemplating long distance power transmission in order to get a larger market for their power, which is now partly wasted. The intention is to use the alternating system and step-up and step-down transformers. They are now supplying electric power to cotton and weaving mills and some factories by means of Sprague, Edison and Thomson-Houston motors. They sell electrical power delivered at the motor shaft at the rate of $30 per horse power, for motors below 100 horse power, and at the rate of $2,200 (gold) per unit of 100 horse power per year for motors above 100 horse power, working 10 hours per day.

In the city of Tokio an electric light company is now running six motors of the Sprague type from an Edison 125 volt generator, the total horse power being 26 horse power. These motors are installed in newspaper offices for running printing machines. Kioto and Tokio are the only places where they run motors from central stations.

As to isolated power plants, some mines are running generators of the Siemens & Halske, Thomson-Houston and Edison types for pumping and hoisting, and the total horse power would be somewhere between 250 and 300 horse power.

An experimental railroad less than a mile in length with a few cars was built in the Uyeno Park in the city of Tokio, when the national exhibition was held there in the summer of 1890, but it has been discontinued since that time. However, the Thomson-Houston, Brush and Siemens & Halske companies are working hard in the field there and they will have some electric railroads before long. The conditions in the cities are unfavorable on account of the narrow and crooked streets. Electric railways will probably be first installed between cities on special roads, as the country roads have too steep grades and too many sharp curves.

FIG. 3. ELECTRICITY IN JAPAN.

A refinery was started about a year ago in the city of Osaka, owned by the Imperial household department, with a capital of $500,000 (silver). This company refines principally gold and silver bullion and crude copper, mostly obtained from government mines. Everything about the concern is kept secret. It is said that German dynamos and a patented system is used for the electric process.

French Prizes for Inventors.

The French Society for the Encouragement of National Industry has offered a number of prizes to stimulate investigations which may lead to discoveries of value in the industrial world. At least three of the prizes are of interest to electrical workers, and the following statement of the reasons which led the society to propose the awards is condensed from its bulletin.

A prize of 2,000 francs will be given for discoveries of means for the industrial preparation of ozone, and for methods of applying it. Ozone has an oxidizing power that may be compared to that of chlorine. It acts upon silver in a cold state; it disintegrates a vast number of organic substances; it is a bleaching agent; it is a disinfectant—in fact it possesses all the advantages pertaining to chlorine as an oxidizing agent, while at the same time its use is not subject to the same disadvantages. If there were discovered a means of producing ozone economically and means of preserving and using it readily, the agent could be used to great advantage; for after it has acted upon organic substances, ozone leaves them neutral, whereas when chlorine is employed hydrochloric acid is formed, which must be neutralized. The prize is offered for the full solution of the problem of production, preservation and application, but the society may deem it wise to reward those who have made honest efforts to throw light on any branch of the subject. The prize will be awarded in 1895, and all manuscripts must be submitted before January 1st of that year.

A prize of 3 000 francs is offered for the discovery of a substance which shall be a thoroughly satisfactory substitute for gutta percha in one of the principal applications of it or for results which shall develop the production and cultivation of gutta percha. This gum was introduced in Europe in 1847, and its use has been greatly extended from year to year. It would be practically impossible to enumerate the varied list of articles into the manufacture of which the gum enters. It is used in great quantities for insulating purposes and it is absolutely essential in the construction of submarine cables. The production has by no means kept pace with the demand. Cultivation was not conducted intelligently in the restricted region in which the gum can be produced, and little by little the trees have been thinned out. Gutta percha of the quality which could be once readily obtained, and which alone is suitable for the principal uses, is now scarce. In spite of an increase in price there are only to be found mixtures of the same appearance as gutta percha but forming by no means a satisfactory substitute. The manufacture of submarine cables has suffered the most by this deterioration in quality, and it has been feared that the industry may be seriously embarrassed on account of it. Engineers and scientists have been sent out to study on the spot the conditions of production and the means of developing it, and of acclimating the tree in a French colony. Their investigations are interesting as far as they look to the future, but there seems to be no immediate solution, as a number of conditions combine to make the culture of gutta percha very difficult and laborious. Inventors, on their side, have attempted to produce a substitute, but their efforts have thus far given uncertain results. The Society for the Encouragement of National Industry proposed the prize to attract public attention to the matter, and it purposely gave wide scope for competition. It is attainable not only by inventors who may offer a substitute but by savants or explorers who by investigations may develop the production or improve the cultivation.

A prize of 2,000 francs is offered for an apparatus or a process by means of which it will be possible to measure rapidly the insulation of the different parts of a live electrical installation. For a long time instruments of various forms have been employed to determine the variations of potential at the terminals of generators, and the quantity of current, and thus the output of the machine. Meters serve to denote the consumption, but there is another element which is of great importance both from the point of view of economy and that of safety in operation. This is the insulation of the conductors, of the apparatus, and of metal that is brought into use. Instruments used in telegraphy or in laboratory experiments for measuring insulation resistances are either too elaborate, too delicate or too slow in action. Indicators used in the best equipped central stations are available only for showing a serious fault when it is too late to remedy it. A device or a proc

ess by means of which it will be possible to determine or measure accurately and rapidly the insulation of different parts of a system (dynamos, wires and feeders, transformers, etc.) will meet a real want. It can contribute largely to the development and safety of electrical industries if it can furnish means of preventing wasteful leakage which diminishes the output of a station, and can remove a cause of danger which is serious in stations operating with high tension alternating currents.

The last two prizes are to be awarded in 1893, and all contributors must submit documents before January 1st. The article from which these statements are taken appeared in a recent number of *L'Industrie Electrique*.

Electric Lighting in the Saint Cyr Military Academy.

The electric light plant at the military academy at Saint Cyr is regarded as one of the most successful of the smaller installations in France. A view of the station is shown in Fig. 1. As will be noticed from the cut, Fig. 2, the engines and dynamos are coupled direct and the results have been more than satisfactory. From the point of economy it is stated that the plant has been remarkably successful. When the plant was first installed the cautious engineers deemed a battery of accumulators an essential adjunct, in order to insure absolute reliability, but after two years of continuous operation without breakdown or interruption the plant was considered sufficiently reliable and the purchase of accumulators was abandoned.

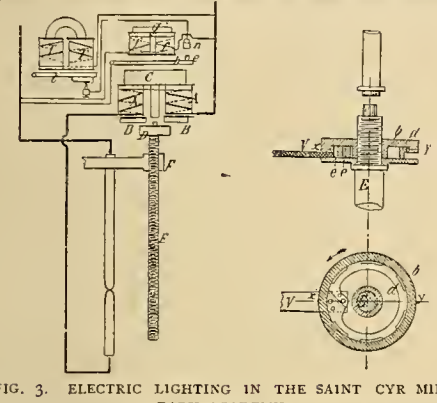


FIG. 3. ELECTRIC LIGHTING IN THE SAINT CYR MILITARY ACADEMY.

The engines, which are three in number, are compound and are rated at 65 horse power each. Connected to each engine shaft is a dynamo of the Manchester type made by Sautter, Harle & Co., of Paris, of a capacity of 500 amperes at 75 volts.

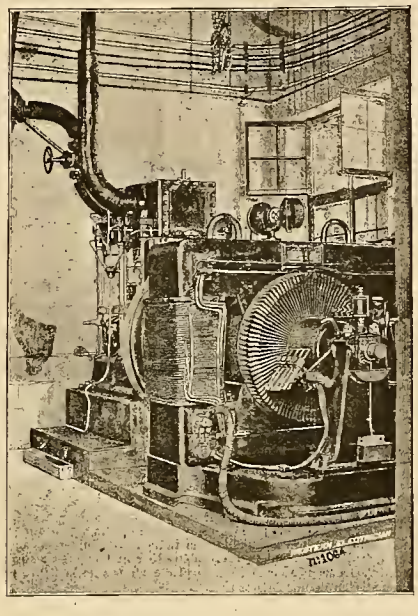


FIG. 2. ELECTRIC LIGHTING IN THE SAINT CYR MILITARY ACADEMY.

There are used in the plant 730 incandescent lamps and 72 arc lamps designed for the incandescent circuit. The latter were made by Sautter, Harle & Co., of Paris. The principles upon which they operate is shown in the diagram, Fig. 3. When the current is switched on, it enters by the positive terminal, passes through the two carbons, through the electro-magnet A, and leaves by the negative terminal. The separation of the carbon is effected by means of the electro-magnet as a result of the action of the soft iron disk D, which lifts the upper carbon. Regulation is produced by means of the electric motor T, which is controlled by a very sensitive relay f. The latter causes the motor to act, and interrupts its action when a proper separation of the carbon is established. The relay is in shunt to the main circuit; its armature is subject on the one hand to the attraction of the electro-magnet A and on the other hand to that of the electro-magnet in f. When the carbons are separated to the proper distance the armature is in equilibrium; when the arc becomes too long the electro-magnet f exercises a greater attraction than A, the spur E strikes against the contact n and current flows into the motor T which acts to operate the mechanism for separating the carbons.

The distribution of light in the study halls was considered with especial care. The best results have been secured by using arc lamps arranged in a somewhat novel manner. The plan consists in projecting the rays of the lamps upon the ceilings and upper portions of the walls. The light is then reflected downward and is so diffused and uniform that no shadows are cast. In order that the best use of the light may be secured the positive carbon is turned toward the ceiling, and special screens are placed under the lamp, as shown in Fig 4. The light is said to be wonderfully uniform and soft and entirely satisfactory in the study hall. A fact which the students notice is that when a pencil is held upright no shadow, practically speaking, is cast. The cuts are reproduced from *Le Genie Civil*.

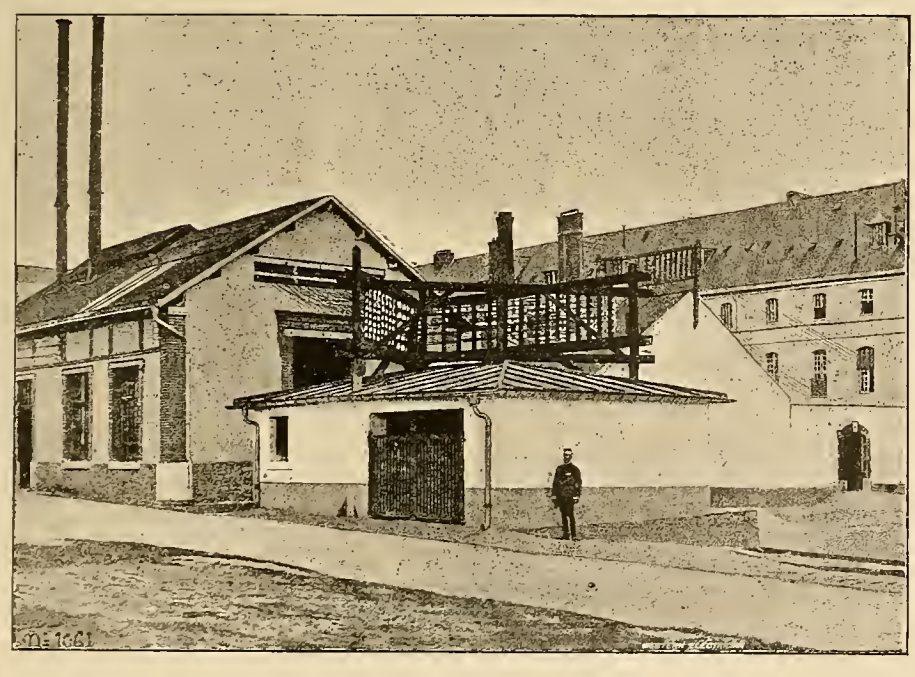


FIG. 1. ELECTRIC LIGHTING IN THE SAINT CYR MILITARY ACADEMY.

Electrical Work on the Pacific Coast.

A conference committee meeting, consisting of a special committee of the San Francisco Chapter of the American Institute of Architects, of the California Electrical Society, and Geo. P. Low as representative of the Pacific Insurance Union, was held in the rooms of the Fire Underwriters' Association of the Pacific at San Francisco on the evening of November 23, for the purpose of discussing the subject matter of a paper prepared by Mr. Low for the October meeting of the Underwriters' Association on "Electrical Impostors" and of devising means by which the ideas contained in it may be enforced. Mr. Low was selected as chairman, with H. T. Bestor, editor of the *California Architect*, as secretary. As the result of the deliberations, a resolution was adopted requesting the Electrical society to prepare a general set of specifications under which accessible wiring may be placed, and also to prepare a second set of specifications under which the wiring at present countenanced by safety requirements, and which is considered safe if properly inspected, may be placed. These specifications, when drafted, are to be submitted to the architects for consideration and revision, when they will be again returned to the conference meeting and formally adopted. It was the sense of the majority of the meeting that it would be inadvisable to endeavor to effect a radical change in existing methods of electrical construction, especially in localities under the surveillance of an electrical inspector, hence, the resolution proposes to countenance ordinary methods of wiring, as defined by existing insurance requirements, in any instance where they can be inspected by some electrician in good standing. This will necessitate the organization of an electrical exchange on the Pacific coast similar in its nature to the New England Electrical Exchange.

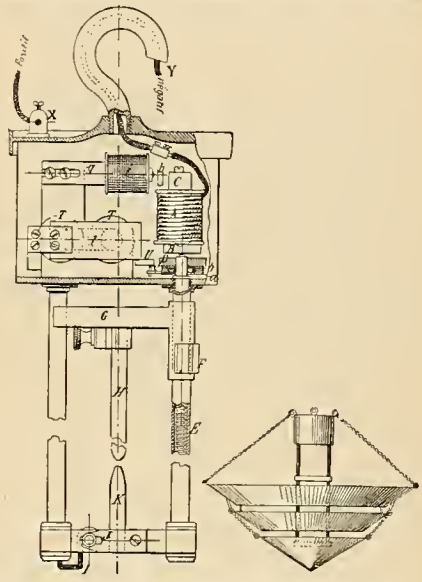


FIG. 4. ELECTRIC LIGHTING IN THE SAINT CYR MILITARY ACADEMY.

Death of Jay Gould.

Jay Gould, believed to have accumulated more money by his own exertions than any other American who ever lived, died on December 2d. He left a fortune, principally in stocks, estimated to be worth from $65,000,000 to $100,000,000. Mr. Gould was the largest stockholder of the Western Union Telegraph company, and at the time of his death he and his three sons, George, Edwin and Howard, were directors of the company. His holdings of Western Union stock had a par value of $22,000,000 and a market value of about $19,000,000. The funeral was attended by a delegation of Western Union officers, including Col. R. C. Clowry of Chicago, who was on intimate terms with the deceased.

A suit has been filed in the United States Circuit Court at Kansas City by the Kansas City Electric Light company against the American Electric Light company of Kansas City for $60,000, and against the Thomson-Houston Electric Light company and General Electric company for $150,000. The suits are for the alleged infringements of the rights sold by the Thomson-Houston company to the Kansas City Electric Light company for Jackson county, Missouri, and Wyandotte county, Kansas, of patent regulators for dynamos. The Kansas City Electric Light company, beside claiming damages to the above mentioned amount, asks the courts to enjoin the Thomson-Houston and General Electric companies from selling the regulator in Kansas City, and both the American Electric Light company and the Thomson-Houston from using the appliance in the two counties named.

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CORRESPONDENCE relating to electricity, or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

	PAGE.
Electricity at the World's Fair. Illustrated	293, 294
Large Lighting Contract	293
Taxation of Electrical Manufacturing Corporations	293
Chicago Electric Club	294, 295
Electricity in Japan. By Kunihiko Iwadare. Illustrated	295, 296
French Prizes for Inventors	296
Electric Lighting in Saint Cyr Military Academy. Illustrated	297
Electrical Work on the Pacific Coast	297
Death of Jay Gould	297
Editorial	298
The Baker Submarine Boat in Chicago Waters	299
Keep the World's Fair Open Evenings	299
Death of George H. Meeker	299, 300
Lundell Motors. Illustrated	300
Russell Automatic Switch. Illustrated	300
The Wirt Electrical Indicators. Illustrated	300, 301
Incandescent Lamps for Railway and Power Circuits. Illustrated	301

DEPARTMENTS.

Correspondence	301, 302 303
New Incorporations	303
Electric Lighting	303
Electric Railways	303
Trade News	303, 304
Business	304
Electrical Patents	304

OUR Milwaukee correspondent this week calls attention to the fact that since the adoption of the trolley system in the Cream City there has been a noticeable decrease in the number of fatal accidents on the street railways. The victims have been mostly old persons and children. The record covers a period of two years, and the company's manager claims that more accidents have occurred in that time on one old horse car line than on all the electric lines. This is certainly an excellent record, and goes far to substantiate the claims of the advocates of the trolley system that electric cars are under such perfect control that they are far superior to any others, especially in crowded city streets. This experience of the city of Milwaukee, which is, by the way, the experience of all progressive communities, may be considered with profit by calamity howlers who are opposing the introduction of the trolley system in other cities. The so-called "deadly trolley" appears to be a harmless device as compared with the slow-going horse car.

ELSEWHERE in this issue is presented an article on "Electricity in Japan," by Kunihiko Iwadare, of Osaka. In this article Mr. Iwadare gives an interesting account of the growth of the electric lighting business in the empire of the Mikado. It appears that the Japanese have already adopted the American custom of attributing to electricity any fires that cannot readily be accounted for otherwise. Naturally, this has had its effect on the industry, but according to Mr. Iwadare electric lighting is advancing in public favor. In a former article, which appeared in the WESTERN ELECTRICIAN of November 26th, the telephone and telegraph interests were reviewed by the same author. Here, too, the electrical engineer finds gratifying evidence of the progressive spirit of the Japanese. It should be mentioned that these electrical enterprises are conducted by native capitalists, and are in charge of native operators. The Japanese are progressive and enterprising, and the American people entertain a kindly and appreciative regard for them.

AN interesting controversy between the Boston city council and the West End Street Railway company has been in progress for some time. The council, under advice of the city's legal department, has virtually abandoned its position. The case in point illustrates the tendency on the part of city councils to take hasty action on matters with which they are not at all familiar. The Boston aldermen ordered the street railway company to equip its cars with fenders to guard against the loss of life. The company replied that it had had the matter under consideration for a long time, but had as yet been unable to decide upon any fender submitted. The council evidently considered this an evasive answer and ordered immediate action. The company thereupon agreed to accept any fender which the council might recommend. It suggested that a commission be appointed to examine the fenders submitted for consideration. The company agreed to pay all expenses and abide by the decision of the council. This proposition had the effect of silencing the aldermen and convincing the public that the company was acting in good faith. It is not expected that the council will accept the company's proposition, as it is believed the city would be liable for damages should accidents follow the adoption of the fender recommended by the city.

ON November 5th the WESTERN ELECTRICIAN called attention to the fact that the National Commissioners had adopted a rule providing for the closing of the World's Fair at 7 o'clock except upon certain evenings to be selected by the directors. In protesting against this rule on behalf of the electrical interests we pointed out at the time the injustice of the measure and called attention to the fact that such a policy was short sighted in the extreme, that it would be a source of annoyance to visitors and would prevent many persons of limited means from obtaining the full benefit of the great exposition. The position of the WESTERN ELECTRICIAN was sustained by the electrical interests of the country. Many prospective exhibitors announced their intention of abridging their displays, while others declared they would withdraw their applications for space and would make no exhibition of their apparatus. Chicago electrical concerns immediately filed a protest with the Council of Administration, and numerous interviews and communications expressing the views of electrical companies have since appeared in this paper. The unanimous opinion of the electrical people is opposed to the 7 o'clock closing rule. In addition the leading daily papers of the country have appealed to the directors to grant the petition of the electrical people. Despite this unanimity of opinion, the World's Fair officers have not seen fit to take action. All friends of the enterprise regret this apparent neglect of the electrical exhibitors' wishes. It is certainly unfortunate that there should be any delay in correcting this blunder. In a matter of such grave importance immediate action should be taken.

IN connection with the recently threatened strike of the telegraph operators on the Jersey Central railroad it was announced that the company had taken steps to protect itself, and, anticipating a "walk-out," had placed long distance telephones in its stations by means of which, it was hoped, the business could be continued without the operators. Whether there was any foundation for this report cannot be stated positively, but certain it is that the differences between the men and the company were soon settled, and there is reason to believe that the men did not secure the advance in their wages that was the principal point in dispute. Aside from the merits of the case it may be said that this incident has a certain bearing upon the future relations of the railroad and telegraph that will be of interest to the public generally and the electrical fraternity in particular. If it can be demonstrated that the long distance telephone can be utilized in railroad work as a substitute for the telephone, an important advancement has been made toward relieving the railroads of the periodical labor troubles they now experience. Such a change would be welcomed by the railroad companies on other grounds—mainly, however, on account of the saving that could be effected in the salaries of employes. There is no question that telegraph operators could be secured for this work at a less salary than is now paid telegraphers. Railroad telegraphers are poorly paid, if their responsibility and the importance of their work are taken into consideration. In many cases the companies employ boys who are utterly incompetent and unfitted for such positions. It may be that with the introduction of the telephone a better class of employes may be secured. If such were the case, the advent of the telephone in railroad operation would be hailed by the traveling public, but there is no good reason to believe that the desired improvement would follow.

SINCE the leading characteristics of the new Westinghouse incandescent lamp were first made public by an illustrated article in the WESTERN ELECTRICIAN the electrical fraternity has evinced the liveliest interest in the bold attempt made by the Westinghouse company to introduce a lamp not infringing on the broad claims of the Edison patent, as sustained by the Federal courts. The eager desire to obtain information about this new departure in electric lighting is shown by the extensive reproduction of the description and the accompanying cuts by the American and English electrical journals—generally with proper credit, but not infrequently without, the *Electrical World* and *Electrical Engineer* of New York being the most conspicuous offenders in this respect.

The comments made by the English papers are interesting. The *Electrical Review*, in the course of a carefully written review of the general description given in the WESTERN ELECTRICIAN, says:

> From a manufacturing point of view, which is of far more real importance than any mere legal rights and quibbles, there are several points which, at first sight, at any rate, appear to be in favor of the modified lamp; but there are also many "if's" requiring to be satisfactorily disposed of. In the first place it is difficult to see how new lamps of the above form could compete successfully against those made by the extremely simple and efficient method of "sealing in," in spite of the employment of a cheap substitute for platinum wire, and in spite also of the assertion that they can be sold for 30 cents each wholesale; for there can be no question that the new form is much more complicated than the present one. Once made, however, they possess some obvious advantages from an ideal point of view. In remaking a lamp there is at once an apparent gain of the cost of the bulb and platinum wire—indispensable items in making lamps by the customary method. (This is, of course, assuming that the double operation of removing and re-cementing the stopper costs the same as that of sealing in by means of the blow pipe.) This gain, however, is not strictly so great, for scrap platinum has a certain value; and then there has to be considered, the wholly additional operation of cleaning the blackened bulbs, requiring workshop space, chemicals, labor, etc. Still, if the bulbs and stoppers had a good average life, the advantage would be distinctly in favor of the stopper plan, other things being equal. But it is just on this point of the life of the bulbs that the economy of the plan rests, and on which we think there are some grounds for fear. One would be inclined to surmise that the number of fractures occurring at the stoppers, firstly in the act of fitting the stoppers, then when the lamps are on the pumps, next in actual use, and finally in the operation of removing the stoppers, would considerably exceed those due to defective "sealing in" in the customary form of manufacture. * * * * * In making the above remarks we have been assuming that the stoppers and cement give perfect satisfaction as regards permanence of vacuum. Naturally if leaks prove to be not infrequent the method under consideration would be at once doomed. The matter naturally rests entirely upon manufacturing results and general experience with the lamps, and we are glad to see that the problem is being dealt with in so exhaustive a manner as the Westinghouse company is sure to give to it. At the same time we cannot help think that the new plan is not likely to supplant the present one in the long run, excepting, perhaps, in the case of lamps of large candle power. With regard to the substitute for platinum, which is apparently capable of being soundly sealed into glass, the company is to be congratulated on a very valuable possession.

Our contemporary's assertion that the new lamp is much more complicated than the common form is surprising, as it has every appearance of extreme simplicity. The *Review's* remarks in relation to the greater liability of fracturing the bulbs and the cost of cleaning returned bulbs deserve attention.

Much more sweeping in his praise is Arthur Shippey, an English lamp manufacturer, who, in a letter to the London *Electrical Engineer*, has only good words for the new lamp. Mr. Shippey examines the lamp in detail, asserts that it is a very easy matter to clean blackened globes, and concludes by congratulating the Westinghouse company on "overcoming a difficulty by placing upon the market a lamp which is novel in construction, natty in appearance, cheap in price, and, above all, entirely free from the combination claims of certain master patents, the working of which has been unfortunately so detrimental to the real advancement of the electric lighting industry."

Generally, however, the English comments are of a conservative nature, the general opinion being that, with the information at hand, the non-infringement of the lamp is not quite clear.

The Baker Submarine Boat in Chicago Waters.

In May last the WESTERN ELECTRICIAN sent a representative to Detroit to investigate a submarine boat that was being tested there in the Rouge and Detroit rivers by its designer, Geo. C. Baker. An account of the trip made under water on this occasion and also a detailed illustrated description of the novel vessel and the story of its operation during the trial trip were presented in this journal in the issue of June 4, 1892.

Since the time referred to Mr. Baker has experimented considerably with his vessel. The government has shown a great deal of interest in it, Commodore Folger visiting Detroit to witness a test.

Several weeks ago Mr. Baker decided to bring the little craft to Chicago, his place of residence. Accordingly the boat was relieved of all its machinery, and towed over from Detroit to the mouth of the Calumet river at South Chicago.

Of course, the moment the boat was started for Chicago it immediately became an object of interest to the daily newspaper men and various and amusing have been the accounts of its working. For instance one description of the trip contained the following statement: "The strange craft escaped the force of the storm by lowering itself beneath the waves and coming to the surface from time to time for a fresh supply of air."

It may be said in this connection that at the time when this report was published nothing of the boat's whereabouts was known, except the fact that it was on the lakes. Furthermore, it is difficult to see just how a boat which was nothing but an empty hulk could "lower itself beneath the waves, etc".

On its arrival in Chicago waters the craft was towed to a ship-yard at the mouth of the Calumet river and there hoisted from the water so that a slight change could be made in the arrangement of the screws. While at its moorings at the ship-yard the storage battery, the motor and the electric pump which had been shipped from Detroit were re-arranged in the boat. This time, though, the boiler and steam engine were not put in. It was found convenient for present testing purposes to employ a small engine and dynamo on shore, and with these to charge the storage cells in the hold of the boat.

Since the boat arrived at South Chicago two tests have been made, and both of these bear evidence that the designer's faith in the practicability of his vessel has not been misplaced. The first trial was made in the presence of two United States ordnance officers. The trial on this occasion was not as thorough as had been expected. After having made two or three preliminary dives and short runs the little craft sprung a leak, which, unfortunately though slight, was just over the switches that controlled the motor. Rather than take any chances, therefore, it was decided to discontinue further experimenting until the leak could be repaired.

On Wednesday of last week, after the little craft had been overhauled and, it was thought, the leak stopped, another test was made. The day was one suited in every way for the trial, as there was no wind and the waters of the lake were smooth. A tug towed the boat down the Calumet river and out into the deep water of the lake, and the crew of the life saving station pulled out to witness the trial and to be on hand in case its services were required.

Mr. Baker took charge of the boat with T. H. McCarthy as his assistant and the WESTERN ELECTRICIAN representative as a passenger. Before testing its qualities as a diver the boat was given a short run on the surface. When the motor was set at work the vessel shot along through the water at a high rate of speed.

Those outside saw the lid of the conning tower fastened down and then after running a short distance the boat sank from sight and left not a ripple to show where it had gone. For several minutes the party on the tug looked in vain for some ripple or current which would show which way it was headed. Suddenly, like a huge red porpoise, it shot up out of the water, only to disappear again as soon as the helmsman had assured himself that he was in no danger of running into the tug, which lay a couple of points to port. The next time it came up within a few rods of the tug. The gaskets of the turret lid did not work satisfactorily and the boat shipped considerable water, so a stop was made to repair the damage. A few minutes' work effected a remedy and the turret was closed again. Some acid used in connection with the battery had on a previous trip slopped over onto the wire cable connecting the rudder with the wheel, and before the boat was well under way, this rope parted and another halt was necessary. This damage was soon repaired, and again the boat settled toward the bottom of the lake and made an excellent run.

Several times it was brought to the surface of the water and almost instantly disappeared again, always going through these actions in obedience to the hand at the helm. After behaving beautifully a seam forward started slightly, and this leak unfortunately was in the same place as before, that is, over the switchboard; and Mr. Baker, fearing that the water would do some damage to the electrical fixtures, decided to end the trial, and the boat was towed back to its berth at the ship-yard slip.

The experience of those on the inside was no novelty, as all present had gone through it before. The most peculiar sensations were those at the moment of starting to go under and on reaching the surface after a dive or run. Glancing up at the windows of the conning tower, just before the screws were inclined for a run under the waves, one could see the water rushing past the glass covered portholes and washing over the turret. Then, when the screws were thrown up at a slight angle by a movement of the controlling wheel, and more current was thrown into the motor, there would be an increase of the whirring sound of the gearing, and down the boat would go. One could look up and out through the gray water, growing darker and darker as the boat went deeper and deeper, but that was about all there was to see.

It was during the longest run, and at the time of the deepest dive, that the old leak over the switchboard was sprung again. It must be confessed that the solitary passenger's feelings were peculiar as the water began to run in and splash over the electrical apparatus. To say the least, the water was dark enough overhead to indicate that the boat was at considerable depth, and although the little vessel, through its own buoyancy, would have come to the surface, still a leak in a submarine boat, however slight it might be, is an occurrence of considerable interest. But the vessel was absolutely under control, and a turn of the screw wheel allowed it to return to the surface with a bound. This bound to the surface is what gives the peculiar sensation somewhat similar to that experienced in a swift running elevator suddenly brought to a stop.

Mr. Baker was thoroughly satisfied with the boat's showing. He proposes to make only one more trip this fall, but during the cold weather he will not be idle, as he has several additional features which he expects to have fully matured before spring, when the boat will be placed in commission again. The boat will be overhauled and provision made to prevent any further small but vexatious leaks.

Keep the World's Fair Open Evenings.

In view of the widespread interest that has been manifested in the agitation for evening exhibitions since the WESTERN ELECTRICIAN called attention to the effect of the seven o'clock closing rule, it would seem as if the council of administration would bestir itself and give some definite assurance of what may be expected. Nothing has been done, however, which may be taken as an official guarantee that the grounds will be open after seven o'clock. This apparent neglect of the electrical interest will tend to discourage exhibitors. The subject continues to excite comment in the daily papers and class journals, and there is an unanimous sentiment in favor of immediate reconsideration of the offensive rule. Following are a few additional abstracts from editorial comments on this question:

Street Railway Gazette, Chicago: The position which the directors of the World's Fair have been in the habit of assuming has been a curious one. Since the start their method of ascertaining the will of the people on any subject relating to the exhibition has been to take some outlandish position, and then to watch the howl of remonstrance immediately set up in every corner of the country. It would be too great a discredit to the common sense of the management to consider them capable of believing that the real wishes of the people demanded the transformation of this fairyland into a dungeon at sundown. To say that everybody is heartily disgusted with these unrivaled exhibitions of wire pulling and selfishness is putting it very mildly.

New York Tribune: Tens of thousands of visitors to Chicago next year will be compelled to keep a rigid account of expenses, and to make no slight sacrifice in order to be present at all. Their burden ought to be made as small and their reward as great as possible. If, as at earlier exhibitions, little or no part of the projected display required the absence of sunlight to reveal its utility and beauty, other considerations might offset the advantage of saving time by keeping the show open in the evening. But it happens that the class of exhibits which would be most injuriously affected if the gates were shut at 7 o'clock is precisely that class which will disclose the most remarkable development, and concerning which popular interest and curiosity are strongest. And so a double loss is threatened.

Electrical Engineer, New York: The question of opening the World's Fair at night has continued to be the subject of agitation and discussion. The management of the fair, having been invited to reconsider the rule closing the grounds every night at 7 o'clock, has done so, but its statements as to a possible opening two or three times a week are regarded as vague and unsatisfactory. What is wanted, and should be given, is an assurance that a portion of the grounds and some of the buildings, will be open regularly at night, including such buildings as electricity, fine arts, etc. The matter has been taken up by the newspapers, and in New York, the *Tribune* and the *Sun* have both expressed themselves in favor of night opening. In view of the immense success of night opening at Paris, in 1889, there is every reason to believe that regular night opening at Chicago in 1893 would be very successful and a great boon.

Street Railway Journal, New York: The recent announcement that the gates will be closed at 7 P. M., except on special occasions, has a particular interest. There is a multitude of weighty reasons for keeping the exposition open during the evening, and these arguments have been advanced by the press and public. We desire in this connection, however, to refer merely to the bearing which the hour of closing may have upon the transportation problem. Whatever may tend to facilitate the gradual movement of the people to and from the grounds is assuredly eminently desirable from the point of view of the railway man. If the gates were open until, say, 10:30, it is true beyond question that people would be starting cityward three hours before that time. On the other hand if the closing hour were at seven o'clock, certainly a vast majority of the people would be inclined to remain until that hour. All the conditions that lead to a congestion in traffic would be present. Here is a point which seems to be well worthy of the attention of the exposition management.

Kansas City Architect: It has been suggested by some of the World's Fair managers that the fair be closed at 7 o'clock every day. Now, this would be well enough were we not living in an age of wonderful development of electrical energy which produces not only power but light. To properly show the wonderful achievements of the past, it is necessary to show the production of light, heat and power; without the aid of the machinery it will be impossible for the many electrical exhibitors to properly show the results of their researches and usefulness of their inventions. To do this properly the machinery must be run at night, when the most brilliant effect will be produced. To close the fair at 7 P. M. will therefore do a great injury to a large class of exhibitors. We do not for a moment believe that it is the wish or intention of the management, so we would add our voice to many others asking that at least the electricity building should be kept open between the hours of 7 and 10 p. m., thus giving the visitors an opportunity of witnessing this grand display of light at the proper time. The WESTERN ELECTRICIAN, with a view of feeling the drift of opinion regarding this matter, has addressed a circular to a large number of electrical goods exhibitors, who have joined in a protest against this new movement on the part of some of the management. Forty-seven exhibitors have written the WESTERN ELECTRICIAN to make the protest still stronger. We hope the protest will have the desired effect.

Madison, Wis., *Democrat:* The electric interests of the country oppose the closing of the World's Fair at 7 o'clock evenings. They contend that the electrical features of the exposition can be shown to advantage only at night, and that as the electrical department is one of the most important of the exposition, and one in which great popular interest has been manifested, it would be very poor policy to enforce the 7 o'clock rule; in fact it would, they believe, prove disastrous to the electrical display. In substantiation of their views they maintain that, with the grounds open in the evening, there will be an additional advantage that many persons will remain at the park for supper, and the throng will disperse more gradually than if all went home between 6 and 7 o'clock. This will greatly aid in simplifying the transportation problem—one of the most serious that the exposition authorities are called upon to meet. With all these disadvantages, they ask, why should the evening closing rule be adopted against the undoubted wish of the general public and in the face of the unanimous protest of the electrical fraternity? What is the reason? The only one that we have heard urged is the question of expense, but the experience of the Paris exposition in 1889 seems to demonstrate conclusively that the evening may prove far more profitable than any equal period of time in the day time. To the other reasons urged for nocturnal opening might well be mentioned the additional opportunity offered to the working classes to attend. This consideration would seem to be of greater importance than any other suggested.

Death of George H. Meeker.

George H. Meeker, western manager of the New York Insulated Wire company, died at his residence, 4758 Lake avenue, Chicago, on December 5th. The deceased had been ill only a short time, and his death proved a great shock to his numerous friends, who did not realize his critical condition. On November 26th Mr. Meeker contracted a severe cold while attending the funeral of his grandfather at Astoria, N. Y. He returned to Chicago and, although he had the best medical attendance, he failed rapidly. Complications of a serious nature set in, and it soon became apparent that recovery was not to be expected. Throughout his painful illness Mr. Meeker preserved the utmost composure, and only a few days before his death directed the disposition of his affairs. Mr. Meeker's wife survives him.

Mr. Meeker was born at Newark, N. J., and was twenty eight years of age. His first experience was gained in the rubber business, and for several years he was manager of a large eastern concern engaged in this line. About two years ago he came to Chicago as manager of the New York Insulated Wire company. He had been very

successful in this city and gained many friends. Mr. Meeker was a member of the Chicago Electric club, and took an active interest in the affairs of that organization. His death will be regretted by the electrical fraternity.

Lundell Motors.

In the accompanying cuts are shown the new Lundell motors which have just been placed on the market by the Interior Conduit & Insulation company of New York. This motor in general appearance resembles the Lundell fan motor but is of larger size. Fig. 1 gives a general

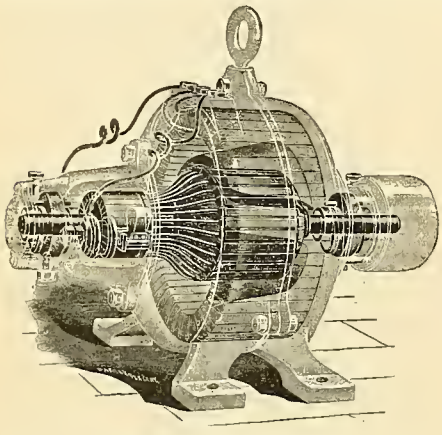


FIG. 1. LUNDELL MOTORS.

idea of the motor, Fig. 2 shows the field and pole pieces, while the armature and details of the brush holder are shown in Figs. 3 and 4. It is claimed for this motor that it contains many features that are not found in the smaller sizes; for instance, the increased dimensions permit the adoption of the cylindrical form and the placing of the field coil concentric with the armature instead of at an oblique angle. The concentric position of the field coil permits the withdrawal of the armature without disturbing either the field coil or the pole pieces, a very great advantage in large motors. A further modification is obtained in placing the commutator outside of the field magnet shell, but well protected between the two limbs of a broad and strong bracket. This change of commutator position is made for

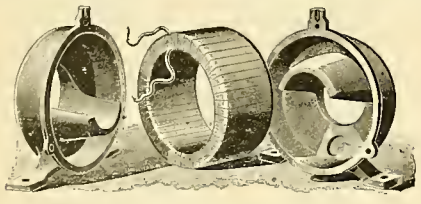


FIG. 2. LUNDELL MOTORS.

the purpose of affording ready access to the brushes and commutator. Both the commutator and brush holders are of superior design and workmanship. By reference to the illustration it will be seen that a flat clock spring section is employed to keep the brush in contact and does its work in a perfectly uniform manner, while its two ends are made to engage in their respective places in such a simple way as to permit of the renewal and restoration of a brush by the employment of the fingers only and in a second or two of time. The armature is substantially built, and combines maximum cross section with minimum length

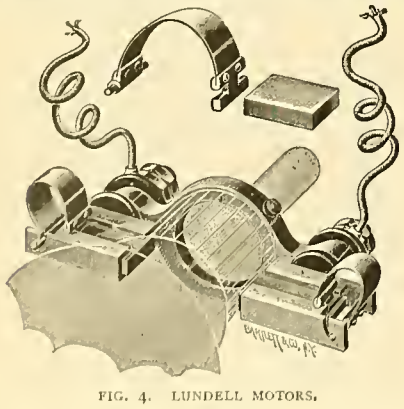


FIG. 4. LUNDELL MOTORS.

of wire. The bearings are likewise of a superior design and efficiency; they are self-oiling and are provided with a vision gauge by means of which a glance will suffice to indicate the necessity for a renewal of the oil supply. The bushings are made of the best material, and are so arranged as to be readily and quickly removed and renewed when worn out.

Russell Automatic Switch.

With the automatic lamp controlling switch shown in the accompanying illustration the inmates of a house need never be in the dark. By touching a button one can turn on the lights ahead or extinguish the lights no longer needed. The same light may be turned off and on from several different points. A person may have absolute control of any or all lights from any part of the house. A person coming home late in the evening can press a button on the outside of the house which turns on the porch or vestibule light, or both, and when inside all the lights on the ground floor of the house, or as few as desired, may be turned on or off. These buttons are collected on a neat metal plate finished to match the hardware in the hall. A similar plate, or any number, may be located in various places in the house to control the lights. It is not necessary that the push buttons be collected on a plate, but they may be small ivory or pearl buttons set in door casings at the entrance of the various rooms. Many combinations may be made. Stable lights may be controlled from the bedroom, bed-room lights from the hall, dining room lights and parlor lights from the kitchen; hall lights from bedrooms—in fact, lights can be controlled at any point from any one point or from any number of points. In case of any suspicion a householder can have every light in his house turned on. Wires can be attached to an ordinary clock and lights turned on and off automatically at any time desired. In a store or building the buttons can be on the outside, and the watchman when trying the door to

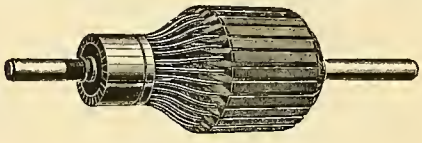
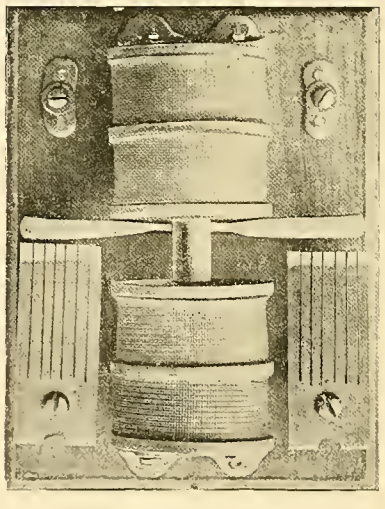


FIG. 3. LUNDELL MOTORS.

see that all is safe can turn on the lights inside for a moment, and with the same ease extinguish them. The system may be also used to automatically control an electric motor current from any number of different points.

The device is simple, consisting of two spools of fine magnet wire of a high resistance. These are connected on one side to the positive wire of the circuit through a push button, and though only a minute part of the current passes through them the large number of turns makes a strong magnet whenever the current is allowed to pass



RUSSELL AUTOMATIC SWITCH.

around the coils. By making a connection through one push button the copper bar, shown in the illustration, is drawn into the jaws of two hard drawn copper brushes closing the circuit to be controlled, and when the other button is closed the pull of the magnet is in the other direction and withdraws the copper contact bar, opening the circuit. The current on the magnet is only exerted as long as the push button is in circuit, and the action of the switch is positive and instantaneous.

The switch is in operation at the Chicago Electric club and in several other places in Chicago. Over one hundred are in use in Denver, Colo. The invention is owned by Russell & Officer of Denver, and the patent is controlled by Edward R. Grier of Chicago in the United States east of the Mississippi.

An Indianapolis paper says that the Jenney company of that city has been awarded the contract for a 3,600 incandescent and a 200 arc light plant for a large factory in Berlin, Germany.

The Wirt Electric Indicators.

The instruments illustrated herewith are designed to meet the severe condition of the most exacting commercial practice in electric lighting. The intention of the designer has been to produce an electrical measuring instrument without the faults of temporary or permanent variation, mechanical defects or imperfect design. The cases are similar to high grade steam gauge cases and have cast-iron boxes with heavy ornamental polished bronze rims.

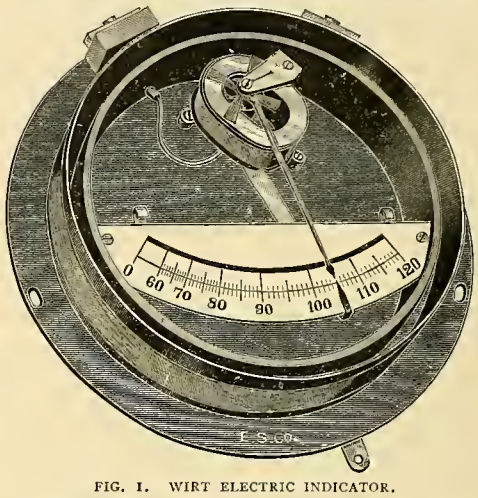


FIG. 1. WIRT ELECTRIC INDICATOR.

These rims are cast and have the "draw-file" finish. The glass front is finished in black and pure gold leaf. The case is moisture proof, dust proof, and "time proof," which is a very important matter and often not appreciated. Fig. 1 is a detached view of the armature system. The resistance wire used in the volt indicators is one of the new alloys which have appeared the past few years. The one selected has not the highest resistance, nor the least temperature variation of those tested for the purpose. It is superior to 18 per cent. German silver in both qualities and remarkably constant as regards slight change from year to year, which is the most important feature by far in this case.

It is manifestly impossible to simplify an action consist-

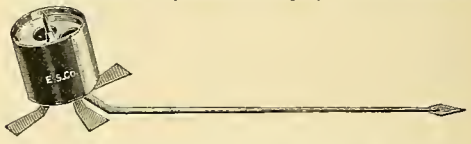


FIG. 3. WIRT ELECTRIC INDICATOR.

ing merely of a stationary coil acting on a light piece of iron free to move in response to the attraction exerted. In such an instrument the moving parts are reduced to one; control is left to gravity, the varying strength of the field due to the coil is known to be rigidly proportional to the current in the same, and it is only required that the iron which acts as the straw in the "magnetic" wind shall be so selected, shaped, treated and acted upon, as to eliminate "magnetic memory." Fig. 2 shows the interior of the volt indicator. The action consists of an oblong spool having ends with a cylindrical curve. The armature is a semi-cylinder of thin sheet iron suitably attached to a light steel

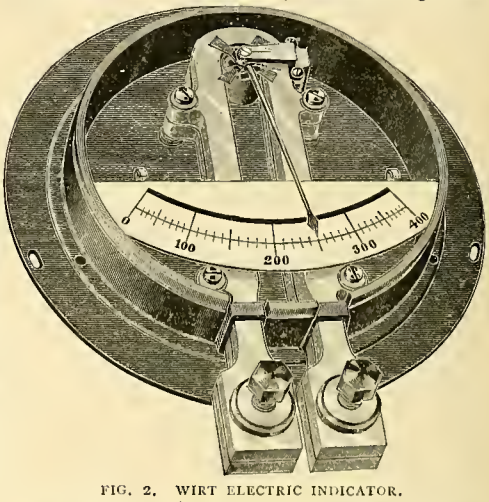


FIG. 2. WIRT ELECTRIC INDICATOR.

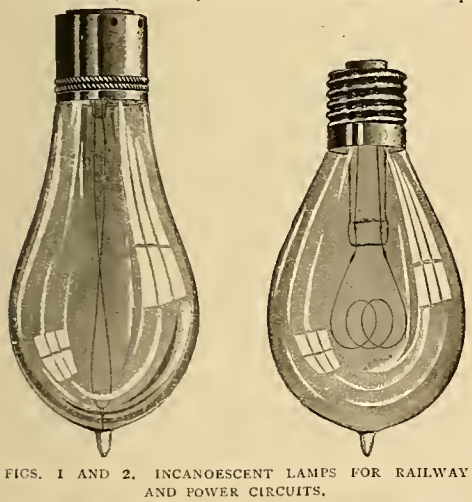
spindle with conical ends carried in jeweled cups of special shape designed to give the maximum sensitiveness. The attached pointer is made of thin bronze ribbon having the stiffness of tempered steel and formed to a V section. Aluminium was tried for these pointers at first, but it was

found that, weight for weight, other materials were stiffer and more satisfactory. Fig. 3 shows the interior of a 400 ampere indicator, the conductor consisting of a single turn. For large sized ampere indicators the coil or strap is cast of pure copper. These instruments are manufactured by The Electrical Supply company at its factories in Ansonia, and a complete stock is carried in the warerooms in Chicago.

Incandescent Lamps for Railway and Power Circuits.

The demand for a thoroughly high class incandescent lamp especially adapted to the lighting of street cars, or for use on power circuits, has been steadily growing during the recent months. At the lamp works of the General Electric company a series of experiments in the direction of satisfying this demand has lately been made, with entire success. The outcome of the experiments is three special types of lamps. It must be borne in mind that the special requirements of a lamp destined for use in series on railway circuits differ materially from those of the ordinary lamps which are connected in multiple on low tension circuits.

The first lamp, shown in Fig. 1, is the straight, unanchored filament lamp, differing in no way in appearance from the ordinary incandescent lamp. This lamp is rated according to the amount of current consumed, and only those consuming the same amount of current should be used in any one series. In the anchored filament lamp, Fig. 2, the chance of breakage of the filament by sudden contact with the glass of the bulb, caused by motion of the car, is entirely obviated. The life of the lamp



FIGS. 1 AND 2. INCANDESCENT LAMPS FOR RAILWAY AND POWER CIRCUITS.

is, consequently, not exposed to abrupt termination or even abbreviation. As will be seen from the cut, the filament is made in three spirals, mounted on a heavy glass center, and requires no extra support. Great care is exercised in the manufacture of the lamps in order to render the resistance exactly the same throughout each form, so that any "spiral" or "anchored" filament lamp may be used with others of similar form. Neither one, however, must be used in series with the others.

CORRESPONDENCE.

New York Notes.

NEW YORK, December 3.—It is apparent to any unprejudiced observer that there has been an organized attempt on the part of prominent capitalists and railroad magnates to depreciate in the public mind the value of the franchise which the Rapid Transit commission is offering. The reason for this is apparent. It is the intention of these men to secure the franchise, if possible, without paying the city what it is worth. It is safe to say that after all that has been done to prepare the way for rapid transit in this city the plan submitted by the commission will be carried into effect either by private capital or by the municipality itself. The people will not allow all this valuable work to be thrown away. Several things must now be admitted as settled. The needs of the city in the matter of local transportation have far outgrown the existing facilities and a new system of rapid transit is a necessity. It must be had. The law under which the commission has been acting since the spring of 1891 is as well adapted as any law could be to securing the desired result through the employment of private capital. The commission itself is made up of as able and competent men as could possibly be got for the task intrusted to it, and it has performed the task thus far to the entire satisfaction of the community. The routes selected are the best possible, the plans of construction are the result of the most thorough study, the best engineering skill, and the soundest judgment that could be applied to the problem. In short, the system proposed is the one best calculated to meet the requirements of the situation, the most practicable for construction, and the most economical and promising financially that could be devised.

There are, however, many public spirited men in New York who have evinced an interest in this project. Should private capital fail to become attracted by this enterprise, it is proposed to construct the system by raising public funds. Such a step will not be resorted to unless all others fail.

In this connection it may be well to call attention to the street railway statistics prepared by the *Times* and published in its issue of December 1st. It is shown that while the population has increased 47 per cent. per decade during the last thirty years, the passenger traffic in the city has increased 141 per cent. per decade for the same period. This statement can be further strengthened by considering how often each inhabitant rides in the cars. In 1853, when the city had two lines of railways, each person rode 12 times; in 1860, with six lines, 47 times; in 1870, with 12 lines, 122 times; in 1880, with 23 lines, 175 times; in 1883, with 23 lines, 215 times.

Commenting upon this subject the *Times* says editorially: "It may be regarded as certain that this city is going to have rapid transit, if not through the foresight and enterprise of private capitalists, which is most desirable, then through the power of the city government duly authorized and guided by an enlightened public opinion."

Wire tappers continue to annoy the telegraph companies and fleece the pool rooms, but occasionally they are discovered. This was the case last week, when two young men were surprised at 80 Park Row, where they were "experimenting." Their researches had already resulted in establishing connections with Guttenburg, but they had not had time to realize any returns for their labors.

The Kings County Electric Railway company was incorporated at Albany, November 29th, with a capital of $625,000 for constructing about sixteen miles of street surface road in Brooklyn. The terminal points of the road are the Thirty-ninth street ferry and Union street and the city line in the twenty-sixth ward, also Cooper avenue and the city line in the Eighteenth ward.

The committee appointed by the telegraph operators employed by the Jersey Central railroad to ask for an increase in wages from the president, J. Rogers Maxwell, announced Thursday that an agreement had been arrived at and there would be no strike. Mr. Maxwell was closeted with the committee for more than an hour, and at the conclusion of the conference Chairman Gerhart of the committee, who is one of the Central's operators, made the statement that the trouble was settled. He declined to give particulars, but expressed himself as thoroughly satisfied with the result of the interview with President Maxwell. D. G. Ramsay, chief of the Order of Railway Telegraphers, acted as spokesman for the committee. Before going away he received a letter replying to the demands made, offering certain concessions, but declining to increase the salaries of the men. It was this answer that caused the committee to see the president again to-day. The officers of the road would say nothing in regard to the matter, nor in reference to the report that long distance telephones had been put in the signal stations for use in case of a strike. The road has 350 telegraphers in its employ, and their salaries range from $35 to $90 per month. W. F. O.

New England News.

BOSTON, MASS., December 3.—The Bell Telephone company wants more time to put in its evidence in the suit instituted by the government for alleged fraud in procuring patents. Friday last before Judge Nelson in the United States Circuit court a motion for further postponement was argued and the telephone company requested leave to introduce evidence up to Nov. 4, 1893. The United States objected. The testimony for the complainants was finished January 11th of the current year. The defendants began their testimony January 25th and were given till October 1st to put it all in. The telephone company asked leave to file an answer to the whole of the bill against it and further that the answer to the amended bill be taken as the answer of all the respondents. On the first motion the court granted three months further time with leave to apply for a further extension that will not go beyond two years from the day the company began to put in testimony. The second motion was denied.

The Lynn city council is considering an order giving the Woodward Underground Electric Light & Cable company permission to construct and maintain electric subways and cables for the conduct of its business in the streets and squares of the city. The company offers in consideration of this privilege to lay cables in its subways for the fire and police signal systems, and for all wires, whether telephone or telegraph, that may be needed for municipal service, free of charge to the city. This is considered equivalent to a consideration of $75 000.

The fender problem for electric cars is not solved in Boston by any means yet. For over a year the city council has been working in conjunction with the West End Street Railway company in an effort to find a device that would prevent accidents on the streets. At one time an arbitrary order was passed that the West End should equip its cars with some suitable device within a specified time, but the West End company answered that it would adopt any fender the council might recommend. The city found this was not an easy problem, and a long series of experiments followed, all more or less unsatisfactory. The West End offered to pay the expenses of any commission the mayor might appoint to determine the best fender but the city fathers were afraid that if they recommended any fender and loss of life should result from its use a suit in law might lie against the city as an accessory and they accordingly refused to take any action. Recently the West End has placed, gridiron sort of arrangement in front of many of their cars. This is perfectly flat and runs along parallel to the ground at a distance of about eight inches from it. It projects about four feet in front of the car. It worked well in a few instances, and actually saved lives; men about to be run down by a car, finding that they had no time to escape, simply jumped in the air, came down on this gridiron and were carried along in safety till the car could be stopped. But this was only temporary success. People being thrown or slipping on the tracks could not jump in the air, and women and children do not have presence of mind enough usually to attempt this acrobatic feat. On last Wednesday afternoon George Killian, a little 4-year-old boy, was crushed to death in Dorchester under an electric car. There was no one to blame. The boy was running along between the tail end of a wagon and the car, when he stumbled and fell directly on the rails. The car was not more than a few feet behind him, and it was impossible for the motorman to stop it in time. It was going slowly, but was on a down grade. The fender cleared the child's body completely, and the bar in front of the wheels crushed his life out. This accident has brought up the fender question again. Chairman Lee of the board of aldermen says that he does not think the fender is yet invented that will prevent loss of life. "The commission that was appointed to investigate this question recommended a double fender," said the alderman, "but the matter was referred to the committee on streets. This committee has not yet made a report, and no one knows what the report will be. If the board advise the West End to place any particular fender on its cars, you can readily see that accidents happening after its adoption would probably result in suits for damages against the city, as well as against the railroad." It is expected that the board will take some action that will remove all responsibility from the city.

Several electric roads in New England are experimenting with electric heaters.

The West End Street Railway company has sold $3,000,000 10-year 5 per cent coupon notes to Kidder, Peabody & Co., who represent a syndicate. This money is to retire the floating debt of $1,500,000 and furnish means to complete the improvements now in progress and contemplated. President Whitney calculates that this money will provide for every expenditure that will be necessary up to Jan. 1, 1894.

The Postal Telegraph company has recently completed what is considered to be the best and most substantially built line running out of Boston. It is from Boston to New York and consists of 10 copper and two iron wires. Unusual safeguards have been observed in constructing this line, and it is expected that this winter will show it to be weather-proof. There are ten more poles to the mile than are usually employed and they are set to a greater depth than is customary. An abundance of guys and braces are used and the route selected avoids other telegraph lines and also shade trees. The line which runs from the office of the *Boston Globe* to its New York correspondent's headquarters in the *World* building has hitherto been considered the best between the two cities. Time and again after a severe blow or snow storm which has beaten down other lines and rendered them inoperative the *Globe* wires have worked along steadily. Especially was this noticeable in the great blizzard of four years ago when Boston was shut off from New York for several days. Then it was the *Globe* that got the first news from the storm-beleaguered city. Its New York correspondent, who is an old telegrapher, walked out into the country, tapped the wire, put in his instruments on an old log and clicked rapidly away till he had sent columns of news into the *Globe*

office, the first that had been received since the storm set in. The secret of the effectiveness of this service is in the care with which the line was built. It shows that thoroughness pays in the telegraph business as in everything else.

The big Mechanics' Fair, the biggest exposition New England possesses, has paid more attention this year to electrical industries than ever before. Still the exhibit as a whole is open to criticism in many ways. The first point is that it is not grouped better. The second is that it is not as representative as it should be. This is solely the fault of the management, which has gone on the penny wise policy. With the strides that the electrical industries have taken since the last fair they should have formed the greatest attraction this year. But exhibitors were not encouraged as they should have been. In the domestic science department this is strikingly shown. There some 60 models of electrical cooking appliances are on exhibition, but they are nearly all very crude compared to what has been done in this line. Still they serve to prove the principle that the current that lights the house can be made to furnish heat enough for preparing food. This apparatus calls for 77 volts and it takes about five minutes to heat the irons hot enough to cook buckwheats and other breakfast dishes. The heat is turned on in just the same manner as is the incandescent light. This is the first exhibition of these appliances made in New England on any extended scale. The most striking of the electrical exhibits is that of the Beacon Vacuum Pump & Electrical company of incandescent lamps. These are exhausted by a mechanical vacuum pump with a capacity for 576 lamps at a time, or at the rate of 5,000 a day. Another interesting exhibit is of an electric alarm which gives notice of any undue heat or cold at any place where it is located. A combination Case steam engine and Riker slow speed dynamo for small power or lighting plants, the whole weighing less than 700 pounds, is also to be seen. It is of 4 horse power and operates at 300 revolutions. The Railway Equipment company of Chicago displays insulators, trolley apparatus, gears, etc. Direct coupling between engine and dynamo is known. In one case a Sturtevant engine is directly coupled to a dynamo. The engine is a double cylinder vertical. It is of 65 horse power. Economy of space makes this a very desirable arrangement in many instances. Westinghouse, Church, Kerr & Co. also show this principle in their exhibit. The speed of their engine is 400 revolutions a minute.

J. C. E.

Milwaukee, Wis.

MILWAUKEE, December. 3.—Breaks at the power house of the Milwaukee Street Railway company are causing much comment among electricians and a great deal of complaint among the patrons of the lines. Breakdowns are frequent, and much of the time there is not enough power to run the full number of cars. The trouble invariably is caused at the power house, for in the matter of track and rolling stock the Villard system is unsurpassed. In order to permit all the lines to be operated, the management reduces the number of cars when power is lacking. For some time there were only three cars on the Chestnut street line, eight on the Farwell avenue line, seven on the Bay View line, and the other lines in proportion. Complaints, petitions and threats of mass meetings are the result. At no time in the history of the city has there been more fault found with the operation of the street railways. Henry C. Payne, the chief representative of the Villard syndicate, admits that the service is rather poor and that the trouble is caused at the power house. Insufficient power, he states, has been the chief source, almost the only source, of trouble. He promises early relief. A new engine, capable of furnishing power for forty cars, will be added to the present equipment. The Filer & Stowell company is building two more engines of the same size, one of which must be ready by December 22d and the other by January 22d. Mr. Payne says that all trouble will be at an end when the three new engines are in place.

Mayor Jackson I. Case, of Racine, has resigned, owing to the fact that he is a stockholder in Racine's electric railway. Legal advisers gave him the impression that he could not be a city official and a stockholder in the railway without violating the law. The city attorney of Racine, however, has decided that Mayor Case may legally continue to hold his office, and it is quite probable that the Common Council will decline to accept his resignation. He became interested in the electric railway after he was elected mayor. Electric cars are running in Racine. There have been occasional delays, due to the system not being complete. The Main, Sixth and Wisconsin street and Washington avenue lines are all that have been used thus far, but within the next two weeks the whole system will be in working order.

Harry Mortimer has been appointed superintendent of the Milwaukee & Wauwatosa Motor Railway company. He was the oldest conductor on the line.

The Broadway-Chestnut street line has been equipped with electricity from end to end, and electric cars are running on the East Side part of the line as well as on the West Side. The line extends from the Northwestern railway depot to the western city limits.

Charles F. Pfister, in addition to securing a judgment for nearly $145,000 against the Milwaukee Electric Railway company, has foreclosed four mortgages, the aggregate amount being about $20,000.

In the case of Barbara Donaldson against the West Side Railway company to recover $20,000 damages for injuries received on a car, the plaintiff secured a verdict for $2,500.

The departments of the Milwaukee Street Railway company have been completely reorganized. Henry C. Payne remains vice-president, and the chief local representative of the Villard syndicate. A. W. Lynn, who has been superintendent of the Cream City system for six or seven years, has been appointed superintendent of building and repairs for all the systems in the city. The company's machine shop has been removed from the Farwell avenue car house to the big car house on Kinnickinnic avenue, which was rebuilt last summer under Mr. Lynn's direction, and all the machinery work, as well as the making of switches, curves, etc., is now being done there. The company has just let a contract for new car shops, to be built opposite the Kinnickinnic avenue car barn, and to extend through to Clinton street. The car shops will be 120 by 300 feet and two stories high. The building will be thoroughly equipped for building, re-building, repairing and painting cars, and all the company's work in that line will be done there. Mr. Lynn has been succeeded as superintendent of the Cream City line by George W. Hommel, the manager of the Milwaukee City system, who will hereafter have charge of the operating department of the entire Villard system. George Kuemmerlein will continue to be his assistant. H. Benson remains as superintendent of construction, W. L. Mason as auditor, and George O. Wheatcroft as secretary and treasurer. In the engineering department J. C. Henderson of New York is the chief and consulting engineer; R. S. Steichman remains in the position of mechanical engineer; Lucius T. Gibbs in the position of electrical engineer, in charge of the overhead and underground systems and the motors, and O. O. M. Rau is the station electrician.

The Milwaukee Street Railway company pays taxes on $500 000. It owns property in the Fourth, Eighth, Twelfth, Thirteenth, Fifteenth and Eighteenth wards, and elsewhere, which is valued at about $150,000, with the buildings upon it; the personal property, such as rolling stock, etc., is valued at $100,000; and the tracks, which are assessed at $6,000 a mile, make the remaining $250,000. The assessed valuation of the Becker lines, which the company will acquire next spring, is $100,000, so that the company will pay taxes on at least $600,000 next year. Besides, the company pays a license fee of $15 per car annually. Its yearly contribution to the city treasury approximates $20,000. The Badger Illuminating company, by the way, is assessed at $20 per arc lamp, and it operates more than 1,000 of them.

The petition of Charles F. Pfister has been granted and a receiver of the Milwaukee Electric railway, or Hinsey line, has been appointed in the person of Gustavus J. Melms, who for two or three years has been superintendent of the road. In the litigation the road has been valued at $250,000 and Mr. Melms had to give a bond in the sum of $500,000. His sureties are Mr. Pfister and Frederick Vogel, Jr. The sale of the road will probably occur within two months. It consists of thirteen miles of single track, but the purchaser will get little for his money except the franchise. The roadbed and rolling stock are in a very poor condition. Flat 45 pound rails were used in building the line, and as they were put down three years or more ago, it is not difficult to conceive what the roadbed is. Its condition would be better had it been kept in good repair, but the company has barely earned operating expenses, and has had no money to pay the interest on its bonds or to protect its property by doing necessary work upon it. The power house is and always has been inadequate, and none of the apparatus is duplicated. The claims of Mr. Pfister alone against the company aggregate nearly $200,000, and it is estimated that it will take that much more to put the road into first-class condition, for not only will it have to be completely rebuilt, but the rolling stock will have to be renewed, the cars being out of proportion to the track. It is reported that Francis E. Hinckley, of Chicago, the principal stockholder, will endeavor to buy the road at receiver's sale, but the general expectation is that the Villard syndicate will secure the line.

The Milwaukee, Whitefish Bay & North Lawndale Electric Railway company has changed its plans, and now, instead of running to the bay via Third street, proposes to connect with the Cambridge avenue line at Racine street and run out on Humboldt avenue.

So far seven people have been run over and killed by the electric cars. The victims have mostly been old people or children. The record covers a period of two years, and Manager Hommel states that the accidents are fewer than when horse cars were operated. Since the new system has been in use more accidents have occurred on the old Washington horse car line, Mr. Hommel says, than on the electric lines.

There is some talk of using the immense water power at the Dells, on the Wisconsin river, for the generation of electricity. The natural force there could be so utilized, it is claimed, that power could be furnished to such distant places as La Crosse and Milwaukee. The Niagara Falls project may have given the idea of this scheme. Nothing definite has been done yet.

All the West Side electric cars now run the full length of West Water street. The lower part of Third street is traversed only by the Washington street horse cars.

C.

Northwestern Notations.

MINNEAPOLIS, December 3.—The Lowry Street Railway company is having considerable trouble in Minneapolis as well as St. Paul. Up to date the Minneapolis end of the line has been very peaceful, the public appreciating the fact that since the electric system has been perfected, with all the transfer privileges provided, the service has been excellent. However, there was, of course, more wanted. At several outlying points people wanted transfer stations. These were granted, but the company secured some important concessions on its side, notably release from the necessity of giving transfers to and from interurban lines. Provision has also been made for a single transfer station at Bridge Square, where a $5,000 building is to be erected. It is claimed that this arrangement will not be nearly so convenient as the present plan. But the main howl is over the abolition of interurban transfers. Many residents of Southeast Minneapolis have been using the interurban in getting to and from home, and they insist that they shall not be deprived of transfers. Business men are afraid it will hurt trade. The ordinance was rushed through the council without previous discussion, and all sorts of charges are made about the deal. The ordinance has been signed, and there seems to be no getting around it. It does not take effect 'till February.

The presence of Henry Villard in St. Paul has brought to the surface all sorts of rumors of gigantic schemes, combinations, consolidations, etc. One story was that Villard's arrival had significance in connection with the reorganization of the Electric Light & Power company. Another was that he was figuring in reference to testing an electric railway motor on the Northern Pacific road. Mr. Villard promptly denied all the rumors. He said he was making one of his regular visits up this way to look after his various interests here. He stated that the idea of utilizing the water power of the Apple river, over in Wisconsin, to generate power for use in the Twin Cities had been abandoned.

One of the most interesting sights of Minneapolis nowadays is the great power station of the Twin City Rapid Transit company. The station is located very conveniently, near the center of business, and quite a steady stream of visitors flows to and from the building. The company has concluded to encourage this sort of thing, and has put in a spectators' gallery around the room leading off the third story. The engine rooms have been opened up, and a fine view of the mammoth machines is afforded.

Charles W. Grant, superintendent of the Electric Light & Power company at Davenport, Ia., was badly hurt in a fall while walking from the coal shed to the power plant.

Rapid progress is being made on the new electric light plant at Deadwood, S. D. The plant will have three arc light dynamos, with a total capacity of seventy-five lights, each of 2,000 candle power, and incandescent dynamos for 2,000 lamps ranging from 12 to 30 candle power. Two big Phœnix engines furnish the power. The plant, it is estimated, can supply a city of twice the present population of Deadwood.

The franchise giving the Midway Electric Light company permission to string its wires in the interurban district is still hanging fire in the St. Paul council. An effort was made at the last meeting to shove it through so that work might be begun, but the effort failed.

The citizens of Grand Forks, N. D., had about given

up hope of getting the coveted electric street railway—at least from the company that recently secured a franchise. They were therefore pleasantly surprised a day or two ago to learn of the arrival of several cars of steel rails and other material. The time allotted by the council to intervene before the beginning of work had already expired without anything being done. The members of the company have insisted all along that they meant business.

All of the handsome new vestibuled cars for the interurban line are being put into service as fast as possible.

The Minneapolis Electro-Matrix company has been sued by Charles Bartleson to collect $350 for legal services in defending the company in its suits with S. S. Small.

The city electric light plant and the planing mill of George Hiles at Dexterville, Wis., was destroyed by fire November 30th.

Mayor Winter, of Granite Falls, Minn., expressed himself as highly elated at the success of the city's electric light enterprise. He is confident that the taxes will be somewhat less than last year, with the expense of the plant included. H. C. C.

PERSONAL.

H. C. Thompson of the Electric Gas Lighting company, Boston, was in Chicago last week.

George B. Shaw, formerly general manager of the National Electric company, Eau Claire, Wis., visited Chicago last week. Mr. Shaw was elected member of Congress from Eau Claire at the recent election by a very flattering majority.

H. Laws Webb, well known to the electrical fraternity of New York, returned last week from London, Eng., after a three months' vacation. Mr. Webb reports that there is a great deal doing in electric lighting on the other side, and a number of electric railroad projects are on foot. Mr. Webb had a very pleasant time while abroad, and returned greatly improved in health.

Fred DeLand has resigned his position as manager of the Chicago office of the *Electrical World*. Mr. DeLand announces his intention of publishing a monthly paper to be devoted to the electrical and mechanical features of the World's Fair. The new publication will be known as the *World's Fair Electrical Engineering* and will be printed at Chicago. Mr. DeLand, by reason of his experience and wide acquaintance with the electrical trade, is well equipped for the management of the new periodical, and his numerous friends wish him success in his undertaking.

L. H. Hart, who is very well known to the electrical fraternity through his association for the last three years with the *Electrical World*, in connection with the business staff, resigned his position December 1st. Mr. Hart has secured an interest in a Boston steam fitting paper and will publish it hereafter in New York. It will be known as *Heating and Ventilation*. The officers are Frank W. Foster, president; H. M. Swetland, general manager and treasurer, and L. H. Hart, vice president and secretary. It will be a monthly and the first number will appear early in January. Last week, members of the *World* staff gave Mr. Hart a luncheon and presented him a testimonial in the shape of a gold Odd Fellows' watch charm. Mr. Hart has a host of friends in the electrical field, who wish him success in his new undertaking.

NEW INCORPORATIONS.

De Kalb Electric company, De Kalb, Ill.; capital stock, $60,000; furnishing electricity; Bradt & Shipman, DeKalb, Ill.

Sterling & Rock Falls Interurban Railway company, Sterling, Ill.; capital stock, $100,000; electric street railway; E. W. Jackson, Millington, Ill.

Monroe Water Works & Light company, New Orleans, La.; capital stock, $125,000; operating waterworks and electric light in the city of Monroe, La.

Flatland Electric Light & Power company, Flatland, N. Y.; capital stock, $50,000; the manufacture and use of electricity for producing light, heat and power.

Everett Light, Heat & Power company, Everett, Pa.; capital stock, $15,000; supplying light, heat and power at the Borough of Everett, Pa.; John H. Jordan, Bedford, Pa.

Bristol & Newton Street Railway company, Bristol, Pa.; capital stock, $100,000; constructing and operating an electric railway in Bucks county, Pa.; A. C. Milliken, Pottsville, Pa.

Longview Electric Light & Power company, Longview, Tex.; capital stock, $10,000; to supply light and electric power to the public by means of electricity; R. B. Levy, Longview, Tex.

Boone Electric Street Railway & Light company, Boone, Iowa; capital stock, $200,000; to build and operate an electric street railway; furnish electric light and power; Loran W. Reynolds, Boone, Ia.

Marion Electric Railway, Light & Power company, Marion, Ohio; capital stock, $100,000, constructing and operating a street railway, furnishing electric light and power; Daniel Babst, Jr., Crestline, Ohio.

Schuylkill Valley Electric Street Railway company, Pottsville, Pa; capital stock, $50,000; constructing and operating a street railway in the counties of Chester and Montgomery; Lyon, McKee & Saunderson, Pittsburgh, Pa.

Edwardsville Electric Light & Power company, Edwardsville, Ill.; capital stock, $20,000; to operate an electric light and power plant; Interstate Complete Electric Construction company, 809 South seventh street, St. Louis, Mo.

Columbia Electric Light company, Philadelphia, Pa.; capital stock, $100,000; supplying light, heat and power by means of electricity in the city of Philadelphia, Pa.; E. Cooper Shapley, Fifth and Chestnut streets, Philadelphia, Pa.

Dravosburg Electric Railway company, Dravosburg Pa.; capital stock, $15,000; constructing and operatiag an electric railway from Reynoldton to Dravosburg, Allegheny county, Pa.; J. S. & E. G. Ferguson, 408 Grant street, Pittsburgh, Pa.

Walnut Hills District Telegraph company, Cincinnati, Ohio; capital stock, $25,000; furnishing messengers and summoning police officers; delivering messages, letters and packages, operating a system of electrical signals, etc.; Enoch L. Stricker, Cincinnati, Ohio.

Cinnaminson Electric Light, Power & Heating company, of Riverton, N. J., Riverton and Palmyra, N. J.; capital stock, $50,000; to erect buildings and machinery for generating electricity for lighting, heating and other purposes, etc.; Howard Flanders, 333 High street, Burlington, N. J.

National Automatic Fire Alarm company of Louisiana, New Orleans, La.; capital stock, $30,000; to lease, sell and supply electrical apparatus and appliances of every nature for the communication of intelligence concerning fires by the use of automatic fire alarms; E. J. Hart, New Orleans, La.

ELECTRIC LIGHTING.

Ground has been broken for the new station of the Mutual Light & Power company of Montgomery, Ala.

The Cincinnati Board of Public Works has ordered that all electric light wires in that city be placed under ground.

The Franklin Electric company of Kansas City has made a proposition to sell the city of Waco, Tex., a lighting plant.

Proposals were received by Comptroller May of Chicago until December 7th, for furnishing the city with 1,500,000 arc light carbons.

On November 30th, which was an unusually dark day in Chicago, there was a load of 24,000 amperes on the Adams street station of the Chicago Edison company. This is equivalent to 55,000 16 candle power lamps.

The new security building at Madison street and Fifth avenue, Chicago, will be lighted from an isolated plant supplied by the Chicago Edison company. The equipment will consist of two 800 light machines driven by two 75 horse power New York safety engines.

At a meeting of the Electric Light & Power company of Lansing, Mich., it was decided to accept the proposition of the electric light commissioners of the city to pay $45,000 for the plant. The sale was subsequently approved by the common council, and the city is now the owner of the plant.

The Electric Light & Power company of Syracuse, N. Y., has completed its contracts for the new station on Fulton street. The new plant will take 316 feet front and will be 26 feet deep. The new works will not be finished till June, and probably the machinery will not be in till next fall. The extension will be valued at something more than $200,000.

The city solicitor of Columbus, O., has rendered an opinion as to the authority of the city to establish and maintain an electric light plant. Under the general statutes, he says, the council would probably have the right to light the city itself, but there might be some inconvenience in raising the money. He was of the opinion that it would be much more feasible to wait until the Legislature met and secure authority to issue bonds for the purpose.

It is stated that the residents of Carondelet, Mo., are considerably wrought up over the action of the Carondelet Gas company in removing its meters from the houses of persons who also patronize the Carondelet Electric Light & Power company. Merchants and many other people in the town use both gas and electricity, and the gas company has apparently decided to attempt to compel them to give up the electric lights. The gas company denies the report.

No men were more loyal to their employers than were the employes of the Edison Electric Light company in the late strike in New Orleans. In the general gloom the lights of the Edison company shone brightly. President Bemiss said that his chief engineer, electrician and dynamo men remained on duty and braved every danger; they were often threatened with physical injury, and one row took place in which pistols were drawn, but the intruders were driven off and business proceeded.

The balloting for and against the proposition to bond the city of Hillsdale, Mich., for $15,000 to erect and maintain its own electric lighting plant called out a large vote, and the majority "for" was 197. The question seemed to be of more interest in the city on the day of election than the general election, as the citizens had been stirred up by circulars issued over the signatures of the four aldermen who had opposed the submitting of the question, which was followed by a circular signed by the mayor and the other four aldermen stating their side of the question. A third circular was also distributed signed by three of the first four mentioned aldermen as an answer to points in circular No. 2. Every ward in the city gave a majority "for the loan."

ELECTRIC RAILWAYS.

The sheriff has been enjoined from selling the plant of the Wichita, Kan., Electric Railway company at the instance of a stockholder, who alleges collusion between the directory of the company and the American Loan & Trust company of Boston, the plaintiff bondholder, which sought to foreclose on a mortgage for $324,000.

Members of the Wightman Electric company of Scranton, Pa., recently assigned, have had attachments issued against Mr. Dunston, assignee of the Wightman company, the People's Street Railway company and the Carbondale Traction company, as garnishees, levying on the money in their hands due the Thomson Houston company for about $50,000. The primary cause of the assignment was monetary difficulty with the Thomson-Houston company of Boston.

A scheme is projected to build an electric railroad across the state of Ohio, with Cincinnati and Cleveland as the terminals. For the last week an electric expert, representing the capitalists, has been in the state looking the ground over. He is heartily pleased with the prospect and will recommend the execution of the plans adopted. For the present the road is to run only from Cincinnati to Springfield. It is estimated that the cost of operating the line will be comparatively small, inasmuch as water power can be utilized for the generation of electricity along a good part of the line.

The Calumet Electric Street Railway company last week completed negotiations for a loan of $1,000,000 to extend and improve the electric system which the company is now operating in the southern part of Chicago. The entire plant of the road, including franchises and real estate, is given as security. The road extends from Seventy-first street to Kensington, with a branch crossing the Illinois Central near Burnside, running to South Chicago. East of Burnside, on Ninety-fourth street, the company's power house is located, and here extensive buildings have been planned. The company, of which W. V. Jacobs is president, expects to use nearly all of the amount of the loan in preparations for the World's Fair traffic and in improving the portions of the line already in operation.

A press dispatch from Toledo, dated December 3d, says: Suits were brought here to day involving every electric street railway in the United States. Two suits were filed in the United States Circuit Court by attorneys representing Benson Bidwell of Rochester, Ind., against the Toledo Consolidated Street Railway company. It is claimed that this company has infringed Bidwell's fundamental patents for running electric cars and the principle involved in the use of underside spring trolley contact; also that the patents for the running and lighting of cars with the same current of electricity and the lighting of streets and houses along the line from the current which propels the cars have been infringed upon. Charles F. Bidwell of this city is interested in the patents of his father, Benson Bidwell, and has been working for the past three years with a view to bringing suit against the street railway companies which, he claims, have been infringing. This is to be a test suit.

TRADE NEWS.

Queen & Co., of Philadelphia, are pushing their Cardew voltmeters, on which they announce a special sale for this month.

Alfred F. Moore, of Philadelphia, is making arrangements for an extensive exhibit of insulated wire at the World's Fair.

Walter C. McIntire & Co., of Philadelphia, manufacturers of the Crown reflector, report good business in their line. They expect to establish a western agent in Chicago about January 1st.

Charles H. Perry, representing the National Brotherhood of Electrical Workers of America, is calling on the electrical people of the east in the interest of the Brotherhood's publication, the *Official Year Book and Convention Number*.

The Knapp Electrical Works have received, during the past two months, orders for nearly one million yards of their lamp cord, and since August 1st they have shipped over 200,000 Perkins sockets. Their factory is working night and day to supply the demand for their specialties.

Warren Webster & Co., Philadelphia, are working their factory to its utmost capacity to keep up with orders received for immediate shipments. This concern has prepared plans and purchased land in Camden, N. J., for a factory to have four times the capacity of their present one.

The Electric Appliance company has just rounded up its first business year, and reports that the results have been highly satisfactory in every way. The company will begin the new year by calling the attention of the trade to several recently acquired specialties of considerable interest. Its facilities have been increased in every direction, and the prospects for a heavy business for the coming year are very flattering.

Secretary and Treasurer J. A. Sheriffs, of the Mosher Electric company, Chicago, reports a good business in arc lamps for constant potential circuits. The Mosher company has already earned a good name for itself, but before long it will have a surprise for the lamp buying public in the shape of a new lamp for incandescent alternating circuits. Many new "wrinkles," inventions of J. A. Mosher, will be embodied.

Wm. N. Marcus, manufacturer of the Marcus auxiliary mouth piece for telephones, 218 N. Second street, Philadelphia, reports increased sales of this device during the last month. There are many advantages connected with this

simple but useful device. It rotates so that it can be readily used by persons of any stature. It also concentrates the sound of the voice directly upon the diaphragm of the telephone, and in no case is the telephone injured by its use. The person using the instrument can stand from three to six feet from the telephone, and by talking in a natural tone be heard very distinctly by a person at the other end. This device is used in over 200 places in Philadelphia, Pittsburgh, Wilmington, Del., and Camden, N. J.

The Pennsylvania Electric Engineering company of Philadelphia was awarded recently the contract for the installation of the plant to be placed in the new Philadelphia & Reading railroad terminal depot in Philadelphia. The plant consists of 300 arc lights, 10 Western Electric dynamos and the entire construction work. The company has issued a handsome lithograph of the depot, which is said to be the finest building of its kind in the world, and one of the most handsome public buildings in America. The building occupies four city squares, is fireproof, and cost, together with the elevated tracks, upward of ten million dollars. This company has completed the plant of the Steelton, Pa., Heat, Light & Power company, consisting of two 1,000 light alternating dynamos. The contract included transformers of the National Electric Manufacturing company of Eau Claire, Wis.; 2,000 sockets; 2,000 Pennsylvania lamps and the necessary construction work.

BUSINESS.

General Manager S. L. Phillips, of the Dahl Electric company, New York, reports an increasing demand for his arc lamp "Success."

To light residences profitably has been a serious problem with central station men. The manager of the Whitewater, Wis., Electric Light company claims to have discovered the solution. If so, he has discovered a boon to central stations.

General Manager George H. Dallett of T. H. Dallett & Co. of Philadelphia, manufacturers of the Billberg motors and generators, reports a large demand for motors for electric hoists. Mr. Dallett refers with commendable pride to an installation of an elevator for A. A Shumway & Co., Philadelphia, three years ago. This firm says that nothing has been spent on the motor for repairs. Work of this kind is the best evidence of the ability displayed by this concern.

C. O. Mailloux, the well-known electrical engineer of New York, says that the prospects of the storage battery for traction work are better now than they have been in the last few years. He believes that the storage battery has passed the experimental stage and there is now a basis from which further development in street railway work will be rapidly made. The Fifteenth street line in Washington, which has a charter allowing nothing to be used but the storage battery, and with which he is connected as consulting engineer, is giving him an excellent opportunity for forming an opinion based upon practical results.

Owing to other important business interests and a contemplated trip to Europe in connection with the same, F. W. Cushing, so well and favorably known in electrical circles as the general western agent for kerite wire and cables, has resigned the agency, and will be succeeded by his brother, Horace A. Cushing, and Samuel F. B. Morse. W. R. Brixey, who has recently acquired the entire kerite interests, was in Chicago last week and confirmed these appointments, which took effect December 1st. Horace A. Cushing has been identified with the western agency ever since his brother took charge and is thoroughly familiar with the details of the business. S. F. B. Morse has also been identified with this branch for some time. He is an experienced and practical electrician and a grandson of the illustrious inventor whose name he bears. The new agency will pursue the same general plan of business as that carried out by the retiring agent, which has proved so successful in the past, and resulted in a large and increasing demand for kerite wires and cables in the territory controlled by the western agency.

To judge from appearances at the Chicago end of the projected Chicago & St. Louis Electric railway, this company, whose plans are being carried out so energetically by Dr. Wellington Adams, is in the field to push its enterprise to a successful completion. The offices in the World's Fair city are in the Women's Temple. They are elegantly fitted up and are in charge of Assistant General Manager Charles E. Bleyer. Since the prospectus of proposed road was published a great deal of enthusiasm has been aroused over the new electric line. A number of the daily newspapers, speak most encouragingly of it. Assistant General Manager Bleyer exhibited recently a quantity of newspaper clippings that may be taken as an indication of how the road is looked upon by many in this section. The most flattering testimonial comes from the *Chicago Times*. Speaking of the financial outlook for Dr. Adams' project that paper says: "The company is bound to prove a handsome dividend paying investment at all times. The history of the electric light, telephone, telegraph, and street railway companies has been that of unexampled prosperity. The Chicago & St. Louis Electric Railroad company has this advantage over them—that its field is broader, since, with its power-supply system, its coal mining, and the utilization of the clay for brick and tile making, with which its landed acquisitions in Missouri and Illinois abound, it practically has four businesses, any one of which must be profitable, while all combined cannot fail to realize results beyond the expectations of the investors." This however is but one of a number of favorable press comments exhibited by Mr. Bleyer.

The grain elevator being built for the Boston and Maine Railroad company by Simpson & Robinson of Minneapolis, which is nearing completion, is one of the largest in the country. The engines are compound condensing of Hamilton Corliss type, built by the Hoven, Owens & Rentcher company, to which are connected heaters and surface condensers manufactured by the Wainwright Manufacturing company of Massachusetts. The heaters for compound engines and the auxiliary heater and surface condenser are of capacity for a 600 horse power plant. This company has recently furnished some very large surface condensers for marine and stationary plants, all of which are giving the most satisfactory results. Among the largest and most recent sales of heaters may be mentioned the following: Ames Iron Works, Chicago, Ill., 150 horse power; Robert Bishop, Newton Lower Falls, Mass., two 400 horse power; Stearns-Roger Manufacturing company, Denver, Colo., 1,150 horse power; Juniata Limestone company, Carlin, Pa., 125 horse power; Ball Engine company, Erie, Pa., 150 horse power; Globe Milling & Reduction company, Philadelphia, Pa., 100 horse power; Elmira Silk Mills, Elmira, N. Y., 200 horse power; Bennington Electric Light & Power company, Bennington, Vt., 200 horse power; Middletown Electric Light company, Middletown, Pa., 200 horse power; Ashland Electric Light company, Ashland, Wis., 500 horse power; Massachusetts Charitable Mechanics' association, Boston, Mass., 600 horse power; N. C. Foster Lumber company, Fairchild, Wis., 400 horse power; M. C. Bullock Manufacturing company, Chicago, Ill., 500 horse power; American Theater, New York, 230 horse power; J. W. Parker & Co., Philadelphia, Pa., 150 horse power; Cooperstown Electric Railway company, Cooperstown, N. Y., 150 horse power; Wilmington City Electric company, Wilmington, Del., 1,000 horse power; Piedmont Pulp & Paper company, Piedmont, W. Va., 450 horse power; George Fuller, St. Paul, Minn., 100 horse power; Buckeye Engine company, Salem, O., 360 horse power; Mitchell Electric Light company, Mitchell, S. D., 200 horse power; Baker, Smith & Co., New York, 150 horse power; Norton Bros., Chicago, Ill., 250 horse power; Penrose Brothers, New Orleans, La., 300 horse power; Burlington Electric Light company, Burlington, Ia., 600 horse power; Lowville Electric Light company, Lowville, N. Y., 100 horse power; Owatonna Electric Light company, Owatonna, Minn., 200 horse power; Hughes Steam Pump company, Cleveland, O., 100 horse power; Clark Brothers, New York city, 200 horse power. The following sales of condensers are also reported: National Dredging company, Wilmington, Del., 650 horse power; Manhattan Elevated Railway company, New York, 150 horse power; Robert White & Co., Montreal, Can., 150 horse power.

ELECTRICAL PATENTS.

Issued November 30, 1892.

486,845. Machine for Covering Wires. John A. Barrett, Brooklyn, N. Y.

The machine binds together several wires by weaving cords between and about them.

486,879. Magnetic Separator. Thomas J. Lovett, Chicago, Ill.

A wheel with a number of small magnets in its periphery is revolved by means of a belt, the magnets alternately presenting their north and south poles to the outer surface of the wheel.

486,888. Electrical Transmitting Apparatus. Albert D. Neal, Boston, and Howard F. Eaton, Cambridge, Mass.

Character controlling magnets are located at the receiving stations, and are adapted to be actuated by a change in condition of the line at the transmitting station at which is provided a continuously moving surface provided with contact points adapted to co-operate with corresponding circuit terminals operated by the character keys.

486,889. Type Writing and Printing Instrument. Albert D. Neal, Boston, and Howard F. Eaton, Quincy, Mass.

486,902. Galvanic Body Battery. John W. Shults, Wichita, Kan.

486,908. Burglar Alarm Cabinet. Alfred Stromberg, Chicago, Ill.

The safes or objects to be protected are surrounded by a cabinet, the walls of which carry alarm circuits; the front of the cabinet is provided with removable stanchions and flexible curtains adapted to be drawn down between the stanchions. When the objects are in use and the alarm circuit is opened the curtains may be raised and the stanchions removed.

486,909. Automatic Telephone or Other Electrical Exchange. Almon B. Strowger, Chicago, Ill.

The substations are each connected with the central station by two wires—a telephone wire and a switch wire. There is provided at the central station an exchange apparatus for each subscriber connecting him with all of the other subscribers. By means of keys the subscriber may, through the switch wire and the exchange apparatus, automatically make connection with any other subscriber.

486,911. Lineman's Wire Grip. Claes A. Svensson, Buffalo, N. Y.

486,916. Electrical Transformer. Elihu Thomson, Swampscott, Mass.

The transformer has means for automatically varying the effective inductive length of one of its windings in a continuous unbroken manner simultaneously with the change of load upon the secondary, so that the potential delivered to the secondary may be maintained constant.

486,926. Coil for Electrical Apparatus. Henry C. Buck, Somerville, Mass.

486,958 Electric Arc Lamp. Charles E. Scribner, Chicago, Ill.

486,985. Trolley for Conduit Railways. Benjamin Olbricht, Brooklyn, N. Y.

Two trolley wires are supported by the ceiling of the conduit and the trolleys engaging therewith are each provided with a swinging casing or box to prevent short circuiting in case water should rise in the conduit.

486,987. Electric Switch. William J. Schultz, Detroit, Mich.

487,002. Safety Device for Electric Circuits. George Cutter, Chicago, Ill.

487,022. Adjustable Electric Light Holder. Leroy S. Pfouts, Canton, O.

487,046. Electric Light Carbon. James Clegg, London, England.

The filaments are heated to incandescence while suspended in a vessel from which air is excluded above a volatile liquid having dissolved in it an acid salt of one or more suitable metals.

487,049. Incandescent Lamp. Johannes H. F. Georges, Berlin, Germany.

The lamp is adapted for use in systems employing multiphase currents, and consists of three leading-in wires, and three united filaments.

487,069. Device for Transmitting Motion for Electric Street Car Motors. Walter E. Harrington, Atlantic City, N. J.

A belt of magnetic material passes over a cone pulley made powerfully magnetic by suitable windings.

487,070. Electro Magnetic Pulley. Walter E. Harrington, Atlantic City, N. J.

487,073. Magnetic Separator. Thomas J. Lovett, Chicago, Ill.

Several sets of electro-magnets are combined with a resistance box so that more or less current may be thrown through the coils of the electro-magnets.

487,074. Magnetic Separator. Thomas J. Lovett, Chicago, Ill.

487,092. Electric Switch. John J. Nate, Chicago, Ill.

The switch is adapted for electric elevator motors and a rheostat with duplex contact points is connected in circuit with the armature, the contact arm of which is adapted to send an increasing current through the armature, as it is moved over the contact points in either direction; while a switch in the field circuit is adapted to complete circuit through the field before the circuit through the armature is completed.

487,093. Electric Current Indicator. Charles P. L. Noxon, Syracuse, N. Y.

487,095. Auxiliary Fire Alarm Signal Apparatus Charles E. Scribner, Chicago, Ill.

An auxiliary circuit including a generator and bell is provided at one or more stations so arranged that when the generator is operated the bell in connection with that generator will be rung until the break wheel of the signal box begins to turn, when the bell will be disconnected from the circuit.

487,096. Multiple Switch-Board System. Charles E. Scribner, Chicago, Ill.

A spring jack having a line spring and a test ring insulated therefrom, and an auxiliary spring and contact anvil insulated from both line spring and test ring, is combined with a plug having contact pieces making connection with the test ring and line spring, and an insulated tip raising the auxiliary spring from its contact anvil.

487,097. Telephone Exchange System. Charles E. Scribner, Chicago, Ill.

Each telephone line is connected with a spring jack upon each of two boards, and two calling circuits, each including telephone apparatus at the substation, and each terminating in a telephone receiver at one of the switch-boards, to enable the subscriber to call the attention of the operator at either board, and to secure connection.

487,098 Telephone Switch-Board Apparatus. Charles E. Scribner, Chicago, Ill.

A switch lever is held in one position by a connecting plug when not in use, and is adapted when the plug is removed from its socket to slowly rise and break connection through the operator's test circuit by the time she has finished the test.

487,102. Development and Distribution of Electricity. John S. Stone, Boston.

487,109. Automatic Electric Lighting Apparatus. Leonidas G. Woolley, Grand Rapids, Mich.

487,114. Electric Locomotive. Conrad M. Conradson, Madison, Wis.

After the load is started the use of gearing may be discontinued and a rigid connection made between the rotating armature and the driven shaft.

487,128. Burglar Alarm. Harry W. Reynolds, Long Branch, N. J.

487,154. Telegraphic Apparatus. Josiah A. Parker, St. Louis, Mo., and Leland L. Summers, Chicago, Ill.

487,176. Process of Electro Depositing Alloys. Sherard O. Cowper-Coles, London, England.

487,185. Electric Belt. John H. Johnson, Dodgeville, Wis.

487,213. Incandescent Lamp Socket. Charles B. Elliott, Boston, Mass.

487,219. Telephone. Hammond V. Hayes, Cambridge, and Wilton L. Richards, Malden, Mass.

A compound telephone receiver is adapted to be connected with two circuits at the same time, and to receive messages from either without introducing or facilitating any inductive effect; the magnets of the separate receivers being angularly displaced to prevent such inductive effects.

487,220. Electrode for Arc Lamps. Charles W. Hazeltine, St. Louis, Mo.

The carbon is coated with copper, and with an exterior coating of zinc, whereby the carbon is protected, and the resistance of the electrode decreased.

487,227. Electrical Type Writer. Albert D. Neal, Boston, and Howard F. Eaton, Quincy, Mass.

487,228. Electric Type Writer. Albert D. Neal, Boston, and Howard F. Eaton, Quincy, Mass.

487,229. Printing Telegraph. Albert D. Neal, Boston, and Howard F. Eaton, Quincy, Mass.

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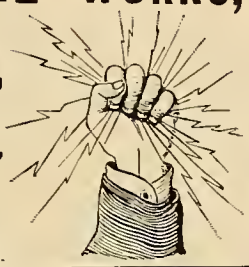

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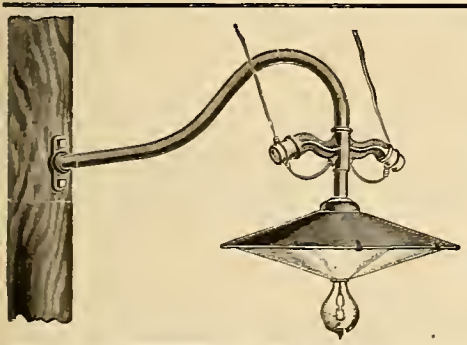

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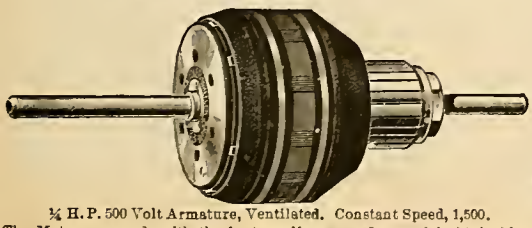

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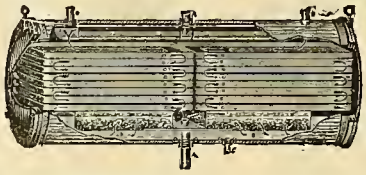

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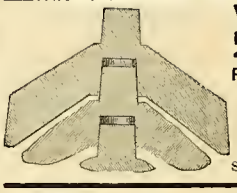

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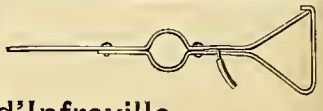

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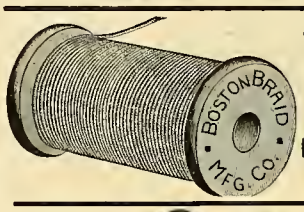

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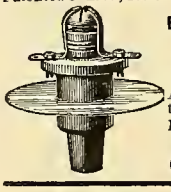

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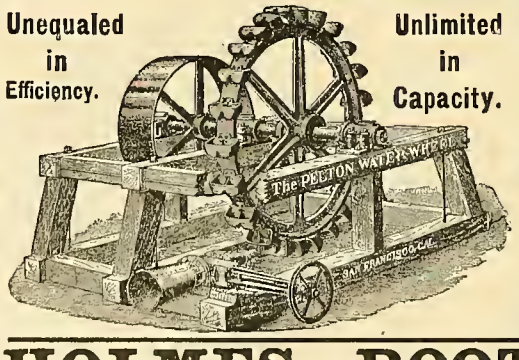

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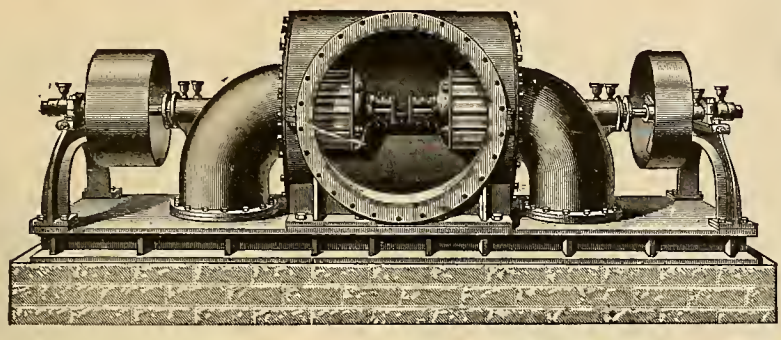

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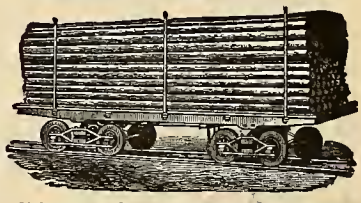

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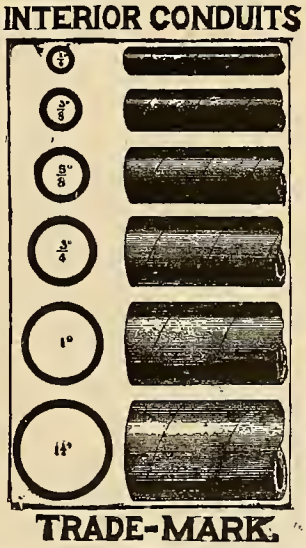

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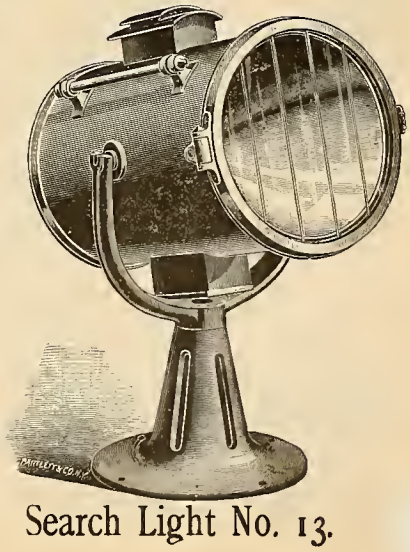

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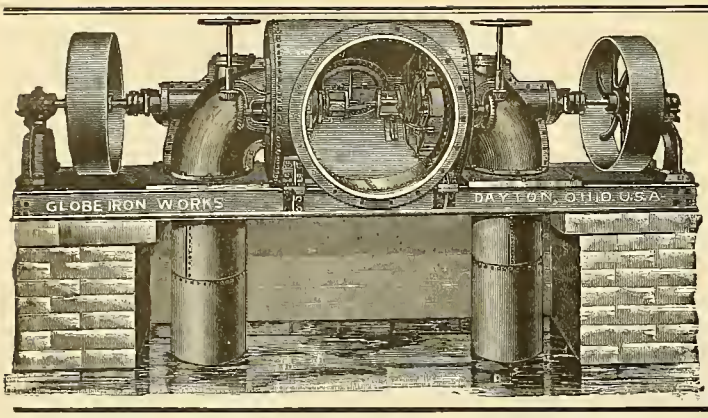

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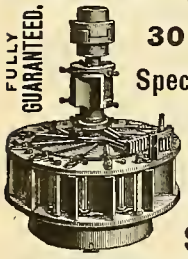

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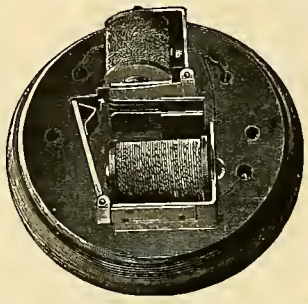

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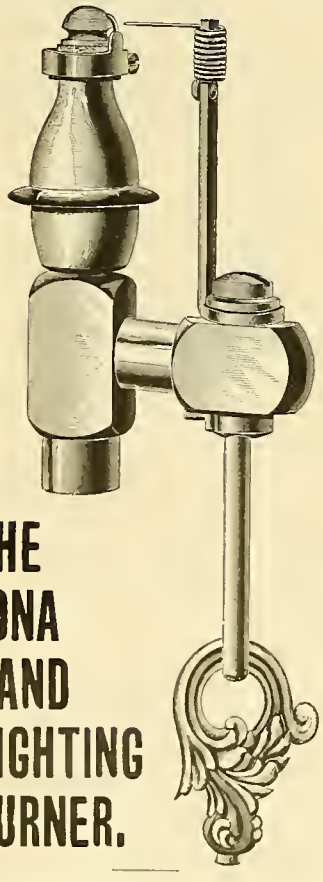

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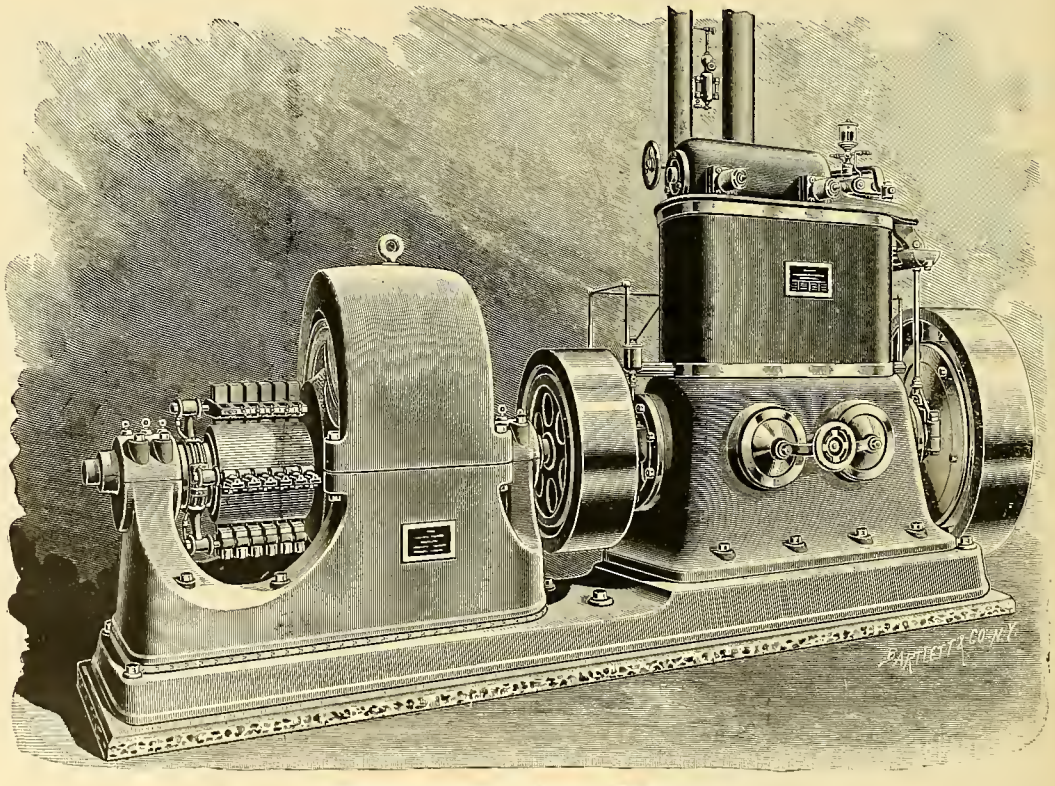

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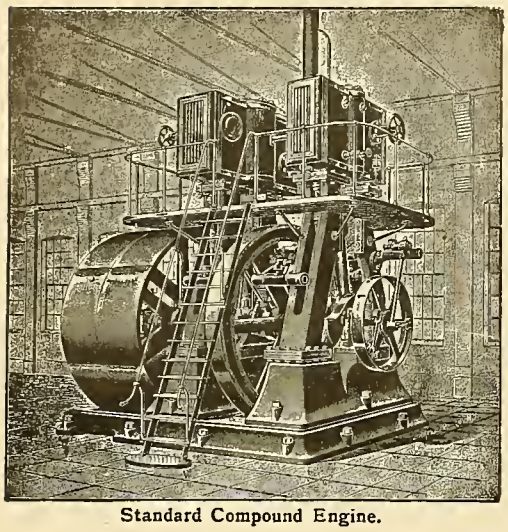

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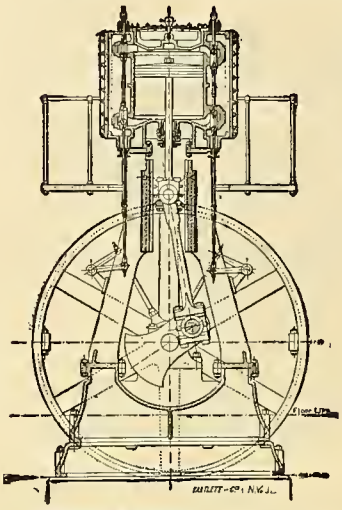

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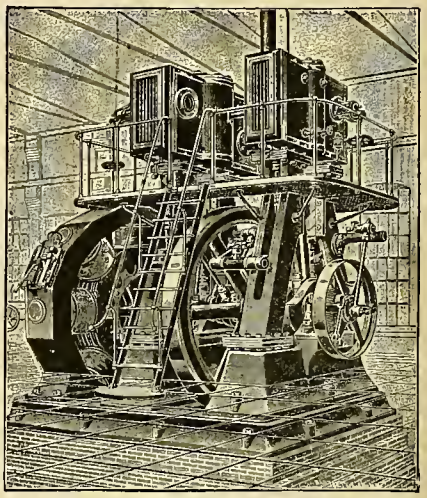

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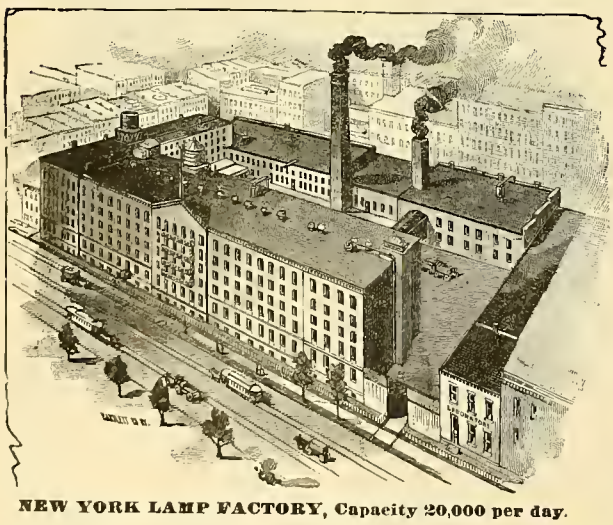

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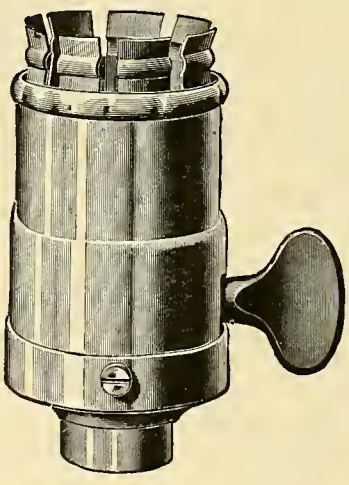

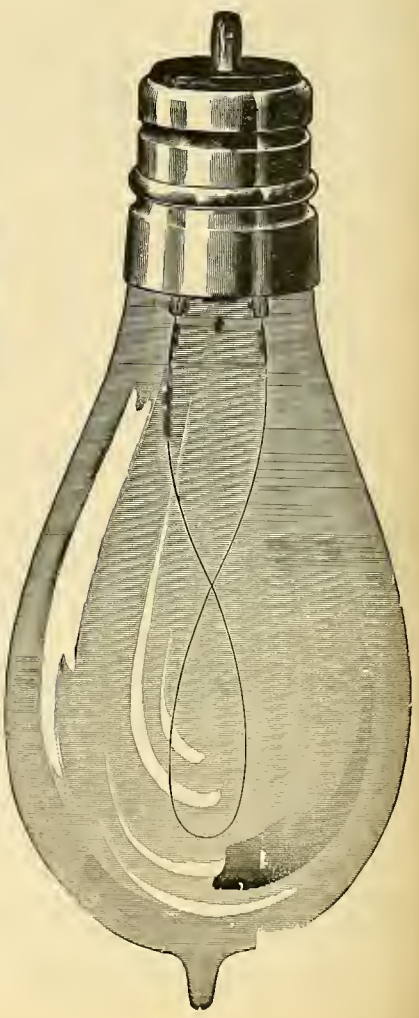

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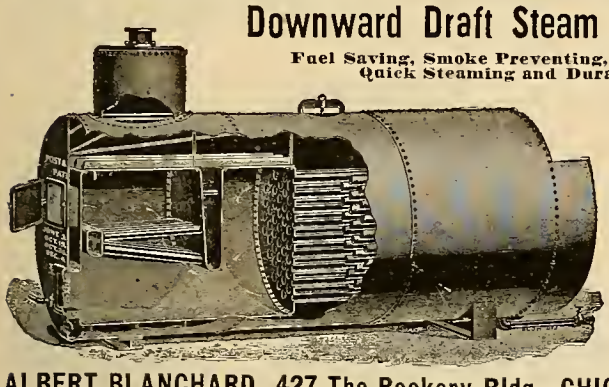

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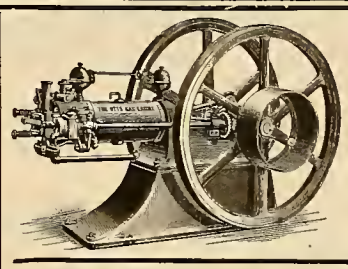

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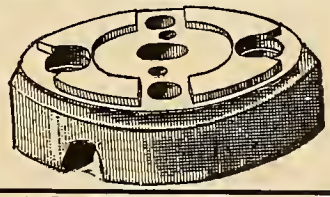

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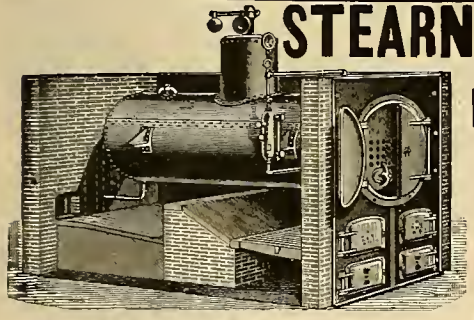

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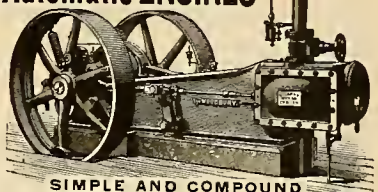

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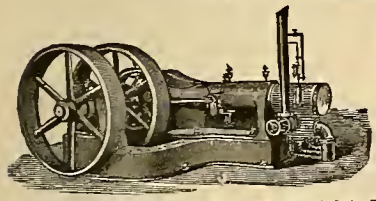

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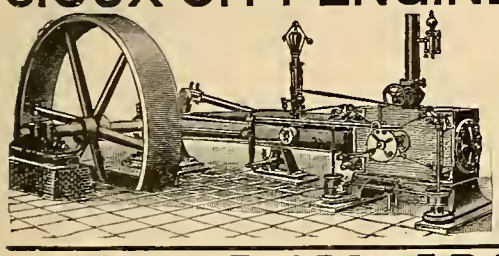

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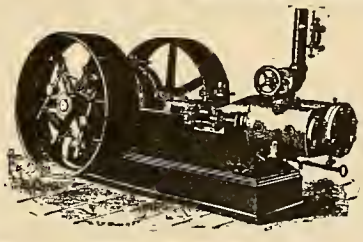

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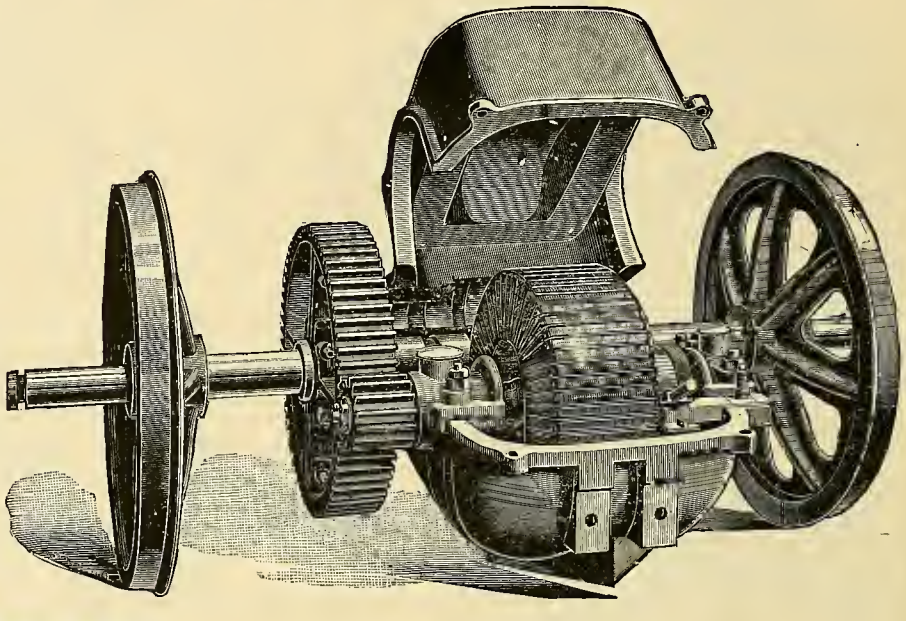

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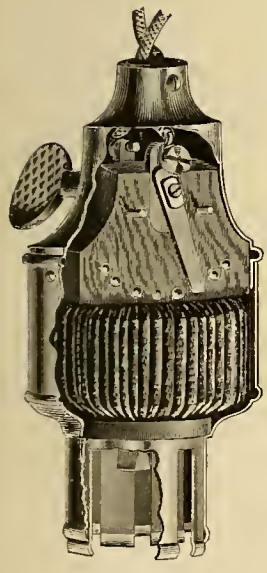

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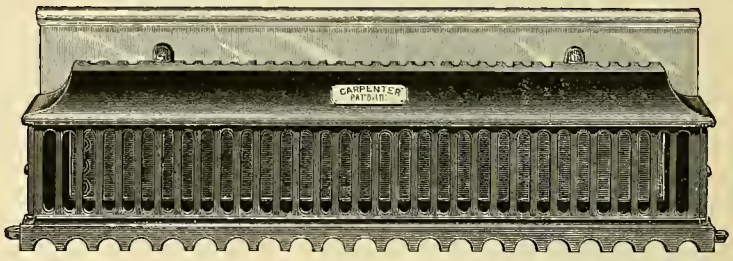

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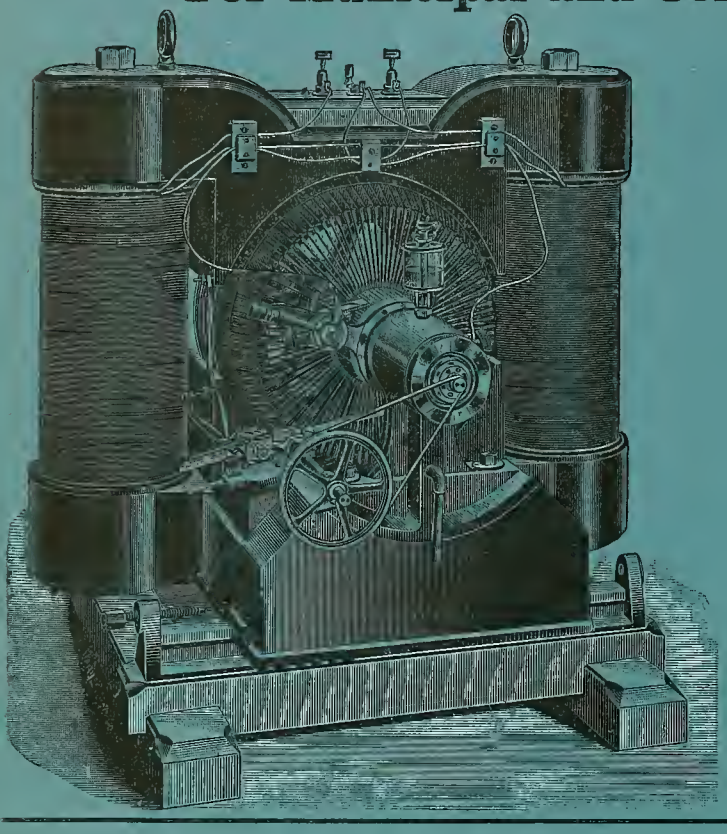

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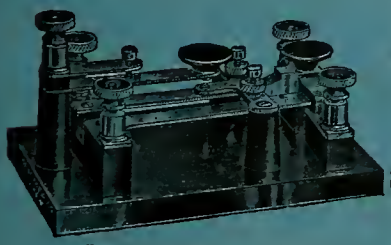

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PAGE VI.

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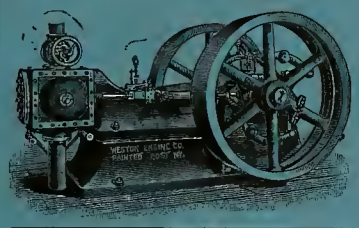

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Pittsburgh, Pa.
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INDEX AND CLASSIFICATION OF ADVERTISEMENTS.

ALPHABETICAL LIST.

American Battery Co..... iv
American Electrical Mfg. Co.. ix
American Electrical Works.... xiii
American Engine Co..... xii
Atwood, A. H..... x
Babcock & Wilcox Co., The.... i
Baggot, E xiv
Baker & Co..... xii
Ball Engine Co..... xxi
Ball & Wood Co., The i
Beacon Vacuum Pump & Elec. Co. i, vi
Becker Mfg. Co., John..... xiii
Beggs, J. E., Mch. & Supply Co. xiv
Bernstein Electric Co..... xii
Blanchard, Albert... ..... —
Boston Braid Mfg. Co..... —
Bowers Bros..... xiii
Bridgeport Mach. Tool Wks.. —
Brookfield, Wm..... xii
Brush Electric Co xix
Bryan, W. H.. xiii
Bryant Electric Co..... xii
Buckeye Electric Co , The..... ix
Cabell, L Breckin idge..... ix, xv
Carpenter Enamel Rheostat Co. xix
Central Electric Co..... ... v
Chicago Rawhide Mfg. Co.... —
Columbia Inc. Lamp Co..... —
Columbia Mfg. & Supply Co.. xiv
Crescent Ins. Wire & Cable Co. xiii
Crocker-Wheeler Electric Co.. xiii
Cushing, F. W..... : vii
Cutter, Geo..... i
Cutter Electrical & Mfg. Co.... —
Dayton Globe Iron Works Co.. xvi
Densmore Typewriter Co..... xii
Diamond Electric Mfg. Co.... xii
d'Infreville, G..... x
Dixon Crucible Co , Jos..... xv
Duplex Electric Co., Ltd..... —
Eastern Electric Cable Co..... xiii
Eastman Kodak Co..... xiv
Edwards, W. S. Mfg. Co iv
Electric Appliance Co xii
Electric Cons. & Supply Co.. xv
Electric Engr'g & Supply Co .. iv
Electric Secret Service Co.... xxi
Electrician Pub Co. ... xvii, xviii
Electrical Eng & Supply Co. The.—
Electrical Mfg. Co., The iv
Electrical Supply Co., The ...xxiv
Elektron Mfg. Co..... xvii
Empire China Works..... xiv
Enterprise Electric Co..... xix
Falls Rivet & Machine Co..... ix
Ferracute Machine Co..... x
Ford-Washburn Storelectro Co. iv
For Sale Advs. .....xii, xiii, xiv
Fort Wayne Electric Co.....xviii
General Electric Co..... ii, xxii
Great Western Elec. Supply Co.—
Greeley & Co., The E. S..... i
Gregory, Chas E..... xiii
Hart & Hegeman Mfg. Co..... x
Heisler Electric Co..... viii
Hill Clutch Works..... xxi
Hine Eliminator Co.... .....—
Holmes, Booth & Haydens.... xiv
Hood & Co., Wm.... iv
Hughes Bros. Mfg Co..... xix
India Rubber & G. P. Ins. Co. xxv
Innis & Co xiii
Institute of Technology..... xix
Interior Conduit & Insulation Co. xv
International Okonite Co..... i
Jewell Belting Co..... i
Johns Mfg. Co., H. W..... xxi
Kartavert Mfg. Co..... xix
Klipstein, A..... xiii
Koapp Electrical Works..... xxiii
Lake, J H. & D., Co xvii
Lake Erie Engineering Works. xx
Lane & Bodley Co..... —
La Roche Electric Works xvii
Leclanche Battery Co., The .. xiv
Lefmann, Julius xv
Leffel, & Co., Jas xvi
Loud, H. M. & Sons Lumber Co. xiv
Manz & Co..... x
Mass. Chemical Co..... x
Midland Electrical Wks..... xii
Moore, Alfred F..... i
Morse & Co., A. M..... .. xiv
Munsell & Co., Eugene..... xii
National Electric Mfg. Co .... —
National India Rubber Co .... —
New York Insulated Wire Co. xix
N. Y. Safety Steam Power Co. x
New York & Ohio Co..... i
Otto Gas Engine Works..... —
Osborne Steam Engineering Co. xii
Ostrander & Co., W. R..... xxi
Page Belting Co..... —
Partrick & Carter Co..... —
Pearson & Co., W. B..... xx
Pelton Water Wheel Co xiv
Penn. Electric Engineering Co xvi
Perkins Elec. Switch Mfg. Co.—
Phoenix Glass Co..... xxi
Porter-Leavitt Elec. Motor Co. xiii
Queen & Co..... xiii
Racine Hardware Mfg. Co....—
Railway Equipment Co.. ix, xxvi
Redding Electric Co..... xiv
Roebling's Sons Co., J. A ....—
Rose Elec. Light Supply Co... xii
Russell & Officer.. i
Samson Cordage Works. xii
Sawyer-Man Electric Co..... xvi
Scott Electrical Mfg. Co viii
Sechrist, Albert..... xvi
Shawmut Fuse Wire Co xv
Shultz Belting Co..... xvii
Siebert, G..... —
Siemens & Halske Electric Co. ix
Sioux City Elec. Supply Co...—
Sioux City Engine Works.... xxi
Smith, A. T..... .....—
Smith, Thos. G. Jr..... —
Sperry Elec. Mining Mach. Co. xix
Standard Electric Co..... xxvi
Standard Paint Co x
Stanley Electric Mfg. Co..... v
Stearns Mfg. Co..... xxi
Steuben Lamp Works..... xiii
Sterling, W. C..... xv
Stillwell & Bierce Mfg. Co. xlv, xv
Sunbeam Incand. Lamp Co.. xxv
Taylor Engine Co..... —
Union Hardware Co..... xii
Utica Elec. Mfg. & Supply Co. x
Vulcanized Fibre Co..... xv
Waddell-Entz Company..... xii
Washburn & Moen Mfg. Co.. iv
Western Electric Co..... x
Westinghouse, Church, Kerr & Co..... xx
Westinghouse Elec. and Mfg Co.....viii, xi
Weston Engine Co..... ... i
Worthington, Henry R..... xii

CLASSIFIED LIST.

Annunciators.
Central Electric Co.
Electrical Supply Co., The.
Knapp Electrical Works.
Ostrander & Co., W. R.
Partrick & Carter Co.

Arc Lamps.
Beggs, J. E., Mchy. & Supply Co.
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Greeley & Co., The E. S.
Knapp Electrical Works.
Ostrander & Co., W. R.
Partrick & Carter Co.
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Greeley & Co., The E. S.
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(See Insulated Wires.)

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Bryan, W. H.
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Cabell, L. Breckinridge.
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Fort Wayne Electric Co.
General Electric Co.
Great Western Electric Supply Co.
Heisler Electric Co.
Lake Erie Engineering Works.
Lane & Bodley Co., The.
La Roche Electric Works.
Lefmann, Julius.
Morse & Co., A. M.
N. Y. Safety Steam Power Co.
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Pearson & Co., W. B.
Racine Hardware Mfg. Co.
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Sioux City Engine Works.
Smith, Thos. G. Jr.
Standard Electric Co.
Waddell-Entz Company.
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Electrical Supply Co., The.
Enterprise Electric Co.
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Knapp Electrical Works.
Moore, Alfred F.
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Hood & Co., Wm.
Knapp Electrical Works.
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Utica Elec. Mfg. & Supply Co.

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Cutter, Geo.
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Electric Appliance Co.
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American Electrical Works.
Central Electric Co.
Crescent Ins. Wire & Cable Co.
Cushing, F. W.
Cutter, Geo.
Eastern Electric Cable Co.
Electric Appliance Co.
Electrical Supply Co., The.
Enterprise Electric Co.
General Electric Co.
Great Western Electric Supply Co.
Holmes, Booth & Haydens.
International Okonite Co., The.
India Rubber & G. P. Ins. Co.
Knapp Electrical Works.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Roebling's Sons Co., J. A.
Shawmut Fuse Wire Co.
Sperry Elec. Mining Machine Co.
Waddell-Entz Company.
Washburn & Moen Mfg. Co.
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Beacon Vacuum Pump & Elec. Co.
Bernstein Electric Co.
Buckeye Electric Co.
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Cutter Electrical & Mfg. Co.
Electric Appliance Co.
Electrical Eng. & Supply Co., The.
Electrical Manufacturing Co., The.
Electrical Supply Co., The.
General Electric Co.
Hood & Co., Wm.
Knapp Electrical Works.
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Bowers Bros.
Johns Mfg. Co., H. W.
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Motors.
Brush Electric Co.
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Electrical Eng. & Supply Co., The.
Ford-Washburn Storelectro Co.
Fort Wayne Electric Co.
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Great Western Electric Supply Co.
Knapp Electrical Works.
La Roche Electric Works.
Porter-Lesvitt Electric Motor Co.
Siemens & Halske Electric Co.
Waddell-Entz Company.
Westinghouse Electric & Mfg. Co.

Name Plates.
Becker Mfg. Co., John.

Pins and Brackets.
Central Electric Co.
Electrical Supply Co., The.
Hughes Bros. Mfg. Co.
Lefmann, Julius.
Loud, H. M. & Sons Lumber Co.
Railway Equipment Co.
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Siebert, G.

Poles.
Electrical Supply Co., The.
Lefmann, Julius.
Loud, H. M. & Sons' Lumber Co.
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Central Electric Co.
Electrical Supply Co., The.
Knapp Electrical Works.
Union Hardware Co.
Western Electric Co.

Railways, Electric.
(See electric railways.)

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Klipstein, A.

Separators, Steam.
Hine Eliminator Co.

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Speaking Tubes.
Central Electric Co.
Electrical Supply Co., The.
Knapp Electrical Works.
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Speed Indicators.
Queen & Co.

Steam Pumps.
Worthington, Henry R.

Supplies, Electric Railway.
Electric Appliance Co.
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Railway Equipment Co.

Tapes, Insulating
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Central Electric Co.
Cushing, F. W.
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Electrical Supply Co., The.
Greeley & Co., The E. S.
Knapp Electrical Works.
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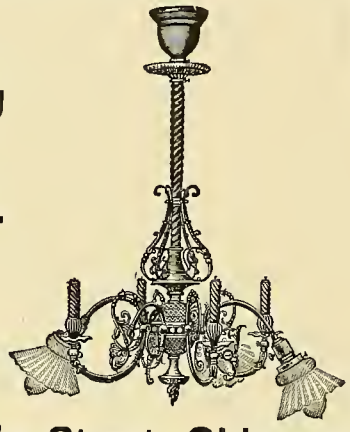

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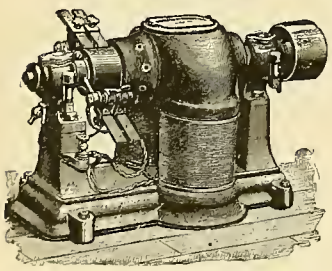

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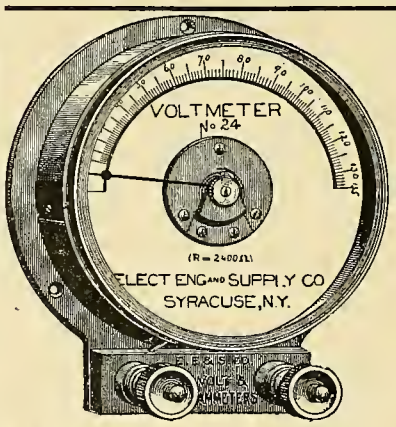

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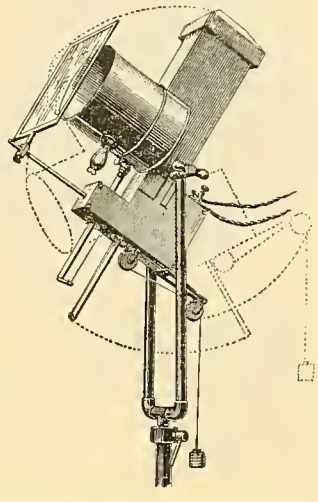

Electric Companies, Supply Houses, Contractors, and the general public are hereby warned that all Corporations or persons who **infringe, manufacture** or **vend imitations** of **Electro-Calcium Apparatus for Theatrical Stage Lighting, Automatic Electric Focusing Arc Lamps** for **Search Lights, Photo-Engraving Lamps,** covered by **United States, Canadian** and **English Patents** owned by The Scott Electrical Manufacturing Company, will be prosecuted to the full extent of the law. Signed

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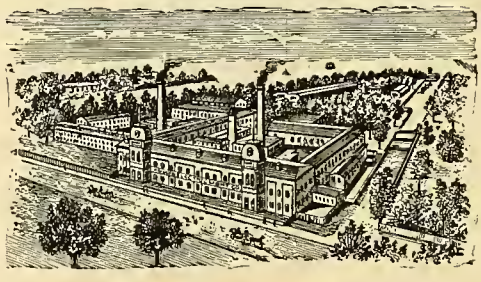

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These mines are of ancient discovery, and were worked with great profit for a long period, being only abandoned on account of political troubles before and after the War of liberation.

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These mines are so richly endowed with auriferous material, from the easily-worked sand, gravel, and dirt (carrying virgin dust and nuggets), to the fissure veins of free milling quartz, that when properly equipped a profit of ten thousand dollars ($10,000) a day, or over three million dollars ($3,000,000) annually is a very low and conservative estimate.

There is an abundance of timber and unfailing water power, with a genial and healthy climate.

It is proposed to organize this property on a basis of five million dollars ($5,000,000), upon which there can be dividends earned of 60 per cent. or more, and the parties furnishing the original capital, in small or large sums, for this organization, which will be about twenty-five thousand dollars ($25,000), will be let in on a basis of two and a half cents (2½c.) on the dollar, with the privilege of purchasing pro rata at five cents (5c.) on the dollar, a sufficient amount to give them a controlling interest if they so desire.

There is also the right of prior possession to double the amount of contiguous land.

The poverty of the owners of this property, being land poor, is the reason of this unusual offer, and they will retain as much of the property as they possibly can, parting with only what is necessary in order to work it.

Situated in the Jurisdiction of Simite, District of Guamaco, Province of Mompos, State of Bolivar.

An experienced miner who has been over and thoroughly examined the property, says more gold is there than in the entire State of California, while another says so great is the evidence of mineral wealth I sometimes doubted my own sanity, and were I to tell California and Colorado miners even a tithe of what I actually saw, I would be branded as a foolish liar or raving maniac.

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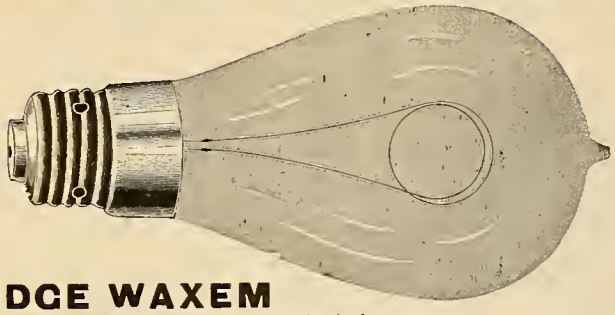

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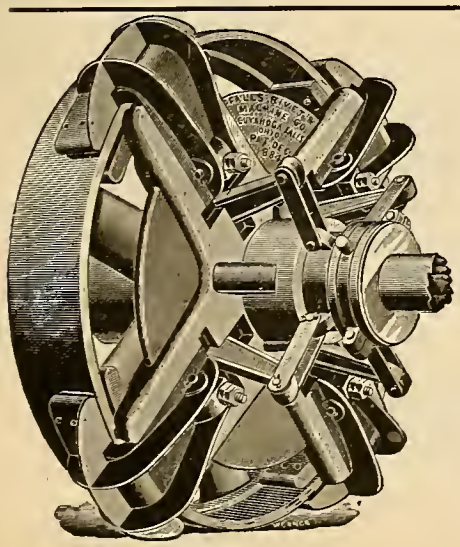

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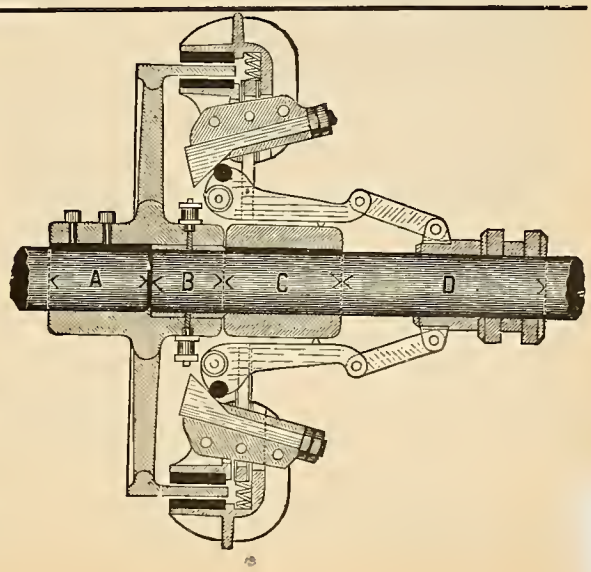

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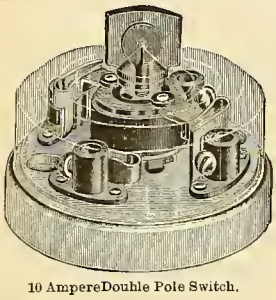
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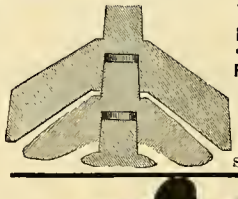

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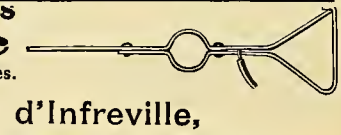

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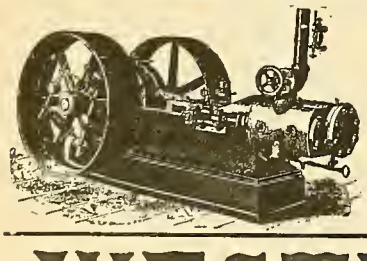

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SIMPLE, ORNAMENTAL, RELIABLE, CHEAP.

OUR NEW LAMPS not only do not infringe the Edison Patent, but they are fully covered by patents of our own.

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By reason of economies effected in the manufacture of our new lamp in large quantities by the use of special machinery, we are able to

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25 and 20 candle power lamps, - - - - $0.35 List Price.
16, 10 and 8 candle power lamps, - - - - $ .30 " "

DISCOUNTS.

Central Stations 10 per cent. discount, and to all others 2½ per cent. to 10 per cent. according to quantity.

ALLOWANCES.

A credit of ten cents will be given for every unbroken burned out lamp, delivered at the factory of the Company.

The saving by decreased cost of lamps and renewals should equal nearly one per cent. on the capital stock of any Central Station.

The constant effort of the agents of the General Electric Company to induce our customers to exchange Generating Apparatus of our make for Thomson-Houston Generating Apparatus is fully explained by the fact that

THE THOMSON-HOUSTON COMPANY PAYS US

through the Consolidated Electric Light Company Five Cents for every Incandescent Lamp it makes, for the right to sell such lamps for use in connection with Generating Apparatus of its own manufacture only.

While we do not sell our new lamp for use in connection with Thomson-Houston Generating Apparatus, the present users of the same may avail themselves of our new lamp by substituting our Generating Apparatus, the quality and efficiency of which will fully warrant the cost.

NOTE: A dealer came to our office and stated that he had **the exclusive sale** of second-hand apparatus for the **General Electric Company**; and he offered five of our Number One Alternating Current Generators for sale, to be delivered a few weeks hence as they are still in use. **We can of course Commend this apparatus if in good order.**

An official of a central station lighting company approached us recently for the exclusive right to the use of our apparatus in his town, stating that his company had already entered into a contract, Form D., with the General Electric Company, for the exclusive use of their apparatus. He frankly avowed that his purpose was, by securing a contract with us, to have a monopoly of electric light and power in the district covered by his station.

We thought it better to leave that place open for competition.

We have also been informed that one other Company had executed Form D contract of the General Electric Company. These three are the only instances we have discovered, where they have succeeded in doing business in the direction of inducing users of our apparatus to discard it for apparatus made by members of the Trust.

Although we have many tons of apparatus made by the various members of the Trust, taken in the course of trade, we have not cared to offer it for sale, for we believe the sale of inferior apparatus does great harm to the electric trade in general.

We have perfected devices that can be inserted in the various sockets now in use, thereby making them standard, for the use of our new lamps. The manufacture of these in sufficient quantities to meet the demand has been unexpectedly delayed, so that the delivery of lamps and these attachments, will be made only from and after January 1st.

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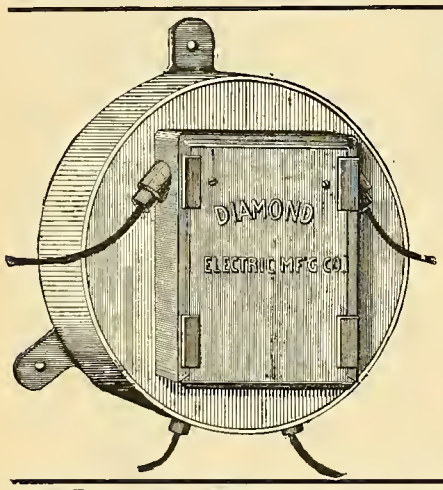

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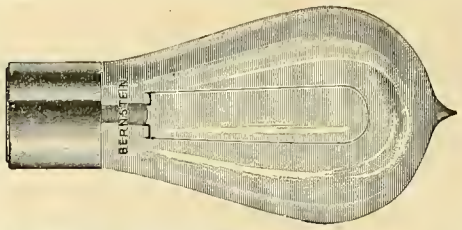

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Sixty No. 16 Brush Arc Lamps.

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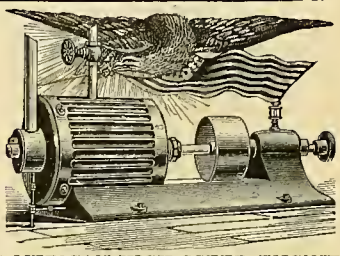

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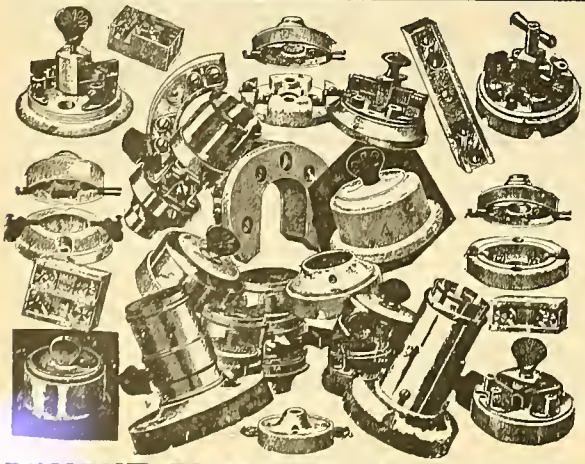

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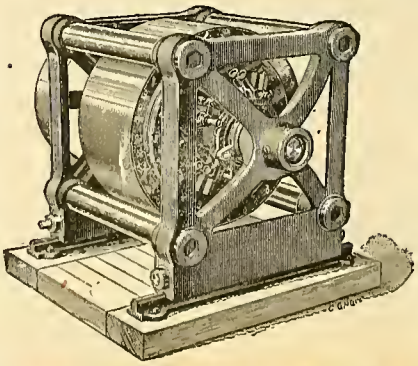

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Western Electrician.

EVERY SATURDAY.

Vol. XI. CHICAGO, DECEMBER 17, 1892. No. 25

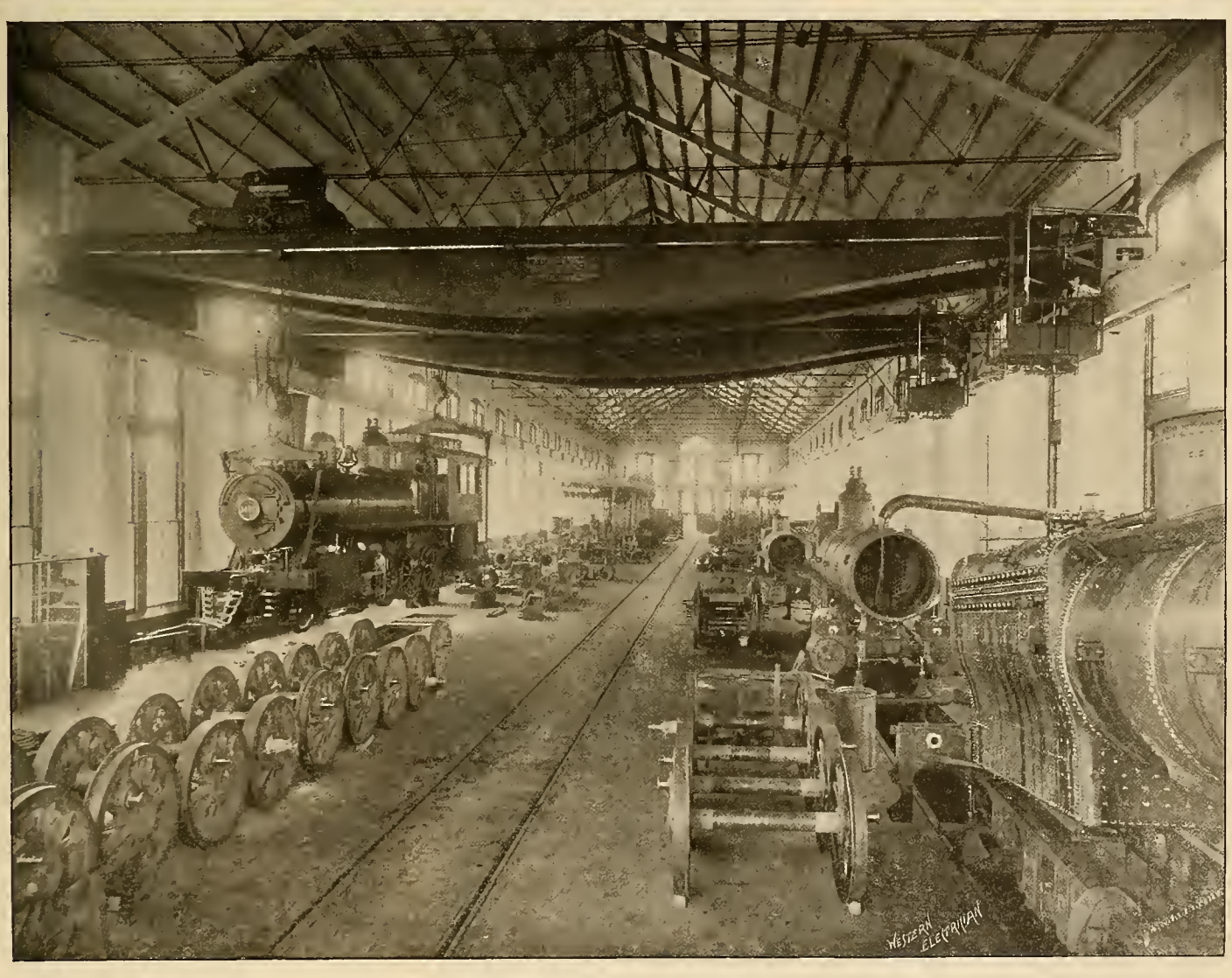
Electric Cranes in Railroad Shops.

The introduction of electrically operated cranes for handling heavy work in large machine shops has been recognized by engineers as a most important advancement. This improvement is being utilized largely in railroad shops. The Pennsylvania Railroad company, for instance, has placed two large cranes in its shops at Altoona, Pa. One of these is shown in the accompanying illustration. It is operated by two motors and has a carrying capacity of forty tons. One of the motors is used for propelling the crane, while the other operates the trolley. By the introduction of clutches the cross travel, main hoist and auxiliary hoist are operated. The auxiliary hoist has a separate drum and chain for lifting light loads at high speeds, and, as can be readily seen, ninety-nine details out of one hundred on a locomotive can be lifted in this way. The span is 62½ feet.

The magnetic brake with which the crane is equipped is governed by the same lever that operates the hoist motor, and is absolutely antomatic under all conditions. The controling device, which is attached to and moves with the crane, consists of three levers. The lever actuates a cam disk, which in turn actuates the arm of an ordinary rheostat. When the crane is at rest the governing levers are in a central vertical position. By throwing them forward or back, motion in either direction can be given the motors. Thomson-Houston motors are used.

Current is supplied to the crane by carbon shoes sliding upon flat copper strips, which run the entire length of the building. The span which carries the carriage is also supplied with copper strips, and carbon brushes sliding on these collect the current for the hoisting and cross-travel motor. With this crane any weight within the capacity of the machine is lifted and transferred to any part of the room in which the crane is located.

The cranes were built by the Morgan Engineering company of Alliance, O. This company is now building two 60 ton double trolley cranes for the New York Central railroad, for handling locomotives; and on each one of these cranes there are six motors, having six independent motions. The spans are 66 feet. The company has also placed eleven electric overhead traveling cranes at the Edison Works in Schenectady; other users are the Thomson-Houston factory at Lynn, Siemens and Halske company, Chicago, and the Brush Electric company, Cleveland. It has one crane of 150 tons capacity at the Watervliet Arsenal, West Troy, N. Y. It is now building a traveling crane of peculiar design, being a combination of electricity and hydraulic. There is a large power pump mounted on the trolley which is operated by an 80 horse power motor. In the center of the trolley is the large hydraulic cylinder. In lowering the water is exhausted to the upper side of the cylinder, practically making the cylinder its own tank. The cylinder can oscillate in all directions, but cannot turn on its seat. It is 21 inches in diameter. The pump is capable of raising 750 pounds to the square inch. It is arranged to operate from the floor as well as the trolley, and is intended for handling molten steel. The cross travel is operated by an independent motor, as is also the longitudinal travel. The diameter of the piston rod is 10 inches, and the weight of the trolley without load is 75 tons.



ELECTRIC CRANES IN RAILROAD SHOPS.

Chicago Electric Club.

There will be a meeting of the Chicago Electric club Monday evening, December 19th, at which many important matters will be disposed of. It is possible that some action may be taken on World's Fair matters. The literary programme for the evening consists of the reading and discussion of a paper on "An Ideal Power Station" by C. J. Field, E. J. Cook and F. Bourne. This will probably be one of the most important meetings of the season.

An electric light plant is wanted at Addison, N. Y.

The Bruckner Electrical Engraving Machine.

One would have to search a long time for a better illustration than the one shown in the accompanying cut, of the peculiar usefulness of the electric current as an agent through which movements in machine tools may be controlled with the greatest nicety. The engraving machine herewith shown, which is now on exhibition in the Masonic Temple, Chicago, does its work mechanically; but, without the aid of electricity, its designer, Charles C. Bruckner, declares it would be impracticable and perhaps impossible to secure results equal to those now obtained.

The accompanying cuts give an excellent idea of the general construction of this contrivance and the work that may be produced through its aid.

In this machine the engraving is done by an electrically controlled tool made to traverse the work so as to cut fine parallel lines or tool marks, similar to those left by a planer, shaper or lathe.

The engraving tool proper, shown at the left in Fig. 1, in position to cut a name in a finger ring, is mounted in connection with an electromagnet armature, through which it may be made to bear upon the work or be lifted from it. This electromagnet, controlling the position of the cutting tool, is in electrical connection with what might be called a contacting device shown at the right in Fig. 1. The work is held in a chuck on the sliding table or, as in the present case, where it is desired to operate upon a circular surface, in a revolving chuck receiving motion from a rack upon the sliding table. The table carrying the work is moved to and fro by the hand lever. To the hand lever another sliding table, shown at the right, is also attached, and this carries a metallic matrix or electrotype. This matrix is slid to and fro under the device through which contact is made, and being attached to the hand lever moves simultaneously with the work table. The electromagnet and the contact point and matrix are all in circuit with two Samson primary batteries, and the electrical connections are such that as the matrix is moved back and forth and fed across under the contact stylus, the engraving tool, under which the work is being similarly fed, is lifted or applied to the work by the action of the electromagnet according to the relative positions of matrix and contact stylus.

From the foregoing general description of the Bruckner machine's operation it will be seen that it does its work in an exceedingly simple manner. To cut a design, say, for instance the portrait of an athlete upon a medal, all that is required is a matrix in the shape of an electrotype or zinc etching. This electrotype is clamped in the chuck on the sliding table at the right in Fig. 1, and the object to be engraved, if it be of circular form like, say, the ring, is clamped in the revolving chuck that is geared to the other sliding table. If the surface to be engraved is flat the object is clamped in the chuck shown in the picture detached from the machine, and the latter is then screwed on the sliding table and a straight tool inserted.

One of the objects of the designer was to produce an engraving machine that would operate in the most direct manner and cover the range of work required of such machines by jewelers. To this end the table having a reciprocating motion was provided and adapted to hold such jewelers' goods as have a flat surface to be engraved, or on which the surface within the limits to be engraved does not curve materially—as, for example, such objects as a watch case, a tray, or a water pitcher. Besides such objects as already mentioned and all intermediate in size, by separate devices, provision has been made for three classes of circular work that may be illustrated by three examples, as engraving on the inside surface of a finger ring, as shown in Fig. 1, engraving on a flat surface in a circle like the inscription adjoining the edge of a coin, and engraving on the convex surface of a goblet.

The great variety of work, however, to which the Bruckner machine may be applied will be better appreciated after an inspection of Fig. 2, which is a reproduction of a photograph of a number of articles that have been engraved by this contrivance. It should be noted that there are among the articles shown a number of stones cut in various shapes that have been engraved upon with this machine. The substitution of a diamond pointed tool in place of the steel tool is the only change required to fit the machine for stone cutting.

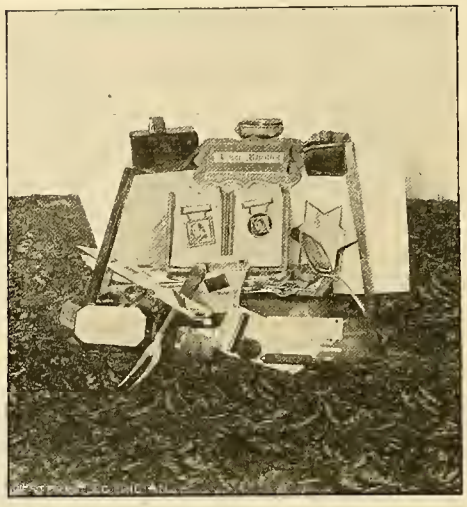


FIG. 2. THE BRUCKNER ELECTRICAL ENGRAVING MACHINE.

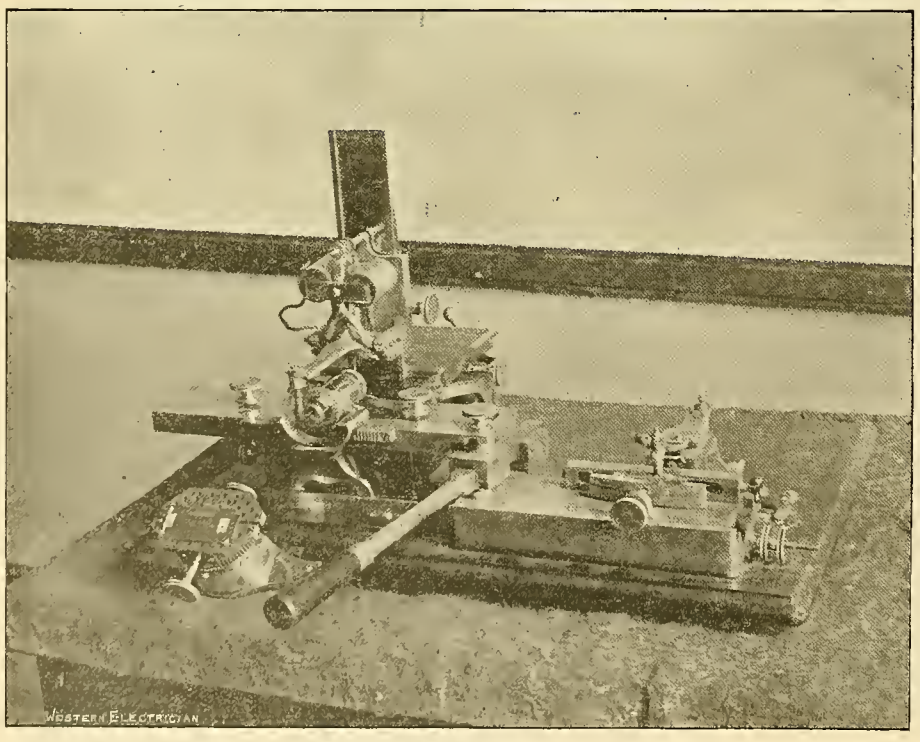


FIG. 1. THE BRUCKNER ELECTRICAL ENGRAVING MACHINE.

Electricity at the World's Fair.

The progress that is making on the elevated electric railway at the World's Fair is shown by the accompanying illustrations. Fig. 1 is a reproduction of a recently taken photograph of the loop at the southern end of the line, near the annex to the agricultural building, in the southeastern portion of the grounds. The picture represents the single-track structure from near the point of juncture with the double-track construction and also shows a considerable extent of iron girders. The radius of the loop is 100 feet. The iron framework shown at the right of the illustration is that of the building for the leather industry. The present appearance of the machinery foundations in the power house, which is located directly south of the forestry building, is shown in Fig. 2. The steam and electrical plant was briefly described in this journal several weeks ago, and no changes in the plan have been made since that time. The power house will have wooden walls, covered with staff, with the exception of the rear wall, which will be of brick and contain the boiler flues. The foundations shown in the illustration were erected on three feet of concrete laid on a timber platform equal in extent to the area covered by the heavy machinery. This unusual precaution was made necessary by the character of the soil. The engine foundations will extend ten feet above the level of the floor of the power house, but a gallery between the engine and boiler rooms will be provided for the benefit of spectators. The line of railway will be mostly level, and access to it will be afforded at eleven stations. A rather unusual feature of the construction is the fact that for a distance of about 900 feet the line will run over the roof of the annex to the transportation building. Power will be furnished by electric motor cars, each of which will draw two or three trailers. The office of the company will be in the building forming the southwestern corner of the colonnade connecting the machinery and agricultural buildings.

The headquarters of the department of electricity were removed from the Rand-McNally building down town to the electricity building at Jackson park on Tuesday of last week. The offices are on the second floor of the building at the southern end. The rooms are far from being elaborately fitted up as yet, but with the aid of a comfortable stove Secretary Hornsby and his assistants manage to worry along.

The General Electric company will have an interesting exhibit on top of the electricity building. It will be a flash of artificial lightning with a spark 35 feet long. Two discharge points will be arranged on the roof of the building 35 feet apart vertically. These discharge points will be connected to the opposite ends of a series of condensers and induction coils, so arranged as to increase the voltage to a pressure that will approximate that of lightning. The discharge will be accompanied by a noise not unlike thunder, and will certainly attract much attention.

Fifteen of the fifty electric launches ordered for the World's Fair are completed and awaiting electrical equipment. The General Electric Launch company has the contract for furnishing the boats now being built at Racine and Detroit.

Lamps manufactured by the Westinghouse company are now in operation in the administration building, current being taken from Edison machines in the temporary plant.

The rules relating to electric lighting and power service at the World's Fair, as adopted by the national commission, are given below. It should be stated that all of these rules have not been approved by the local company, and that they are liable to change. Following are the rules:

ELECTRICITY FOR INCANDESCENT LIGHTING SERVICE.

All state and territorial World's Fair boards, persons, firms or corporations who may desire to wire their respective buildings for the purpose of lighting same shall so install said wiring as to meet with the approval of the director of works before connections can be made with the main circuit.

All power service for generating light will be furnished during the exposition hours by the World's Columbian Exposition from the 1st of May to the 30th of October, 1893, at the rate of $8.00 per 16 candle power lamp capacity or the equivalent in lamps of other candle power. All changes in the location of lamps or appliances whence once installed will be made subject to an extra charge to be fixed and determined by the director-general and the director of works. The incandescent lighting circuit will be operated from 100 to 110 volt alternating circuits.

ELECTRICITY FOR POWER SERVICE.

First—All contracts to be made with exhibitors for power service shall be executed between said exhibitors, the director-general and the director of works, but the amount of power to be supplied to the exhibitor in each case shall be fixed and determined upon by the director, general.

Second—The electric motor shall be suitable to operate on a 500 volt constant potential circuit.

Third—The rheostat shall be constructed wholly of non-combustible material.

Fourth—The main line switch shall be of the knife blade type and suitable for working a 500 volt constant potential circuit.

Fifth—The motor shall be erected in position by and at the expense of the consumer and in a manner subject to the approval of the director-general and the director of works.

Sixth—The service connections to the motors shall be installed, maintained and owned by the World's Columbian Exposition.

Seventh—No service will be rendered for less than

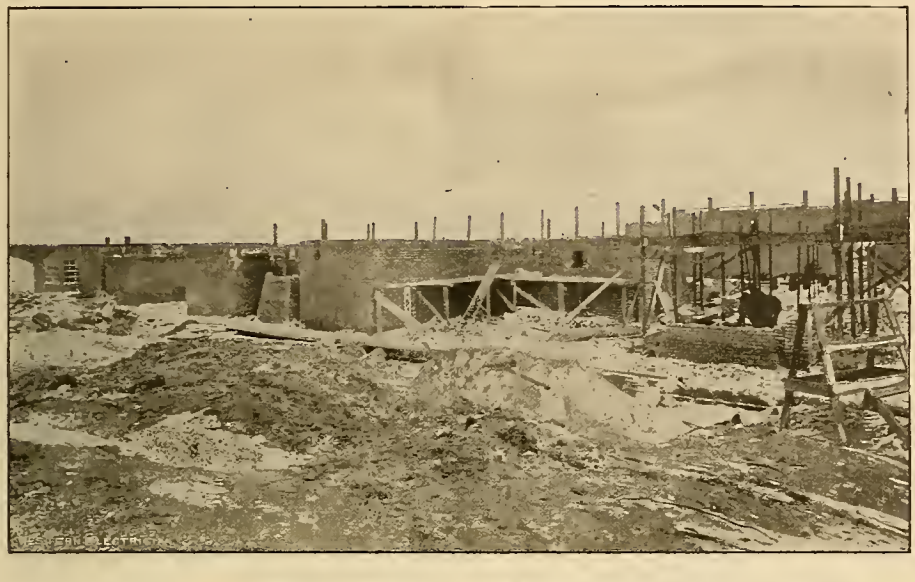


FIG. 2. ELECTRICITY AT THE WORLD'S FAIR.

$20.00. Fractions of horse-power will not be considered except for motors of less than 1 horse power.

Eighth—Charges will be made for service of connecting the main line at the following rates;

For ½ horse power and less.....	$10.00	per horse power.
For 1 to 5 horse power.....	15.00	" "
For more than 5 horse power and not exceeding 10 horse power...	12.00	" "
For more than 10 horse power....	10.00	" "

Ninth—Charges for service will be based upon the maximum mechanical horse power delivered to the motor, irrespective of the class of work to be operated by motor, at the following rates:

For ½ horse power and less.....	$20.00	per horse power.
For more than ½ horse power and not exceeding ½ horse power...	40 00	" "
For more than ½ horse power and not exceeding 1 horse power...	75.00	" "
For more than 1 horse power and not exceeding 2 horse power...	70.00	" "
For more than 2 horse power and not exceeding 3 horse power...	60.00	" "
For more than 3 horse power.....	60.00	" "

Tenth—Special service for motors not exceeding 2 horse-power can be furnished on ½ alternating current incandescent circuit.

ELECTRICITY FOR ARC LIGHTING.

The aisles of the main building will be illuminated by arc lights free of expense to the exhibitor. A limited number of arc lights will be supplied for private lighting on the following basis, viz.:

First—The consumer shall pay the cost of wiring.

Second—The consumer shall pay for service from May 1 to October 30, 1893, at the rate of $60 per lamp of 2,000 nominal candle power.

Third—Lamps will be suspended from the ceiling and furnished with opalescent globes. If any special fixture is required, it shall be furnished by the consumer.

Fourth—All care and attendance to the lamps and circuits will be furnished by the World's Columbian Exposition without extra charge.

ELECTRICITY FOR CHARGING STORAGE BATTERIES.

First—The consumer shall provide lines and all material necessary from the local switchboard from which the current is to be distributed to storage batteries.

Second—The consumer shall provide all necessary labor and attendance connected with the charging or handling of the batteries.

Third—Current will be provided 110 to 220 or 500 volts, at the rate of 10 cents per electrical horse power per hour.

ELECTRICITY FOR MISCELLANEOUS PURPOSES.

First—Electricity for special purposes will be subject to special agreement to be determined at the time of making application therefor.

Second—Rates will be based either on those of power or those for storage battery purposes, according to the class of work to be performed.

RULES GOVERNING LIGHT AND POWER IN ELECTRICITY BUILDING TO BE SUPPLIED BY THE WORLD'S COLUMBIAN EXPOSITION.

Exhibitors in the electricity building will be divided into two classes: First, those who contribute to the service of lighting and electric power transmission for the building; second, those who do not so contribute.

Contributors will be again divided into two classes:

(1) Those who furnish generators connected to prime movers in machinery hall.

(2) Those who contribute to the service lighting of electricity building through motor power taken from circuits in the electricity building.

Contributors to either class will be required to enter into a formal contract with the director-general, to be approved by the director of works, for furnishing and operating machinery offered in accordance with the following general terms:

No steam power being available in the electricity building, all generators provided by contributors of class (1) must be installed in machinery hall. Generators provided by American companies will be located in the regular service plant in machinery hall. Generators provided by foreign companies will be located in the spaces severally allotted to these countries in machinery hall.

Power circuits will be led from the generators of each contributor of class (1) through existing subways from machinery hall to the electricity building. The several exhibitors offering generators for this service are expected to furnish and install at their own expense the several power circuits before mentioned, subject to the supervision of the chief of department of electricity.

The aisles of the electricity building will be illuminated by arc lights, which will be considered the service lighting for the building. Arc lights in addition to these, as well as all incandescent lights, and power for keeping exhibits in motion, will be considered as special service rendered to individual exhibitors.

Power of operating generators needed for the service lighting will be furnished free of cost to the exhibitors installing this light. In consideration of such contribution to the service lighting of electricity building, exhibitors participating in this service will be granted such amount of extra power and light for the operation of their own exhibits as may be mutually agreed upon between them and the director-general.

Arc and incandescent lights may be taken direct from the several power circuits leading from machinery hall, or they may be furnished from generators driven by motors taking current from the power circuits before mentioned, motors and generators in this latter case being located in the electricity building. Arc lights for all night service are an exception to this rule, and will be supplied from the regular service plant already contracted for by the World's Columbian Exposition.

Contributors of class (2) who use current from the power circuits will be expected to provide the necessary motors, generators, and shaft free of cost to the World's Columbian Exposition. Exhibitors contributing to the arc lighting necessary in the service of the building will be expected to wire, hang and maintain such lamps as may be assigned to them free of cost to the World's Columbian Exposition. Such arc lamps, incandescent lights and motors as may be installed within the contributing exhibitor's space will be wired and hung by said exhibitor at his own expense.

In order to provide for lighting and power service to those exhibitors who do not contribute to the service of electricity building, it is proposed to assign to each exhibitor contributing to said service a specified portion of the electricity building in which to furnish special lighting and power. All works of wiring, hanging and maintenance of lamps, etc., done for other exhibitors in such space will be paid by the World's Columbian Exposition at the following rates:

(1) For each incandescent lamp, including the first lamp and socket with installation on a plain cord or pendant, $3.50 per 16 candle power lamp.

(a) Special fancy wiring will be furnished at an extra cost to be paid by consumer under special agreement with the Director-general, approved by the director of works.

(b) Fixtures and shades will be furnished and maintained by consumer.

(c) Lamps of other capacities, fancy or colored lamps, will be furnished in accordance with special agreement with the director-general, approved by the director of works. Lamp renewals must be furnished free of charge by contributor. Breakages must be purchased by the consumer from the exhibitor supplying his exhibit, at the usual market price.

(2) For each arc lamp, including ceiling block, suspension rod and lamp complete, $35. Lamps must be furnished with opal globes. All care and attendance to lamps and circuits must be furnished without extra charge by the contributor maintaining the circuit.

(3) All wiring necessary for the installation of motors within the space assigned to each contributor shall be done by said contributor at the expense of exhibitor desiring said power, at the following rates:

One-half horse power and less, $8.00.

One to five horse power, per horse power, $5.00.

More than five horse power and not exceeding ten horse power, per horse power, $10.00.

More than ten horse power, per horse power, $8.00.

Fractions of a horse power will not be considered except for motors of less than one horse power. In all cases the rating of the motor will be the standard rating of the manufacturer.

Service connections, as well as all lamps and sockets, intalled at contributor's expense, shall be maintained and owned by said contributor. All alterations of original installation shall be made by said contributor after written agreement between the exhibitor desiring change and the director-general, approved by the director of works.

All installation and operation shall be subject to the inspection and approval of the chief of the department of electricity. Installation must confirm to the national code of the Board of Underwriters, subject to the inspection and approval of the director-general.

Service will be provided only from May 1 to November 1, 1893, and during exposition hours, except by special authority from the director-general and director of works.

The service rendered will be entirely at the risk of the consumer. The World's Columbian Exposition will not be responsible for stoppages from any reasonable cause.

RULES GOVERNING THE SUPPLY OF LIGHTING AND POWER TO EXHIBITORS IN THE DEPARTMENT OF ELECTRICITY.

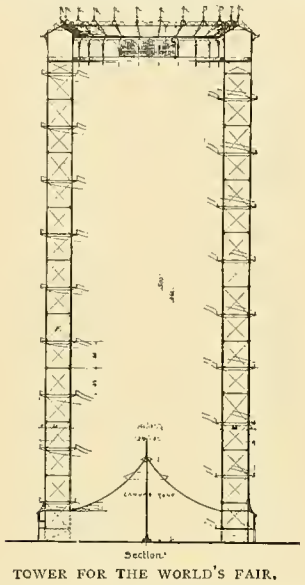
Electric power only will be supplied in the electrical building.

FIG. 1. ELECTRICITY AT THE WORLD'S FAIR.

The aisles of the building will be illuminated with arc lamps without cost to exhibitors; additional lighting to be paid for by exhibitors at the following rates:

Arc lamps, service May 1st to October 31st, 1893, during exposition hours, $65.00 per lamp of 2,000 nominal candle power. Lamps suspended from ceiling with opal globes and globe nets, special fixtures or globes, or special ornamental lamps, will be subject to an extra charge to be fixed by the director-general and the director of works.

Incandescent lamps, service May 1 to October 31, inclusive, 1893, during the hours of the exposition, $8.00 per 16 candle power lamp, including installation of first lamp and socket and lamp renewals. Breakages must be purchased by exhibitor of the contractor lighting his space, at the usual commercial rate. Lamps will be hung on plain cord or pendant. Special or fancy wiring will be furnished at an extra charge to be fixed by the director-general and the director of works. Fixtures and shades will be furnished and maintained by consumer. Special colored or fancy lamps, or



TOWER FOR THE WORLD'S FAIR.

lamps of other than 16 candle power, will be subject to special agreement with the director-general and approved by the director of works. Installations of 300 lamps or more will be subject to special discount to be fixed by the director-general.

MOTORS.—Exhibitors requiring motive power will furnish necessary motors, rheostats, main line switches, insulating base, etc., complete, together with all belts, countershafting, and other means of connecting motors to operating machinery. Motors should be suitable for operation on the class of circuit furnished in exhibitor's location.

The rheostats must be constructed wholly of non-combustible material. The main line switch shall be of the knife blade type, of ample carrying capacity, and suitable for breaking current at the potential used. Motors shall be erected in position at the expense of the exhibitor by the contractor furnishing power in the location of his exhibit, service connections to motors being installed, maintained and owned by the said contractor.

Charges for service connections with the main line will be as follows:

For one-half horse power and less, $8.

For one horse power to five horse power, per horse power, $12.

For more than five horse power and not exceeding ten horse power, per horse power, $10.

For more than ten horse power, per horse power, $8.

Fractions of a horse power will not be considered, except for motors of less than one horse power.

Ratings of motors will be the standard rating of the manufacturer.

Charges for service will be based on the maximum electrical horse power delivered to the motor, irrespective of the class of work to be operated by the motor, at the following rates:

For ¼ horse power and less, $15.

For more than ¼ horse power, and not exceeding ½ horse power, $30.

For more than ½ horse power, and not exceeding one horse power, $50.

For more than one horse power, and not exceeding two horse power, per horse power, $45.

For more than two horse power, and not exceeding three horse power, per horse power, $42.50.

For more than three horse power, per horse power, $40.

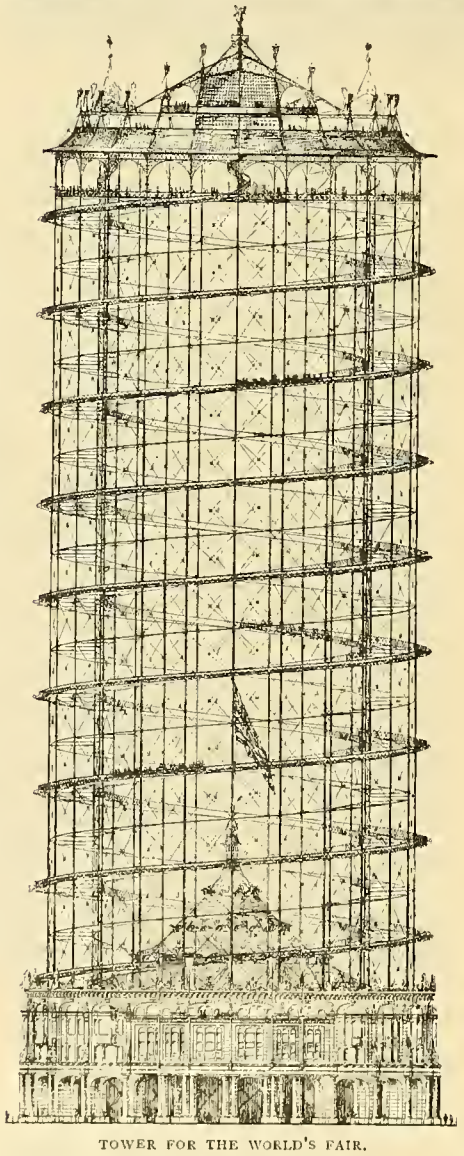
A limited amount of power may be furnished to exhibitors free of charge to simply turn over an otherwise inoperative exhibit.

Copper Combine.

The electrical fraternity will be interested in the following press dispatch, which was sent out from New York on December 6th: The copper combine organized last spring to control the production and price of copper has finally got into effective working order, and the agreement entered into in March by the copper producers is about to be carried out. Among the most striking results will be the shutting down of the Anaconda company's mines at Butte and the reduction of operations by the Boston and Montana company, whose mines are also at Butte. There is inside information that these moves will be made in the next two weeks. It is predicted that the Anaconda company will cease work completely by December 15th, and the Boston and Montana will make its reduction by December 20th. The agreement entered into last March was based on an increase for the year of 10 per cent. on the production of 1891. This, it was believed, would hold the average price of copper in New York at 12½c per pound for "lake" and 11½c for "casting."

Tower for the World's Fair.

As was announced in the last issue of the WESTERN ELECTRICIAN, there seems to be no doubt that there will be a tower at the World's Fair. It is stated that ground has been broken, and work will be pushed as fast as possible, by the World's Fair Tower company, The structure will be entirely of steel and will be of novel design, as shown in the accompanying illustrations. Visitors will be conveyed to the top of this tower by an electric railway. The length of this line will be about one mile, and trains of five cars, each arranged for eight persons, will be operated. A moderate rate of speed will be maintained, giving the passengers an excellent opportunity to view the surroundings. It is expected that 800 cars can be operated on this road, and a plant of 3,000 horse power capacity will be installed. The exploiters of this enterprise announce that they intend to brilliantly illuminate the tower and make it one of the most attractive features of the exposition. Suspended from the brackets, which are twelve to fifteen feet apart and which sustain the hanging garden, will be Japanese and Chinese lanterns of every form and color, each containing

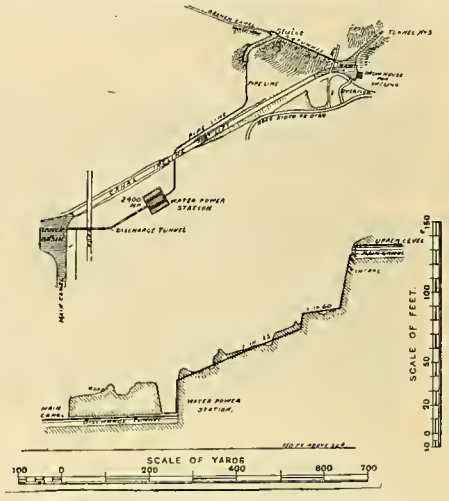


TOWER FOR THE WORLD'S FAIR.

a cluster of three incandescent lights. Surmounting the tower, fifty feet above the observatory floor, will be arranged from five to seven powerful search lights. The canopy of each little car will be lighted, both front and rear, with a cluster of three incandescent lights. One will have to call largely upon his imagination to be able to picture the beauty of this tower when in full operation. The marvelous sight will be presented of 400 cars circling down the tower track and 400 ascending at the same rate of speed, causing 5,000 incandescent lights to be flitting past each other in rapid succession, added to the hanging lamps around the spiral and the incandescent light coming out of the ornamental and gilded stars fixed at every point where the bracing rods cross each other.

The Kioto Canal in Japan.

Reference was made in Mr. Iwadare's article on "Electricity in Japan," published in last week's issue of the WESTERN ELECTRICIAN, to the canal between the city of Kioto and Lake Biwa, in Japan, which possesses a special interest to electricians. Since the publication of the article mentioned London *Industries* has come to hand with several interesting illustrations of this novel installation, three of which are reproduced in this issue. It is to be regretted that the English journal is unable to give more



FIGS. 1 AND 2. THE KIOTO CANAL IN JAPAN.

than a brief general description of the plant, and that Mr. Iwadare does not dwell on it more fully. It may be well, however, to repeat the reference to it made by the latter:

The electric motor business has not been thoroughly exploited in Japan. There is only one central station—that in Kioto. It is owned by the city, and started for electric power business only. They have a water power amounting to 2,500 horse power, the head being 115 feet, but they are now utilizing only 400 or 500 horse power out of 2,500 horse power. They constructed a canal between Kioto and Lake Biwa, the largest lake in Japan. The canal is about fifteen miles in length, and cost $1,600,000 (silver.) It was constructed for the transportation of goods by water from Biwa to Kioto. The water in the canal is utilized for power purposes near Kioto, and therefore when boats from Lake Biwa arrive near the power station they are set on cradles and allowed to slide down an incline of 1,500 feet overland. The cradles with boats are moved up and down by a 50 horse power electric motor. When the boats arrive at the foot of the incline they float again in the river, which takes them down stream to the city of Osaka, whence the goods are shipped to any part of Japan or to foreign countries by ocean steamers. In the power station there are Pelton water wheels. Edison 500 volt power generators and Thomson-Houston alternators are used, the latter being devoted to lighting the city of Kioto.

In describing its illustrations *Industries* gives but few additional facts. It says that the canal, which has a length of 6⅞ miles, passes through several ranges of mountains by means of three tunnels, the lengths of which are 2 680, 137 and 934 yards respectively. Just below tunnel No. 3, at a distance of about 5¼ miles from Lake Biwa, the canal is divided into two. One branch—the high-level—is used for irrigation purposes, while the other, which is designed for navigation, descends 118 feet in a distance of 1,800 feet to the level of the city, a slope of about 1 in 15. The boat traffic at this point is worked by an inclined planeway, the boats being put into a wheeled cradle, which is hauled up and let down by means of a wire rope. Fig. 3 gives a view of this inclined way, and also of the cradles, on one of which a small boat may be noticed. These ways are operated by electric energy furnished by a Sprague motor driven by a Pelton water-wheel. The fall of the canal also affords a very valuable water power, a part of which has already been utilized for various mechanical purposes by means of electric transmission. From Figs. 1 and 2, representing a plan and profile of the canal incline, it will be seen that the power station is located at the foot of the incline, water for which is supplied by three lines of 36 inch pipe, 1,300 feet in length, delivering water to the wheels under a head of about 100 feet. Fig. 4 represents a view of this interesting station taken last year during construction. The whole of the works were designed by and executed under

the direct supervision of Sakuro Tanabe, now professor of civil engineering in the Imperial College of Engineering, Tokio, and consulting engineer to Kioto-Fu.

Buffalo Electrical Society.

At a meeting of the Buffalo Electrical society on December 5th P. K. Stern read an interesting paper on electric heaters. The attendance at this meeting shows that the society has opened the season with its old time enthusiasm. At the next meeting Frank Kitton will deliver a lecture on magnetism, and at a subsequent meeting A. C. Terry will lecture on the subject of electric motors, treating it in a popular and elementary way.

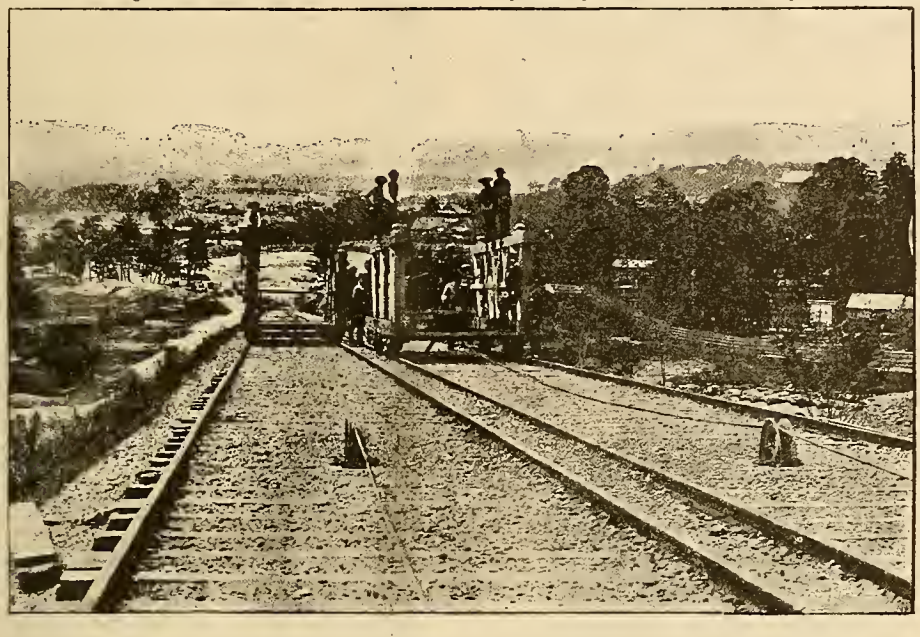


FIG. 3. THE KIOTO CANAL IN JAPAN.

The society is considering the project of a series of lectures on electrical engineering, known as the university extension course.

The members of the Buffalo Society of Natural Sciences are very much interested in this course of lectures, and the prospects are that the plan will be eminently successful. The lectures will be delivered by one of the best electrical engineers in the state.

The following named officers have been elected for the years 1892-93: President, Frank Kitton; vice-president, P. K. Stern; secretary, Astley C. Terry; treasurer, Samuel Stewart; librarian, John G. McNeroy; executive committee, Frank Kitton, P. K. Stern, A. C. Terry, Samuel Stewart, F. P. Jones, F. A. Hallock, John P. Chapin, Geo. A. Burnett.

Keep the World's Fair Open Evenings.

Despite the failure of the World's Fair authorities to evince an interest in the demands of the electrical fraternity for a positive statement of the number of nights each week that the grounds would be open, the electrical concerns have not given up the agitation. Further comments by our contemporaries are herewith presented:

Canadian Electrical News: A very strong protest is being made by electrical manufacturers and the electrical journals of the United States against the rule adopted by the commissioners of the World's Fair to close the gates at 7 P. M. The commissioners have explained that the rule was adopted not with the purpose that it should be enforced every evening, but to place in the hands of the commissioners the power to regulate the hours of closing. This does not satisfy the electrical people, who have gone to great expense in preparing exhibits in the belief that the fair will be open every evening. It is probable that the protestations will be so vigorous as to compel the commissioners to alter their decision.

Electrical Age: The strong and positive opposition expressed in the electrical trades against the closing of the World's Fair at 7 o'clock each evening is having a softening effect upon the authorities. Col. R. C. Clowry, chairman of the World's Fair committee on electricity, called the attention of H. N. Higinbotham, chairman of the council of administration, to the state of feeling in the matter, and the latter gentleman promptly replied to the effect that it was the intention of the fair authorities to open the gates at 8 o'clock and keep them open till 11 o'clock on three to six evenings a week, according to circumstances. To electric lighting interests this practically means that they may have three opportunities or they may have six each week to exhibit their goods as they should be exhibited. The electric lighting interests are very large, and cannot be ignored in this matter. The fair should be open every night in the week without reserve. Mr. Higinbotham's reply is too indefinite to be satisfactory.

Electrical Industries: It is a matter that has attracted world-wide attention that the World's Columbian Exposition has invested an immense amount of capital in an electric plant that is to have a capacity in round numbers of 6,000 arc and 100,000 incandescent lamps; while in addition to the latter, exhibitors will have from half to as many lamps more for purposes of special illumination. Thus there will be concentrated within the limits of Jackson Park by far a larger and more extensive electric plant than the world has yet known. Last month all anticipations in regard to the illumination this great plant was supposed to be installed for, were shocked by the announcement that the fair would not be open evenings except on special occasions. Disappointment at this announcement stirred up electrical and other interests all over the country, and the fair authorities have been petitioned and besieged on all sides to open the exposition every evening so that full benefit of the vast installation can be had. President Higinbotham in an open letter in reply to the protests and petitions says that it has not been the intention to close the fair to evening sessions entirely, but to open the gates from 8 to 11 o'clock from three to six evenings a week according to circumstances. *Electrical Industries* joins most heartily the movement to have the fullest benefit of the lighting exhibit. To say that the grounds will be open a few evenings a week "according to circumstances" is not explicit enough. The fair is for the people, yet we think we are safe in saying that half the people in Chicago and vicinity cannot afford to be away from their labors during the day in order to attend the fair. If it is kept open evenings they can enjoy it fully, while to close the grounds from 7 to 8 o'clock in the evening is to extort a second admission fee from those who are inclined to attend both day and evening sessions. So far as effects are concerned the exposition will be infinitely more attractive evenings with the brilliant illuminations than it can possibly be made by daylight.

The one all important consideration is the greatest good to the largest number of people, and with this as the purpose for which the fair is to be held and for which it has been laid out on such a magnificent scale, the management cannot afford to close a single day from the time of opening in the morning until 10 or 11 o'clock in the evening. This is the demand as it has been presented, and it must be insisted upon without compromise. The illuminations exterior and interior, the electric fountains, the lagoons with lights streaming across them from every direction, and the vast electric plant in operation must be at the command of the public every day and hour possible during the holding of the exposition.

Utilizing Electricity in Founding a Town.

The Rumford Falls, Me., Development company is laying the foundations for a city which within two years, it is expected, will have a population of 10,000, but at present it is only the abode of the workmen who are engaged in clearing the land for the prospective city. One of the principal features of the place will be its splendid electric plant. The site of the town was selected for the facilities the falls afford for water power. These are unequaled in New England. The members of the Development company considered the advisability of transmitting the power by electricity from one main station but finally concluded to use as much of the water power direct as possible and then allow manufacturers who can not get their power direct to transmit it in the form of electricity. There are three falls, all near each other and they have a total drop of 90 feet. The available power is estimated at 35,000 horse power, four times as great as is to be obtained at Lewiston and Auburn combined. Dams and canals are building to make this power available. To build these and make other improvements about $3,000,000 will be spent. The Rumford Falls Paper & Pulp company is putting up what will be the largest pulp mills in this country if not in the world. Sites for 15 mills are being laid out. The electric plant will furnish the city with lights and furnish small plants with power. The plans for a power station are in the hand of a Boston engineer, but have not been submitted yet.

When finished some 200 horse power in electrical apparatus will be bought for both lighting and power purposes. In the course of a few years from 1,000 to 1,500 horse power for operating electric motors will be furnished from this station. Power will undoubtedly be very cheap with such facilities.

Railroad Telegraphers' Strike.

A strike of telegraph operators on the Rock Island railway began on December 9th. There is a considerable discrepancy regarding its extent and the number of men who are idle in the statements made by General Manager St. John on the part of the company and Chief Ramsey of the Order of Railway Telegraphers, on the part of the men. It is agreed that a strike has taken place, and both sides assert their confidence in ultimate victory. Mr. St. John places the number of men who have left the service of the company at about forty. Chief Ramsay is certain that 500 operators have deserted their posts. The refusal of the company to recognize the Order of Railway Telegraphers and sign its schedule is the cause of the trouble.

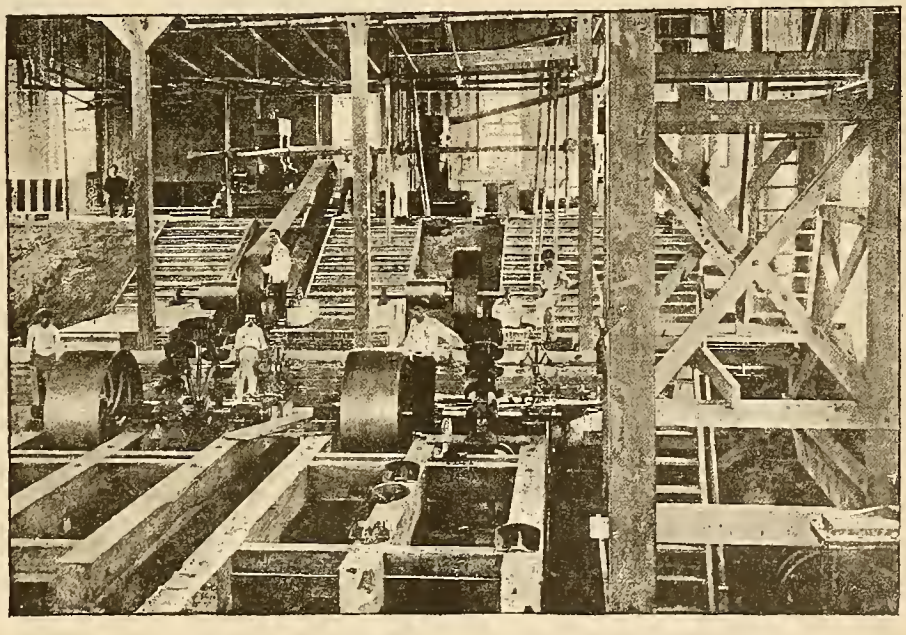


FIG. 4. THE KIOTO CANAL IN JAPAN.

The Pittsburg, Fort Wayne & Chicago Railroad company has secured a permit from the department of public works for the erection of an electric light plant in Chicago, and within a month it will have arrangements made to light all its crossings from Fourteenth street to Sixty-seventh street with electricity.

Western Electrician.

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CORRESPONDENCE relating to electricity, or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

PAGE.

Electric Cranes in Railroad Shops. Illustrated 305
Chicago Electric Club 305
The Bruckner Electrical Engraving Machine. Illustrated 306
Electricity at the World's Fair. Illustrated. 306, 307, 308
Copper Combine 308
Tower for the World's Fair. Illustrated 308
The Kioto Canal in Japan. Illustrated 308, 309
Buffalo Electrical Society 309
Keep the World's Fair Open Evenings 309
Utilizing Electricity in Founding a Town 309
Railroad Telegraphers' Strike 309
Editorial 310
Werner von Siemens. Portrait 311
Electric Power for Cotton Mills 311
Submarine Operations by Electric Light 311
Indications of the Shifting of Neutral Points. By C. O. Poole 312
Improved Ahearn Electric Car Heater. Illustrated 312
Direct Coupled Engine and Generator. Illustrated 312
Green's Improved Fuel Economizer. Illustrated 312
Incandescent Snap-Switch. Illustrated 312, 313
Automatic Regulation of Over-Compounded Machines. By H. Ward Leonard. (Communication) 313

DEPARTMENTS.

Correspondence 313, 314
New Incorporations 314
Electric Lighting 314, 315
Electric Railways 315
Telegraph 315
Telephone 315
Miscellaneous 315
Trade News 315
Business 316
Electrical Patents 316

CONSIDERABLE comment has been caused by the delay of the Westinghouse company in putting its new lamp on the market. There is no reason to doubt that the company is proceeding in good faith, however. On the contrary, we have authority from a disinterested and reliable source for the statement that orders have already been received at Pittsburg for half a million of the new lamps and that every exertion is being made at the factory to have the lamps on the market by the 1st of January. This indcates that the Westinghouse people are doing their utmost to make good their promise to the public, and the company should be given credit to that extent at least.

ONLY a comparatively short time ago the use of electrically operated cranes was considered a novelty, but to-day they are in quite general use, especially in railroad shops, where they are utilized in handling heavy machinery. In another column in this issue there is presented an article on this subject which gives some idea of the magnitude which this special work has assumed. In the Pennsylvania and New York Central railroad shops these cranes are in general use, and they are also found in the shops of all the large electrical manufacturing concerns. It should be borne in mind, too, that this is only one of several types of electric cranes. In the Allis works at Milwaukee and the Grant Locomotive Works, Chicago, electric cranes are used for similar work. These plants have already been illustrated and described in this journal.

BY the death of Werner von Siemens the world of science, particularly in the domain of electrical investigation, has lost one of its most distinguished thinkers. Dr. von Siemens' studies were not confined to the realm of abstract science, however, his activities being largely devoted to the application of scientific principles in the mechanical arts. He was the founder of the great German electrical house of Siemens & Halske, which has contributed so much to the practical development of electricity in Europe, and the success of the business was very largely due to his inventive genius. Unlike many other distinguished inventors, Dr. von Siemens lived to see his name and that of his distinguished brothers spread world-wide as that of leading contributors to the progress of nineteenth century civilization. Full of years and honors, with accumulated wealth, he died, leaving the record of a career that may well excite the emulation of young electricians the world over.

IT has been said that Chief Barrett is opposed to the granting of space in the electricity building at the World's Fair to any corporation, firm or individual who is not connected with some department of electrical work that is recognized as a legitimate enterprise. In this position he will be supported unanimously by the electrical fraternity. There is danger, however, that unless decisive steps are immediately taken, space may be granted to several concerns to exhibit electric belts and similar devices in the electricity building. These concerns have no right to be classified as electrical enterprises, and they should not be encouraged by the exposition officials. They have no standing among reputable electrical people, and should not be aided in their efforts to secure recognition at the World's Fair as legitimate electrical enterprises. In the list of applicants for space in the electricity building which was published in this journal November 26th there appeared the names of several of these concerns. At that time we protested against their admission as an outrage upon the electrical fraternity. It might be well for electrical organizations and the leading electrical concerns of the country to take up this subject and insist upon the withdrawal of these fakirs from the electricity building.

HENRY VILLARD'S visit to the Northwest recently created something of a stir in electrical circles. At Minneapolis it is thought that he may equip the short line of the Northern Pacific between the Twin Cities with electricity in order to compete with the Lowry system. It will be remembered that Mr. Lowry's electric system forced the steam railroads to discontinue the short line service between the two cities. The Northern Pacific had constructed a "short line" which it intended to operate by steam, but the popularity of the electric line caused the company to postpone its equipment. It is generally conceded that the present electric line between Minneapolis and St. Paul is not sufficient to accommodate the traffic, and as many important suburban points are not reached by it, there is a demand for another line. Mr. Lowry is trying to get the right of way for an additional line, but if Mr. Villard turns the Northern Pacific "short line" into an electric railway it is probable that Mr. Lowry will not attempt to put through another independent line. It is said that the Villard line is constructed according to steam railway practice, and this of course would give it a great advantage over the ordinary street railway line. It is to be hoped for this reason, if for no other, that an electrical equipment will be installed, as it will demonstrate what can be accomplished by electric locomotives under favorable conditions.

A COMPLETE set of rules governing the use of electric light and power at the World's Fair is given in this issue. These regulations are taken from a bulky pamphlet entitled "Official Minutes of the Seventh Session of the World's Columbian Commission, Held in the City of Chicago October 18 to 26, 1892, Inclusive." Unfortunately, however, we are unable to announce that these rules, which have evidently been prepared with considerable care, are final and conclusive. They have the approval of the national commission, of course, but it seems that the local company, in whose hands the construction and operation of the exposition were entrusted, has not agreed to the commissioners' rules as a whole. The original rules were prepared under the direction of the Exposition company and were then submitted to the national commission, as required by the Act of Congress. The commissioners made numerous changes and added many new rules, the result being printed in the "Official Minutes," from which we have taken the electrical rules alone. The rules as they now exist have not yet received the sanction of the local company, which introduces a strong element of uncertainty in relation to their ultimate composition. The situation thus presented is very unsatisfactory and one calling for immediate action on the part of the directors. Until a definite understanding is reached the rules of the commissioners may be accepted as interesting if not conclusive.

CAPITALISTS have not exhibited much interest thus far in the rapid transit project which it is hoped will give New York much needed relief. As has been announced, the franchise for this enterprise will be offered for sale on December 29th. In New York it is generally believed that ridiculously low proposals will be submitted, if any. The people of that city, however, will not abandon the scheme without a struggle. Should the commissioners fail to dispose of the franchise at favorable terms, it is proposed to raise the necessary fund by an appeal to the Legislature. This, of course, will not be resorted to unless it be found impossible to secure private capital for the enterprise. It is gratifying to see that the New York *Sun*, which, throughout the preliminary proceedings, advocated elevated roads as opposed to the underground system, accepts the situation and now earnestly champions the building of the proposed system. The case is concisely stated in the following editorial, which recently appeared in the *Sun*: "The conditions upon which we may have underground rapid transit are now ascertained: There must be a company formed with a capital of $50,000,000, ready to deposit a million dollars as a guaranty that it will build the roads, and a bond for two million dollars as a security against damages to property. This company must be prepared, beginning four months after the auction, to build a road which it is estimated will cost from $60,000,000 to $100,000,000. The fare for passengers must not exceed five cents. The road must be built. It is a formidable project, but if it is commercially sound there need be no doubt of its ultimate construction. The auction of the franchise is to take place on December 29th." This is certainly encouraging to the advocates of the proposed system. It is to be hoped that other opponents of the project will follow this example and cease their objections.

THE assertion that corporations have no souls is a common one now-a-days, and no better illustration of its truth can be had than the practice of the Chicago City Railway company. During the winter months this company—and in fact many other lines in Chicago and elsewhere—has continued to run its open grip cars, leaving the gripmen exposed to the coldest weather, with no protection from the cold other than the roof overhead and perhaps the thick fur coat, which, however, is provided at the expense of the gripman. To say that such treatment of men is outrageous is to characterize it in an exceedingly mild manner. It is simply barbarous. At a comparatively small expense the space between the seats in which the gripman stands could be enclosed, windowed in, so to speak, and then if the company found it "too expensive" to add a small stove, the man at the lever, although left in the cold, would be at least protected from the biting lake winds.

Of course, though, as long as the City Railway company continues to maintain its present ramshackle equipment, it will doubtless find a way, backed probably by most excellent economical reasons, to keep its men exposed to the elements, as was the case on the old fashioned types of steam locomotives, where the engineer stood at the throttle with no cab roof overhead. In other words, on the lines at present in operation it is to be presumed that the same old grips and cars will be run until they rattle themselves to pieces. The men on these lines, it is feared, will have to wear their fur coats for some time as their only means of protection, although the company can well afford to provide decent accomodations.

The Chicago City Railway company controls an extensive system, and its latest improvement is the introduction of electricity on a number of the South Side cross-town lines. A large number of motor cars will be needed for the immense cross-town traffic next year. These cars are doubtless now being fitted for service. At this time, then, it would be interesting to many who remember that car drivers, motorneers and gripmen are human beings, to learn whether the south side cross-town motor cars are to be vestibuled, so that in winter the motorman will not have to kick his heels together and blow on his fingers to keep warm enough to work his lever and brake. The motors beneath the cars are carefully screened from dust, dirt and water. Why, then, should not the street railway company do as well by its men?

Werner von Siemens.

Werner von Siemens, the eminent German electrician, died at his residence in Berlin on December 6th. Dr. von Siemens was founder of the great electrical firm of Siemens & Halske, and his funeral was attended by 4000 employes of that concern, together with many distinguished men. The accompanying portrait and sketch of Dr. von Siemens is taken from an article on "Practical Electrical Units," by F. B. Badt, in the WESTERN ELECTRICIAN of February 1, 1890.

Dr. Werner von Siemens was born at Lenthe, in Hanover, December 13, 1816. He was the eldest and most famous of four brothers, namely: Carl Wilhelm (Sir William Siemens), born at Lenthe, April 4, 1823, died in London, November 19, 1883; Frederick, born at Menzendorf in 1825, and Carl, born in Menzendorf in 1829. Werner was educated at the Lubeck Gymnasium. He joined the Prussian artillery in 1834, where his eminent talents soon attracted notice, and, having passed through the military schools, he obtained the rank of lieutenant in 1837. While still holding this appointment in the army he applied himself with great zeal to the study of practical chemistry and physical sciences, and became the inventor of the process of electro gilding, the differential governor and the electro automatic recording telegraph, for all of which patents were granted him in Prussia. As member of a commission of the Prussian general staff for the introduction of the electric telegraph system in place of the optical telegraphs, he proposed, in 1847, the application of subterranean conductors, insulated by gutta percha. Successful experimental lines were operated, the wires of which were coated with gutta percha by means of a press invented by him for that purpose. The press is still used in the manufacture of cables. With the help of these insulated wires he first succeeded, with the assistance of Prof. Himley, in firing submarine mines by electric ignition in the spring of 1848. These mines were designed for the protection of the harbor of Kiel from the Danish fleet. In the same year he directed the construction of the first great telegraph line in Germany, between Berlin and Frankfort-on-the-Main, and in the following year planned the subterranean line between Berlin and Cologne.

Dr. Siemens left the government service in 1850, and subsequently devoted himself exclusively to scientific studies and private enterprises. In 1847 the had already laid the foundaion of the telegraph manufactory conducted by him under the firm name of Siemens & Halske, in Berlin, the celebrated establishment which was destined to become, and at present is, one of the chief centers for the application of electricity to the industrial arts. Its world-wide reputation, acquired within a short time, led him to open branch works in London and St. Petersburg, which soon developed into large independent concerns under the management of his younger brothers, Wilhelm and Carl.

Dr. Siemens' personal achievements are to be found in the fields of science as well as in the technical arts. His scientific merits induced the University of Berlin to confer on him the degree of doctor of philosophy, honoris causa, in 1860. He was honored by admission to membership in the Academy of Sciences in Berlin in 1847, and subsequently in many other academies and societies. Among his many and various achievements in matters relating to science and technical arts may be mentioned as particularly noteworthy the invention and practical application of a standard unit of resistance known as the Siemens unit, the development of methods for testing underground and submarine cables, and of determining the position of faults, the invention of polarized relays, of the so-called Siemens armature, and of the dynamo-electric machine, the principle of which he published first at the meeting of the Berlin Academy of Sciences on January 17, 1867, the electric railway, and of numerous other appliances, including the pneumatic dispatch tube system and the Seimens alcoholometer for registering the quantity of absolute alcohol contained in any alcoholic liquid passing through the instrument.

Dr. Siemens was appointed a member of the Prussian order "Pour le Merite," and was the recipient of many other distinctions and honors. The German emperor created him a noble. He was honorary member of the English Institution of Electrical Engineers, and was corresponding secretary for Germany.

His many papers read before scientific societies up to 1881 were published in book form, "Gessammete Abhandlungen und Vortraege," published in Berlin by Julius Springer in 1881.

Electric Power for Cotton Mills.[1]

Electric motors are now used for hundreds of purposes, and among them the very important one of furnishing power for cotton and other textile mills. As a rule it is advisable to use a high-pressure current for power on account of the saving in copper conductors, but motors are made which run on low-tension current, such as are used on incandescent lamp circuits, so where a mill is lighted by electricity a motor can readily be placed on the circuit at any convenient point. One thing should be observed—if the current required for the motor is more than one-fifth of that required for the lamps, the latter will vary in brilliancy as the load is on or off the motor.

Before deciding to install an electric power plant for a service outside of what is already fixed by precedent, expense, delays and disappointments may be avoided by deciding how much you are willing to experiment; and, secondly, how much the party doing the work must experiment, before the whole installation is in a practical operating condition.

The fact should not be lost sight of that electricity is merely a substitute for other methods of transmission of power. It has its losses at every step in the course, comparable with those of the wear and tear and friction of shafting and belting. Like them, it also costs money, requires attendance and wears out. It does not in any detail give something for nothing, but the results in comparison with other mechanical means of the transmission of power are merely the addition of a lot of differences. Sometimes these differences are on one side of the account and sometimes on the other. An installation of motors in one instance may be extremely economical and in another highly expensive in comparison to ordinary methods of

WERNER VON SIEMENS.

transmission of power. Electric motors, like water wheels or steam engines, have their highest efficiency at a point near to their full proper load, and on either side their efficiency in the percentage of electricity converted into work is diminished. The practical operation of some motors has been improved by the use of fly-wheels. In its application for mill service the most simple uses are those requiring a variable speed and direction, largely on account of causes outside of the electrical conditions in the construction of such motors. It is especially advantageous for elevators in storehouses or other buildings not requiring power elsewhere. The first motor used for operating an elevator in a cotton mill storehouse was placed in that service in 1882, and is in as good working condition to day. Another use having a larger field is in its application for railways in mill yards and buildings. The Salmon Falls Manufacturing company has 2,100 feet of track in the mill yard, and is operating a trolley system of cars to move all their cotton, supplies, cloth and coal with two men, thereby dispensing with the services of a team and three men all of the time and a fourth man a part of the time. The car makes an average speed of 600 feet per minute, and is always ready for service whenever the water wheel is running. Other mills use electric railroads from the cloth room to the storehouse with even greater reduction in cost of moving the load. Motors have been successfully applied to calico printing machines, the absence of heat, small space occupied and perfect control of the machine being advantages of the highest practical value.

This class of service for the distribution of power throughout a mill as a substitute for belt or rope transmission has not been tried in cotton mills, but there are many cases where it has been tried in machine shops and yielded excellent results. The amount of power required in cotton mills is so much greater than in machine shops that the subdivision should be to a smaller unit than the whole room in a large mill. I am convinced that such a distribution of power is mechanically feasible, but will it pay to do so when motors and generators each cost nearly or quite $40 per horse power, or, including wire and foundations, over $100 for every horse power transmitted?

Electricity is advantageously applied by establishing a central station in the millyard and from there distributing the current to the various buildings. At a number of places this is being done with most satisfactory results. The use of a good water power, whether near or at a distance, furnishes the cheapest means of generating the current, and, as the problem of economical long distance transmission is now being solved—indeed, has been by the experiments at Frankfort, Germany—mills and other users of the current are taking advantage of convenient sources of power of this kind.

The electric lighting and power used in Hartford, Conn., is derived in part from a water power at Tariffville, ten miles away, and some 300 horse power is transmitted along the wire that distance and thence distributed to customers around the city.

The Nonotuck Silk company is supplying to its mills at Leeds and Haydenville power transmitted by electricity from a dam in a rocky gorge in the river about a third of a mile from one mill and a mile and three-quarters from the other. The installation is not cited as being on a large scale, but because it contains many ingenious features in the manner in which the motors are applied as an auxiliary and a regulator to the water wheels. The fall of thirty feet is situated between steep banks where it would not be developed under ordinary conditions, because the spot is unsuitable for the location of a mill. There are two water wheels in use, one of ninety horse power, driving dynamos which furnish 950 incandescent lamps on an alternating system at the mills. The other, 130 horse power water wheel, drives one Thomson-Houston generator of eighty-five horse power and another of thirty horse power, the pressure of the current being the same as that used on trolley street cars. At the mills one-third of a mile distant is one motor of forty-five horse power, two of twenty horse power and one of ten horse power, all supplied by electricity from the eighty-five horse power generator.

There are several places in New England where the power of waterfalls is being applied through electrical apparatus to machinery at a distance, and there are numerous extensive enterprises of this nature under construction. The electric transmission of power under any practicable conditions of constant or variable speed at a loss not exceeding 20 per cent has been shown to be entirely practicable, and the open question in regard to all of these devices, whatever may be their purpose, is but the question of cost.

1. Abstract of a paper read before the New England Cotton Manufacturers' association by C. J. H. Woodbury.

Submarine Operations by Electric Light.

A submarine diver with copper headgear and leadweighted feet walked down a ladder into the Detroit river at the foot of Griswold street at 9 o'clock yesterday morning, says the *Detroit Tribune* of November 26th. A half minute later there was a brilliant flash of light in the water. The diver, James S. Quinn, came to the surface like a shot, considerably startled. It was Detroit's first submarine lamp that flashed. The diver wasn't expecting it. It was intended as a surprise to him. It proved a most effectual one. A few energetic mutterings came from within his copper headgear, but an explanation was given by the laughing attendants and he went below the surface again. Instead of feeling around in the dark for the hole in the hull of the schooner Nelson and driving nails by guesswork as usual, the diver patched the hole by electric light as rapidly as though in daylight and above the water. The hole was three feet long and eighteen inches wide. Quinn worked at it unremittingly two hours and a half before it was mended. Then he came to the surface and declared that the scheme worked like a charm.

His brother, John S. Quinn, Detroit's veteran diver, was no less enthusiastic. He exhibits the lamp proudly now at the warehouse at the feet of Griswold street. He can't say too much in praise of it. "Instead of feeling around in the murky river water to drive nails," he said, "or mend a broken bucket on a wheel, we can work night or day in perfect light." A submarine lamp is no new thing, although J. S. Quinn asserts this is the first one Detroit has seen. But the principle of this particular lamp is said to be a novelty never seen on the great lakes and one that is not known to have been tried before in any quarter of the globe. It is the first submarine lamp run by storage batteries.

"The lamp is thirty-two candle power," said Secretary Liggett of the Standard Electric company, "and is the first storage battery submarine lamp that I know of. It will cast light from five to ten feet at any depth below the surface. It arrived in the morning a few hours before we made the experiment. It is run by ten storage cells of 200 amperes capacity at twenty volts. It will run for twenty hours. The cells used for the lamp were in service for lighting the Newberry wedding at Grosse Pointe and for running the car to Mt. Clemens and Royal Oak, and also for the car we ran on the Fort street railway. It demonstrates the wearing ability pretty well, as those cells have been used for seventeen months."

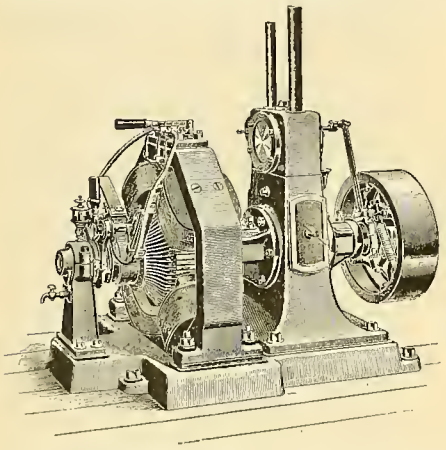
The lamp is in a small cage a foot and a half high, with brass rods running at intervals from the lead bottom to the brass top. Within this cage is a heavy glass globe screwed tightly with rubber packing. Within the globe is the incandescent lamp. The first globe, it is asserted, will stand the water pressure at a depth of fifty feet. The wires are inclosed in a long rubber hose.

Indications of the Shifting of Neutral Points.[1]

By C. O. Poole.

It is a well known fact that in the ordinary bi-polar dynamo there are two points in the circumference of the armature where no current is induced in the armature wires; these points are diametrically opposite, and are called the neutral points of the dynamo. There are numerous ways of determining the induction of an armature; among them is the arrangement used by Sylvanus P. Thompson, which consists of two copper strips to serve as contact brushes. They are fastened to a handle of wood and separated enough to span a segment of the commutator of the armature to be tested. Two wires are then connected to the copper strips and carried to a galvanometer or voltmeter. The copper strips are then held on the commutator while the machine is generating, and if a current be induced in that particular coil, it will be noticed by the deflection of the instrument; and in that way it is possible to determine the electromotive force induced in any part of the field. Of course, the greater the deflection of the instrument the higher the electromotive force, and if a point be reached where there is no deflection, that part of the field is the part where the lines of the force passing through the armature coils do not vary. Consequently no electromotive force is induced, and hence the name of neutral points.

In a station with which I am connected we are running a 60 horse power Keith generator, compound wound, for constant current. The output is 21 amperes at about 2,000 volts; the commutator is ten inches in diameter and consists of 150 segments; and of course a corresponding number of coils in the armature. We use carbon brushes. A few evenings ago I noticed our dynamo man, who by the way is entitled to the credit of this observation, very intently eyeing the commutator of this particular machine. On approaching him and asking the object of his attention, he quickly replied with the question, "Why is it those little sparks do not run all the way around the commutator?" Now, all of you have seen carbon brushes used on dynamos, and noticed the small incandescent sparks chasing each other around the commutator; they are of

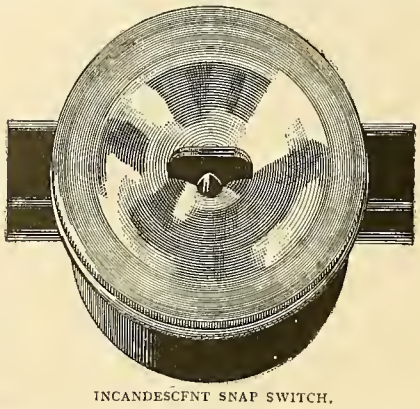


DIRECT COUPLED ENGINE AND GENERATOR.

course small particles of carbon, freed from the brushes and adhearing to the commutator. They are quite numerous and collecting together form a conductor across the insulation between neighboring segments; and if the potential between these segments be sufficiently high, the particles of carbon would be consumed, and the apparent chasing above referred to would be noticed. I confess the question staggered me at the time, but after a moment's reflection the answer came, "Why, that is where the coils enter the neutral part of the field," and it proved to be the case. For two inches on either side of the brushes there were no sparks to be seen, leaving about four inches of space on each side of the armature, clearly defining the neutral points. As you can readily see, while the coils are passing through the neutral part of the field, the only difference of potential between those segments would be that due to the resistance of the wire in those particular coils, that is to say: if the resistance of each coil is 1-100 of an ohm, and the current flow 21 amperes, then the electro-motive force of that coil would be 21-100 of a volt; which you know is not a sufficient pressure to consume the particles of carbon. But, just as soon as the coils enter the active field, the particles are seen to ignite, and continue to burn until they reach the neutral point on the opposite side of the armature when they disappear as suddenly as they appear, only to continue again on entering the other field. With the ever changing load, it is interesting to notice the corresponding changing in the position of the neutral points. The machine being shunt wound, the strength of the field of course fluctuates with the load. When the load is decreased to any great extent, the neutral points will gradually move around in the direction of rotation. This is in accordance with natural laws. We know as a matter of fact, if the field is weakened and the current strength in the armature remains the same, the magnetism of the armature will overpower and distort the magnetism of the fields, carrying the lines of force around in the direction of rotation, and changing the position of the neutral points correspondingly. Again when the load increases, the increased strength of the field asserts itself and brings the point back again to a normal position. Of course, this change of position is not very great; with a variation of say 40 per cent. of the load, the change in the neutral point would be about one inch on the commutator, but quite sufficient for the close observer to notice it.

It is by no means necessary to employ a very high voltage in this case to observe the phenomenon. I have seen it on the alternating exciters, where there is a difference of potential of but 300 volts between terminals. The lines are not quite so clearly cut, but they can easily be seen. In the first instance there were 150 segments in the commutator, and allowing forty of them to be in the neutral position, twenty on either side of the armature, it would leave 110 coils in active operation; and those being placed in parallel, it leaves but fifty-five coils to create an electromotive force of 2,000 volts, which would bring the average difference of potential between the segments up to about 36⅓ volts. In the exciter referred to, there are seventy-two segments on the commutator, and allowing the same percentage to be in the neutral position, it would leave fifty-three coils to do the work, making an average voltage of about 5-6 per coil. So you see there is quite a range to work upon.

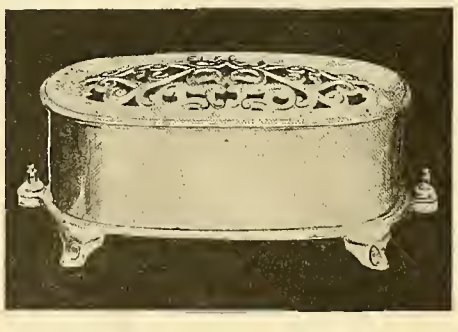
1. Read before the California Electrical Society, San Francisco, November 21, 1892.



INCANDESCENT SNAP SWITCH.

The Improved Ahearn Electric Car Heater.

A short time ago there was published in this journal a description of an electric car heater that was being placed on the market by the Railway Equipment company, Chicago. Since the appearance of that article a number of these heaters have been put in operation, and as is usual under such circumstances, where a new contrivance is installed, slight defects, if they can be called such, develop. The objection raised by some to the first style of Ahearn car heater, which is located beneath the seats in the car, was that its peculiar cylindrical shape made it a receptacle for refuse, such as papers, half eaten lunches, etc. In fact the electrical train men in some instances seemed to look upon the heaters as though they were boxes placed beneath the seat for holding any sort of rubbish or stuff that they might care to deposit in them. Of course this was not a very serious objection, as the heaters were placed beneath the seat and were therefore in one sense covered. But to make the heater as perfect and as ornamental as possible, General Manager Mason of the Equipment company decided to provide the car heaters with an ornamental top. By the addition of this perforated cap the car heaters are rendered practically rubbishproof, and yet their heating power remains unimpaired. In addition to the changes already named, the improved design, as shown in the illustration, makes a very handsome electric



THE IMPROVED AHEARN ELECTRIC CAR HEATER.

stove for service in offices, residences or wherever a neat design of heater is called for.

The *Kansas City Journal* of recent date says: A letter was received from Mayor Cowherd yesterday from the manager of the local branch of the Edison Electric Light & Power company, calling his attention to the recent final decision of the United States Court of Appeals affirming the right of that company to manufacture the incandescent lamps used throughout the country and giving the company the right to collect penalties for all infringements of the patents owned by that company. The letter was referred to the city counselor, who will determine what effect the claim will have upon the city in its use of such lamps in the past and in the future.

Direct Coupled Engine and Generator.

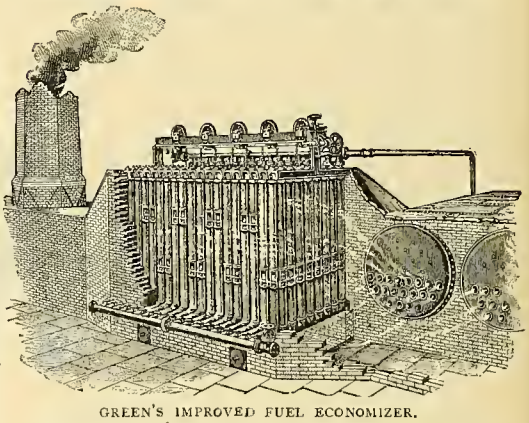
The direct coupled generator and engine in one compact set is, under conditions of restricted space and position, the ideal electrical plant. A small direct coupled generating set recently perfected by the General Electric company is shown in the cut. For marine installations, where a separate engine is indispensable to drive the generator, these sets are especially adapted. As cheap as, if not even less expensive than, belted plants, they can be readily fitted to positions where a belt driven dynamo and engine could not find a sufficiency of space. Compact and simple in arrangement, they are especially adapted to small isolated plants in hotels and buildings where belting is objectionable.

The generator is of the familiar General Electric company quadrupolar type, compound wound, having a regulation automatic within two per cent. over the entire range from no load to full load.

The commutators are cross connected, so that only two brushes, 90 degrees apart, are used. The rheostat is of the new, iron frame, incombustible type. The engine and dynamo are both provided with self-oiling bearings. The sets are manufactured in 4, 8, 15, 30 and 50 kilowatt capacities.

Green's Improved Fuel Economizer.

Practical engineers and users of steam power realize that, however cheap fuel may be for generating steam, it is never too cheap to save. All users of steam power know that a considerable proportion of the heat developed which escapes by way of the chimney should be utilized. This can, in a great measure, be effected by heating the feed water for the boilers. The saving effected by supplying the boilers with water of a very high temperature is not the only advantage, as the life of the boiler will be greatly prolonged. Most of the strains due to unequal



GREEN'S IMPROVED FUEL ECONOMIZER.

expansion and contraction, when colder water is used for feeding the boilers, will be done away with. This is the chief claim for the Green fuel economizer, illustrated herewith. The economizer is formed of cast-iron pipes, 4⅝ inches external diameter, 9 feet in length, arranged in sections of varying widths to suit the space at disposal, and are connected together at top and bottom by headers or boxes, these being again connected, when erected ready for working, by branch pipes at top and bottom. These branch or feed and delivery pipes are outside of the brickwork of the economizer. Where the space is limited the bottom branch pipe may conveniently be put on the lower side of the bottom box. The apparatus is fitted with blow-off valve and lever safety valve. All working parts are accessible without removing the brick work.

A fuel economizer will be used at the World's Fair grounds in connection with the plant that will furnish power for the intermural railway, illustrated elsewhere in this issue. The device is manufactured by the Fuel Economizer company, 91 Liberty street, New York city.

Incandescent Snap Switch.

The cut illustrates an incandescent snap switch neatly encased in an iron receptacle, made by the Electric Engineering & Supply company of Syracuse, N. Y. It is especially designed for the conduit system of wiring. The receptacles will admit a 5 and 10 ampere switch, either single or double pole, and are made in a variety of styles, so that they can be located almost anywhere on the line, and with openings to accommodate any size tube, single or duplex.

The receptacle can be inserted into the walls when the building is in course of erection, and the switch put in and connection made at any time thereafter to suit the convenience of the builder. The covers are made concave, forming a deep recess, by means of which the key or thumb-

piece is set into the receptacle and does not protrude from the wall. This cover is easily removed by detaching the key, and then a slight turn in either direction will lay the switch open for inspection or making connection. A highly polished ring encircles the opening of the box and protects the decoration or frescoing from soiled hands when the cover is removed for repair. The receptacle is furnished with the E. E. & S. switches, especially constructed for the purpose. The entire apparatus is practically flush with the wall, and the highly polished cover makes it a very neat and attractive device. The cover can be furnished to match any other hardware. The same idea is applied to ceiling cut-outs, and a receptacle a little differently constructed is equipped with the E. E. & S. rosette, especially made for this design. Here a convex cover is used, provided at the center with a hard rubber insulating bushing, through which the cord passes. A number of the large buildings recently erected in New York are fitted up with these devices, where interior conduit or vulca ducts are used.

Automatic Regulation of Over-Compounded Machines.

To the Editor of the WESTERN ELECTRICIAN:

Referring to Mr. Willis' paper, read and discussed before the Chicago Electric club, November 21, 1892, I would call attention to a method of overcoming the difficulty of making the over-compounding vary proportionately to the drop in the conductors when several over-compounded dynamos are operated in multiple and the number of dynamos varied as the load varies.

The method is this: Connect the series windings of all the dynamos, so that they are always in circuit and in multiple with each other. The total current will thus always divide between all the series windings, and if only one dynamo be in operation, its over-compounding will be due, not to the total current, but to a fraction of the total current proportionate to the load. The over-compounding will increase as the total current increases, and will be proportionate to the drop in conductors in all cases.

This method of connecting gives another advantage which, in my opinion, is more important than the improvement in automatic regulation, which is this: The inserting of dynamos into the circuit and their removal therefrom is greatly simplified, a single pole switch only being necessary for each dynamo and the current taken by any dynamo being totally unaffected by the insertion or removal of another dynamo, just as in the case of a plant of shunt dynamos, which result cannot be obtained with the double pole switches ordinarily used upon compound dynamos when operating in multiple.

H. WARD LEONARD.

New York, December 10, 1892.

CORRESPONDENCE.

New York Notes.

NEW YORK, December 10 —An idea of the amount of time and labor required of the Rapid Transit commissioners may be gained from the report of the proceedings in the general term last Monday, when John M. Bowers presented an application to Judges Van Brunt, Barrett and O'Brien to fix the compensation of the commissioners for the laying out of the proposed route for a rapid transit railroad. The commissioners were appointed under an act of the legislature of 1891, and by its terms they were to be paid a reasonable compensation for the duties performed by them, to be determined by the general term of the Supreme Court, the compensation to be stated in the terms of sale, and to be paid by the purchaser of the franchise. The petition shows that they have held twelve public meetings, and ninety other meetings, and that the time spent by them has been 250 days of three hours per day. It shows the time spent in examining the route, the examination and consideration of reports made to them by their engineers, and the general labor that they were required to perform preparatory to laying out the routes which were afterward adopted. The signatures of property owners representing property in value to the extent of $52,600,000 were secured, and the signatures of property owners representing $135,000,000 of property were refused. The proposed route was subsequently approved by the court. They now ask to have their compensation fixed so that it may be placed in the terms of sale. The matter was submitted without argument. The court took the papers and reserved its decision.

Argument has been begun in the United States circuit court of appeals in the suit of the General Electric company and the Edison General Electric Light company against the Sawyer-Man Electric Light company to restrain the latter from manufacturing and selling incandescent lamps. Leonard E. Curtis opened the argument for the defense by questioning the validity of the Edison patent. He asked that if an injunction be granted it might not go into effect before January 1st, as by that time the Westinghouse company would have a new lamp in readiness which would in no way interfere with the present incandescent lamps. The court reserved its decision.

The Gas Commission opened bids December 8th for the lighting of the city next year. Mayor Grant and Commissioner Gilroy were present. The bids for electric lighting were:

United States Illuminating company, 351 lamps at 40 cents per night each and 17 lamps at 50 cents; Brush company, 72 lamps at 45 cents each per night, 42 at 50 cents, and 229 at 40 cents; Thomson-Houston company, 277 lamps at 40 cents and 45 lamps at 50 cents; Mt. Morris Electric Light company, 314 lamps at 40 cents; Harlem Electric Lighting company, 194 lamps at 40 cents and 19 at 50 cents; Edison company, for lighting Fifth avenue, 50 cents a post, each post bearing two lamps; Manhattan campany, 52 lamps at 40 cents and 17 lamps at 50 cents, and the North River Electric Light & Power company, 553 lamps at 45 cents The bids were referred to Superintendent McCormick of the Bureau of Lamps and Gas for tabulation.

Wilson G. Hunt, who died in this city December 8th, was deeply interested in the development of the electric telegraph. Mr. Hunt was associated with Prof. Morse in his original experiments, and also in the later although not recent cable projects. He was a director in the Western Union Telegraph company and was in the office in this city when the queen's message to President Buchanan was received. At the time of his death Mr. Huot was a director in the Western Union Telegraph company.

W. F. O.

Northwestern Notations.

MINNEAPOLIS, December 10.—The business men of Minneapolis and St. Paul will not rest easy now until they have telephonic communication with Chicago. Those who know the expenditure involved shake their heads and say we must wait several years, but a good many citizens insist that it can and must be brought about very soon. Manager Joyce of the St. Paul telephone system is more enthusiastic than Manager Christie of Minneapolis. The latter is reported to have figured out the financial phase of it as follows: It will cost over $200 a mile. This means an investment of over $60,000 the first thing. Telephone lines depreciate, on an average, about 10 per cent. a year, so that the investment would have to bring not only a fair return upon the capital but enough additional to make good the depreciation. Reducing the operation to a plain matter of business, it will appear something like this: The line will cost $60,000. It must therefore earn, say, 8 per cent. on the investment and 10 per cent. depreciation, or 18 per cent. of $60,000, or $10,800. Add to this $4,200 a year for operating expenses, repairs, etc., and a grand total of $15,000 a year is required. There are about 300 working days a year, so that the average daily receipts must be $50 to make the line a paying institution. He doesn't believe there is enough business yet to warrant the outlay, especially as there are so few large commercial towns between here and Chicago.

One thing that fosters the agitation of the Chicago scheme is the excellent long-distance service that is now being given by the company to leading point scattered through Minnesota. By recent improvements this service has been so perfected that it is often easier to talk with a man in Faribault than with your neighbor across the street. The latest thing is the provision of public stations at convenient points in the business center from which communication may be had with outside points, for a small consideration. These stations are "sound proof" apartments, and the faintest whisper can be transmitted.

Henry Villard has come and gone, but the echoes of his visit in the shape of mammoth projects are still floating about. About the most plausible story going now is to the effect that plans are being matured gradually for the Northern Pacific company to put in electric service over its line between Minneapolis and St. Paul. The Northern Pacific got its tracks, bridges, etc., all ready for running "short line" trains between the two cities just about the time Lowry's electric line knocked the "short line" business "Galley West." It has a very direct route through some very pretty and quite populous territory that is not tapped by either of the other lines. It would not be a very difficult or expensive undertaking to equip this line for electric service, and unless Mr. Lowry hustles along his second interurban line the Northern Pacific line could command a big business. Being laid out for steam traffic it could make much better time than the present interurban or any street railway line that could be put in. The report is said to be backed up by some real estate purchases in St. Paul looking toward a location for a power plant.

The St. Paul council has passed an ordinance regulating the speed of electric cars. It prescribes limits for the center of town and directs that within these boundaries 8 miles an hour shall not be exceeded. In the outside districts the cars may be run 12 miles an hour. The agitation of this matter has called attention to the statistics of street railway accidents. The St. Paul police reports show 31 accidents from electric cars the past six months. The fire department has had frequent collisions with the cars. Coming down some of the heavy grade streets a pretty rapid pace has been the rule. Ald. Warren, who made a special study of this matter got some data about the speed of cars in other cities that are rather interesting. They are tabulated as follows:

City.	Center.	Suburbs.
Cleveland, O	4	12
Nashville	6	12 to 15
Cincinnati	8	—
St. Louis	8½	10
Louisville	9	12
Syracuse, N. Y.	6	—
Memphis	15	—
Washington, D. C.	9	—
New Orleans	6	—
Baltimore	7	16
Los Angeles	8	—
Sacramento	8	—
Denver	8	12
Portland, Ore	8	—
Boston	8	12

The St. Paul council has passed an ordinance giving the building inspector authority to enforce strict regulations in reference to the wiring of buildings for electric light and power.

The finishing touches are being put upon the new electric light plant at Deadwood, S. D. The boilers and most of the machinery are in readiness. It is a fine plant with a capacity of 75 arc and 2,000 incandescent lights.

A movement is on foot to put in an electric car line between Faribault and Morristown, Minn. Nothing very definite has been decided upon yet, except that it would accommodate a great many people in both places. The route proposed is quite picturesque and passes Cannon lake.

Light Inspector Meloy of Minneapolis is busy locating electric lights to burn all night and every night in the year through the business center. Heretofore the unsatisfactory moon schedule has been in vogue. There will be about 120 lights that will be kept burning every night.

The full quota of the new vestibuled motors has now arrived, and all the old style motors on the interurban line have given way to them.

With the commencement of operation on the Lakeside line, which is a matter of days only, Duluth will have 50 miles of electric street railway in operation. The Lake avenue line has been opened, and cars now run from the canal along the superior street line and down Garfield avenue to the foot of Rice's Point.

The big turbine wheel at Sauk Center, Minn., which supplies power for the new electric light plant and also for the city water works has been perfected and is working well.

The Northwestern Electric company has been incorporated at Superior, Wis., by H. A. Burgess, M. W. Tuttle and J. P. Evans. The capital is $10,000, and a general construction and supply business is contemplated. The company carries on the business started by Mr. Burgess.

The International Carpenter Electric Heating & Manufacturing company has filed articles of incorporation at St. Paul. The company's capital is $400,000.

The advent of the vestibuled cars on the interurban line between Minneapolis and St. Paul has led to a widespread clamor for a similarly arranged car, especially for the protection of the motor man against wintry blasts.

The North American Telegraph directors have re-elected the old corps of officers, viz.: Charles M. Loring, president; A. H. Wilder, vice-president; Henry F. Brown, treasurer; Henry A. Tuttle, general superintendent; Wm. H. Eustis, secretary.

The new steam plant being put in the Electric company's power house at Eau Claire, Wis., will be ready for operation January 1st. It will cost $12,000.

The Owatonna Electric company has completed the building for its new plant and is moving in the machinery.

At Casselton, N. D., the prospects are good for the putting in of an electric light plant at an early day. The projectors want to be sure of 300 lights being taken, and over 250 have been subscribed for. H. C. C.

Milwaukee, Wis.

MILWAUKEE, December 10.—During the last week or ten days the public mind has been occupied to an unusual extent with street railway matters. The general complaints about the service, which have been heard for some time, found expression at the last meeting of the common council. A number of resolutions and ordinances, all looking to a betterment of the street car service, were introduced. One of these provides that the Milwau-

kee Street Railway company run cars according to a schedule to be adopted by the council, the company to forfeit $50 every day that it fails to comply with the schedule. Another resolution provided for the preparation of an ironclad time table, and a third demand was for more cars. A petition signed by West Side people, who demanded more cars, was handed in at the same time. Some measures looking to the protection of street car passengers from the deadly railway crossing and the dreaded open draw were likewise introduced. One ordinance provided that, in approaching a bridge, every street car shall be stopped at least fifty feet before it reaches the bridge, be the latter closed or open. A fine of from $5 to $25 is provided in case the motormen shall not comply with the ordinance. A similar ordinance, providing for a full stop within 100 feet of a bridge, was submitted. An ordinance to compel the stopping of cars before crossing either a bridge or a railway was introduced.

A visit from Henry Villard, who controls the street railway system of Milwaukee, was an event in street car circles. Mr. Villard arrived early Friday morning, and with him came W. N. Cromwell, who represents several large holdings in the Villard syndicate, E. V. Smalley, a St. Paul newspaper man, and J. C. Barber, an electrical expert connected with the Northern Pacific railway. Mr. Villard was met here by Eugene Griffin of the General Electric company and by F. J. Pearson, chief engineer of the West End Railway company of Boston, who is also interested in the General Electric company. A meeting was held at the office of Henry C. Payne, and the forenoon was passed in discussing the trouble which had been experienced in operating the Milwaukee system. After the meeting Mr. Villard talked quite freely on the subject. He said that Milwaukee was going to have a complete electric railway system, and declared that he was dissatisfied with the present situation. He was grievously disappointed, he said. The company should have had its engines long ago, and it was his present mission to estimate the loss which had been sustained by reason of the failure of the contractors to live up to their agreement. On the subject of defective machinery, he said: "I went to the power house and found that many mistakes had been made. The engines are of a new pattern, and whatever their defects are they must be quickly remedied. Two engines are in place, and a third one is ready to start. This third one will relieve the others considerably, but not enough. There are to be five engines, and the other two are promised to us next January and February, one in each month. We are blamed because the road runs so imperfectly, and yet we have not accepted it from the contractors. We can do nothing but attach penalties. We started to run the road with electricity because the animal power was run down, and we were told that the engines would be ready months ago. The power we have had is overtaxed. The plant is arranged to run 30,000 incandescent lights, and yet we have but 18,000 now connected. We have bought and paid for 250 cars, but we have power to run only ninety. We cannot put on more electric lights without injuring the street car service. I regret that any blame has been attached to Mr. Payne. It is hard to tell when the road will be in running order—complete running order. I have looked at the site for the new power house. With a large power house on the South Side to take the lights in that part of the city and to run the cars over there, we hope to give a splendid service to every part of the town. I shall look over the ground thoroughly, and hurry the work of completing the road. Those engines must be in place if money can put them there." Before Mr. Villard left the city negotiations had been concluded with the E. P. Allis company to have the latter furnish power from its works as a temporary measure of relief. The idea is to secure 1,000 or 1,500 horse power in this manner and operate the South side lines with it, thus placing additional power at the disposal of the East side and West Side lines.

During his recent visit it leaked out that Henry Villard is no longer president of the Milwaukee Street Railway company. The president of the company is W. N. Cromwell of New York, who came to Milwaukee with Mr. Villard. Mr. Cromwell is not very well known here, but he is a member of the law firm of Sullivan & Cromwell, New York, and he is the private attorney of Villard and the counsel of the North American company.

During his stay in Milwaukee Mr. Villard was dined by E. C. Wall, president of the Badger Illuminating company, and by Vice-President Payne of the Milwaukee Street Railway company. Some striking electrical decorations were used at the dinner given by Mr. Wall at the Milwaukee club. Through the middle of the table was a line of trolley poles, each pole supporting red, white and blue incandescent lights. A mat of ferns covered the table, and lines of white tuberoses were inlaid to represent the rails of an electric road. The decorations elicited a great deal of praise.

Receiver Melms of the Hiosey electric line has filed his report, and asked that he be given permission to sell the property. Judge Johnson has issued an order requiring the parties interested to show cause why the request to sell the line should not be granted. The receiver's report shows the extent of the company's property. The real estate consists of the tract on which the power house is located in the Second ward, the lots on which the car barns are located, and three lots in the Ninth ward. The rolling stock consists of ten open cars, twelve box cars, a snow plow and a flat car, all with trucks. The machinery at the power house includes a 1,300 horse power Hazelton boiler, a 1 250 horse power Hazelton boiler, a steam pump, a 1,300 horse power Reynolds engine, three 80 horse power generators, and some minor supplies. In his report the receiver says that there was only $20.38 in the treasury when he took possession of the line. He affirms that the average monthly receipts of the road are only about $6,000, and that the expenses will exceed that sum during the next three months. The taxes, which amount to $3,000, will become due soon, and the road owes $2,858.81 to employes and laborers. The total indebtedness of the road, according to the receiver, is in the neighborhood of $200,000. He repeats what has already been claimed in the WESTERN ELECTRICIAN, that the thirteen miles of track are in a very poor condition, and insists upon the franchises being sold with the real estate and personal property, as one would not be worth acquiring without the other. The original cost of the road was about $300,000, it is said, and the indebtedness comes with in two-thirds of that sum. It is reported that Francis E. Hinckley of Chicago, the principal stockholder, wants to raise sufficient money to buy the road, unless it promises to bring $350,000 from the Villard syndicate. The chances are that the road will not bring more than enough to pay the existing indebtedness. The new addition to the Republican house is equipped with an electric plant.

Residents of Whitefish Bay will raise a bonus to secure a half-mile extension of the dummy line.

The Racine aldermen have informally decided not to accept the resignation of Mayor Jackson I. Case, which was offered because he had become interested in the electric railway. C.

PERSONAL.

Charles D. Shain, of New York, was in Chicago on Monday.

J. H. McGraw, of the *Street Railway Journal*, New York, is in the city.

Frank B. Rae, of Detroit, stopped in Chicago last week, en route for Des Moines, Ia.

S. Dana Greene, assistant general manager of the General Electric company, was in Chicago on Monday.

H. C. Porter and A. I. Lee of the Hess Electric Storage Battery company, Des Moines, Ia., are in Chicago.

Warren L. Beckwith has severed his connection with the motor department of the western office of the General Electric company, and has accepted a position with the C. & C. Electric Motor company. Mr. Beckwith did good work for the old Edison company, and his services were also well appreciated by the consolidated interests. He will act as general sales agent for the western department throughout Cook county. It is needless to say Mr. Beckwith carries with him the good wishes of a large circle of friends.

NEW INCORPORATIONS.

Canisteo Electric company, Canisteo, N. Y.; capital stock, $10,000; producing electricity for light, heat and power.

New Paltz Electric Light company, New Paltz, N. Y.; capital stock, $15,000; to manufacture and use electricity for light, heat and power.

Northwestern Electric company, Superior, Wis., capital stock, $10,000; manufacturing and selling electrical goods, Northwestern Electric company, Superior, Wis.

Grand Rapids Electric company of Grand Rapids, Mich.; capital stock, $25,000; to manufacture electrical machinery; Chas. M. Ayer, Grand Rapids, Mich.

Brazil Electric Street Railway company, Brazil, Ind.; capital stock, $50,000; to construct an electric railroad in the city of Brazil and upon highways leading out of said city.

Caldwell Water Works, Electric Light & Ice company, Caldwell, Texas, capital stock, $50,000; to furnish the public water, light and ice; A. I. Rosenthal, La Grange, Texas.

Malone Light, Heat, Power & Coal company, Malone, N. Y.; capital stock, $50,000; Malone Gas company and the Malone Electric Light & Power company consolidated under the above name.

International Carpenter Electric Heating Manufacturing company, St. Paul, Minn.; capital stock, $40,000; to manufacture electric heating apparatus, dynamos, rheostats and machines, and manufacture electric heating and lighting devices; J. C. Bullitt, Jr., Germania Life Insurance building, St. Paul, Minn.

Newton Light, Heat & Power company, Newton, Ia., capital stock, $50,000; to operate a plant for furnishing electric light, power and heat at Newton, Ia.; Harvey M. Vaughn, Newton, Ia.

Metropolitan Railway company, Tacoma, Wash.; capital stock, $700,000; to operate a general system of street and other railways, electric light plants, etc.; Gratton H. Wheeler, Tacoma, Wash.

Campbell-Yates company, Chicago, Ill.; capital stock, $25,000; to operate hotels and supply steam, water and electricity for power, heating and illuminating; H. H. Holmes, 720 Mooon building, Chicago.

Electrolytic Copper Refining company, Ansonia, Conn.; capital stock, $157,000; to refine any and all metal by means of fire, electricity or other agents, to buy, sell and deal in copper, silver and other metals; Edward L. Smith, Ansonia, Conn.

Rochester Engineering company (incorporated in Colorado), Rochester, N. Y.; capital stock, $100,000; to obtain franchises for building and equipping railroads propelled by electricity, steam, compressed air or horse power and sell the same.

The Mount Vernon, Bay View & Northern Railway company, Mount Vernon, Wash.; capital stock, $150,000; to construct, operate and maintain street and other railroads, electric light plants, telegraph and telephone lines, etc.; M. B. Dunbar, Avon, Mich.

Jersey City, Hoboken & Rutherford Electric Railway company, Jersey City, N. J., capital stock, $300,000; constructing, maintaining and operating a street railway for the public use in the conveyance of persons and property, etc.; Pennington & Beam, 148 Ellison street, Paterson, N. J.

Brooklyn Electric Manufacturing company, Jersey City, N. J.; capital stock, $20,000; to manufacture and deal in electrical specialties, mechanical appliances and machinery, and to do a general engineering and contracting business; Peck & Field, 261 Broadway, New York, N. Y.

General Electric company, New York, N. Y., and Denver, Colo., capital stock, $50,000,000; the manufacture of everything connected with electricity, buying plants anywhere in the United States, etc.; A. H. Reece, Denver, Colo., C. A. Coffin, president; E. I. Garfield, secretary.

Automatic Electric Signal company, Indianapolis, Ind.; capital stock, $200,000; to manufacture, sell and use Seaton's Automatic Electric Railway Signals, as covered and described in letters patent No. 484,614, and to sell the rights to use this or any other patent of which this company may hereafter become owner.

Cooley & Vater company, Minneapolis, Minn.; capital stock, $50,000; to manufacture and deal in engines, boilers, pumps, mill, engine and railway supplies, and machinery of every description; construct electric lighting, power and water works plants; manufacture all kinds of steam and other heating apparatus; Ripley, Brennan & Booth, 310 Boston block, Minneapolis, Minn.

ELECTRIC LIGHTING.

An electric light plant for Fulton, Ill., is projected.

The Peoria, Ill., Electric Light company has increased its station capacity by 2,400 incandescent lights.

The plant of the Wellwood Electric company, which supplied many handsome residences in Merchantville, Pa., has been seized by the sheriff on a judgment for $207.79 obtained by the Fort Wayne Electric company.

At Marcus Daly's Riverside Farm in Montana there is now being constructed a covered half mile training track which is to be lighted by electricity and kept in condition for both work and trials at any time of the year.

The value of the electric light for police protection is shown by a dispatch from Vanwert, O., to the *Chicago Tribune*, in which it is stated that the town is at the mercy of thieves, largely owing to the fact that the electric light plant is undergoing repairs, plunging the streets in darkness.

The Newport, R. I., Illuminating company is now fully installed in its new station at 449 to 455 Thames street. Armington & Sims engines, of an aggregate capacity of 1,300 horse power, are used, with Thomson-Houston arc machines and Edison power generators and incandescent dynamos.

The Northwest General Electric company has purchased a plat of ground in Dillon, Mont., for the location of an electric light plant. The original franchise of the company provided that the work must be completed by December 10th. The company has now asked for a thirty days extension of time, which will probably be granted, as the present state of work insures good faith on its part.

The wind was the wrong way for the Detroit Electric Light & Power company one night not long ago, and the West Side and most of the East was in a state of darkness until after seven o'clock. An inquiry at the office of the works as to the cause elicited the following reply: "The wind blew the water in the river away from our intake pipe, and we couldn't get water to fill our boilers."

The Kokomo, Ind., city council is engaged in a bitter wrangle over the electric light contract. Two months ago bids were received from several companies for public lighting, and the contract was awarded to the Western Electric company of Chicago, the home company, with the Thom-

son-Houston system, being underbid. The local company by every possible means resisted the successful bidder, and has succeeded in having the latter's bond rejected. A recent session of the council, after an acrimonious session, closed with a row, in which charges of bribery and corruption were freely made. The chairman of the committee on light posted $100, which he agreed to forfeit if he could not prove that corrupt means were used. The charges will be investigated. The Western company threatens to sue the city for heavy damages if its contract be abrogated.

As a result of the action of the Edison Electric Light company of Philadelphia in increasing its stock from $1,000,000 to $2,000,000, improvements to the plant will shortly be begun which will almost double its present capacity. At a meeting of the board of directors last month it was decided to go ahead with this work, and Professor Marks, superintendent of the works, was instructed to make drawings and specifications for enlarging the plant, and report to the board as soon as possible. The proposed operations will consist of the addition of three more floors to the present building, on Sansom street above Ninth. When these are completed the building will be seven stories high. The fifth floor will be used as a workshop, and will be furnished with all the latest improvements in electric appliances. The sixth floor will be used as a boiler room. New boilers will be put in at once, and more will be added from time to time as occasion demands. The top floor will be used for coal storage. "Our present capacity," says Professor Marks, "is 60,000 lights. With the additional power which we propose adding, we will have a sufficient current to supply 40,000 more, giving us an entire capacity of 100,000 lights. These improvements are the outgrowth of a very successful year, and the board feels encouraged to go ahead with the work as rapidly as possible."

ELECTRIC RAILWAYS.

Ten miles of electric railway are to be built at Alexandria, Ind.

The electric railway in Mobile, Ala., will be in operation in a few days.

Clark Rude, of Sandusky, is projecting a line of electric street railway between Galion and Bucyrus, O.

The Toledo, O., Electric Street Railroad company has increased its capital from $800,000 to $1,400,000.

The Dayton, O, Street Railroad company contemplates equipping its lines with electricity at a cost of $150,000.

The East St. Louis Electric Railway company is to erect a new power house with a capacity of 500 horse power.

The out-door work for the New Orleans and Carrollton electric railroad is about finished, and the cars will soon be running.

The Elmira, N. Y., & Horseheads Railroad company intends to change its motive power on the Horseheads division to electricity.

The Thomson-Houston company has succeeded to the properties and franchises of the Metropolitan Street railroad at Macon, Ga., and now controls all the Macon lines.

The Tramway company of Denver, Colo., has contracted with the Park Railway company to equip two and one-half miles of the road with electricity, the citizens to raise a bonus of $15,000.

The new stack of the power house of the Binghamton, N. Y., Street Railroad company will be of iron, 125 feet high. It will be supported entirely from the foundation without guys of any kind.

The contract for the furnishing of power to the Newport Electric Street Railway company by the Brush Electric Light company has been extended to January 12th. By that time it is thought that the power house of the former will be completed.

The proposed electric street railroad on the new bridge over the Licking river at Newport, Ky., has been abandoned because the council refused right of way over Lowell street. The road will be fitted up as an electric line to Covington by another route.

A New York syndicate has purchased the street railway system of New Orleans for $10,000,000. The motive power will be changed from mules to electricity. The deal includes the purchase of a number of valuable street railway franchises that as yet have not been operated.

A California exchange states that an electric road is soon to be run from Mayfield and Palo Alto through the university grounds. Senator Stanford has refused permission to all stock companies to enter his grounds in this manner, but has given his assurance that he will meet any road at the entrance of the ground and run a branch road from it to the quadrangle.

The property of the Mobile Street Railway company, which recently obtained a franchise to operate its lines by electricity, was lately sold under a court order and purchased by the Fidelity Trust & Safety Vault Co., of Louisville, Ky., representing the bondholders. The property includes about twenty miles of single track, and it is thought that the sale of the road will result in the carrying out of the plans for changing to electric power.

TELEPHONE.

It is said that a long-distance telephone service will shortly be established between Chicago and St. Paul.

The Teche and Vermillion telephone line has been extended to J. Henry Putnam's Rose Hill, La., central sugar factory, thereby connecting all the sugar section in Vermillion by telephone, which will much facilitate the planters in cases of accidents to their mills, such as breakdowns, when material will have to come from New Orleans.

The Central Union Telephone company's employes recently attempted to erect a pole in front of the Fisher residence at Tiffin, O., and were making the excavation when Miss Rebecca Fisher appeared and ordered them to desist. They paid no attention to her and she secured a shovel and, taking her stand by the workmen, filled up the hole faster than two men could excavate it. The men finally became discouraged and that hole is yet to be dug.

TELEGRAPH.

Geo. E. Hinsie, late manager for the Postal Telegraph company at Topeka, Kansas, has disappeared, it is said, leaving $900 unaccounted for.

The decree annulling the contract between the Union Pacific Railway company and the Western Union Telegraph company in the suit instituted at the instance of the late ex-Congressman Anderson, of Kansas, has been entered in the Federal Court at Omaha. District Superintendent Dickey, of the Western Union, says that his company will open no new offices along the line of the Union Pacific, but senders of messages to or from points off the Union Pacific must pay the Union Pacific as well as the Western Union tolls.

MISCELLANEOUS.

It is proposed to erect a central station at the Ohio State University and furnish electrically transmitted power to the different buildings.

Platinum quotations, always of interest to electrical people, have advanced from 25 to 40 per cent. within the last ten days. The price at present is $10 an ounce troy, and dealers say will probably go up as high as once before, when it was $16. The cause of the present rise is due chiefly to the Russian miners holding the ore to advance prices.

A university extension lecture course on "Magnetism and Electricity" is in course of delivery in Aurora, Ill., by Prof. Thwing of Northwestern university. D. A. Belden of the Electric Railway company showed a substantial interest in the lectures by volunteering to furnish a 500 volt current for the professor to use in performing his experiments. The railway circuit was tapped in front of the Methodist Episcopal church, where the lectures were given, and the "juice" was thus on hand on the stage.

During the recent strike of electrical workers at the station of the Chicago Arc Light & Power company, the company paid for a supper at a Washington street restaurant, with orders that it be sent up to the non-union men who were at work. The union had its pickets out and notified the waiter of the situation. The latter refused to serve the meal and took it back. The proprietor, when informed of the facts, called in the union pickets and told them to eat the supper at his expense, as it had been cooked for union men.

The foreign business of the Thomson-Houston Electric company is rapidly increasing, and the invoices of electric apparatus sent abroad from the Lynn works during the past summer have been larger than ever before. A considerable number of Thompson-Houston machines have been sent to England, despite the keen competition of the electrical manufacturers of Great Britain. Last week a large dynamo was shipped in a waterproof case to Leeds, England, and only a short time ago an invoice of some 20 arc dynamos was shipped to Melbourne, Australia.

Preliminary surveys have just been completed between Cashaway Falls and the Chandler, Pioneer and Zenith mines in Minnesota, with a view of putting in an electric plant to be run by water power and to furnish electric power for the operation of the mines above named. Two claims were purchased some time ago by Lazarus Silverman, one from Louis Rouchleau, the consideration being $19,000. These claims include all lands contiguous to the Cashaway water power which is about four miles from Ely. It has been ascertained that at the season of lowest water, with turbine wheels, 4,800 horse power is available, while at times it will be double that. It is intended to locate the dynamos at the Cashaway, using currents of high potential. The mining companies are not interested in the venture, it being the plan of Mr. Silverman and his associates to put in the plant and furnish the power to the companies at a stated rate.

TRADE NEWS.

It was rumored a short time ago that George Cutter had sold out his factory in Chicago. Mr. Cutter states, however, that the report is untrue.

The Heisler Electric company, of Philadelphia, is completing several installations. It reports business for the past year as being largely in excess of any previous one.

Alfred F. Moore, of Philadelphia, has recently added new machinery to his plant to fill the numerous orders for incandescent and battery cords, a branch recently added through the purchase of the Globe Electric Cordage Works.

Waterhouse, Gamble & Co., Hartford, Conn., report a decided increase of late in the demand for their arc lamps. This firm has made arrangements with W. T. Partridge, formerly New York agent for the Radford Pipe company, to represent its interests in New York with offices at 45 Broadway.

The New England Electrical company, manufacturers, contractors and engineers, of Bridgeport, Conn., will place on the market about January 1st a new electric call bell, which is said to have many points of advantage. This company is representing the J. T. Case Engine company, and reports many sales having been made for this company's automatic high speed engine.

The Palermo Mica company of New York reports many large sales of mica to electrical concerns. This company announces a large increase in the sales of all kinds and sizes of mica for electrical purposes during the last six months, and states that the prospects for the coming year are unusually good.

General Manager C. E. Trump, of the Novelty Electric company, of Philadelphia, Pa., recently returned from an extended pleasure trip through the northwest. When in Chicago he visited the World's Fair grounds. He says that the electric exhibit will exceed the expectations even of persons who are interested in it. He reports the outlook for trade through the West as being unusually bright for the coming year.

For the convenience of its patrons the Jewell Belting company of Hartford, Conn., have begun the manufacture of belt dressing and cement. Many compounds now on the market are injurious to leather belting. The Jewel Company's product will be a water-proof dressing with which the company has been treating its belts for years. It has also thoroughly tested the cement. It is put up in packages of convenient size, and is having a large sale.

The Page Belting company of Concord, N. H., manufacturers of the Acme link belting, reports that the indications of business for the coming year are excellent. The new addition to the works in Concord is being rapidly pushed. The company expects to occupy the new building January 1st. This new addition will double the capacity of the plant. During the last month it has made many large sales, a number being in the west.

The Price Railway Appliance company of Philadelphia has several novelties in electric railway apparatus which it is exploiting. This company manufactures the Price rail joints, adapted to any T or girder rail, double girder joints, spoke joints and ribbed truss joints. The company has recently been furnishing special orders of light double girder joints, in which no reduction of strength or toughness is involved, it is claimed.

Edward R. Grier, formerly in the engineering business in Philadelphia, has located in Chicago and will handle the Russell switch in the United States east of the Mississippi rivers. Mr. Grier is a brother of Thos. G. Grier, western manager of the Bryant Electric company. The Russell switch was illustrated in a recent issue of the WESTERN ELECTRICIAN. This device is now in operation in connection with the lighting circuits of the Chicago Electric club.

The Laclede Gas company, St. Louis, will increase at once the capacity of its electric lighting and power station by the addition of a 2,500 and a 1,000 light incandescent machine and a 350 horse power compound condensing engine. The latter will be a Buckeye of the cross compound medium speed type and will be belted directly to dynamos. A. M. Morse & Co., contracting engineeers, St. Louis, have been awarded the contract for this engine.

The Eddy Electric Manufacturing company, of Windsor, Conn., is rapidly getting the large addition to its factory in working order. The company is now installing a second Powell planer, 42 by 48 inches. It is perfecting a system of running all the machinery by motors. Although this addition to the factory gave it a large increase of room, the company was obliged to erect a special building 25 by 272 feet for a pattern shop. In order to keep up with its orders it is obliged to keep the factory running overtime.

The Beacon Vacuum Pump & Electric company of Boston has contributed its share to the lamp controversy by reducing the price of incandescent lamps of 16 candle power to 35 cents. The Beacon company's lamp has already attracted considerable attention, and the present movement will serve to bring it into still further prominence. The company announces that it has recently introduced improved machinery which will enable it to manufacture lamps at this reduced rate and keep up the standard of the lamp.

Taylor, Goodhue & Ames, Chicago selling agents for the Burton Electric company of Richmond, Va., have just compiled and are now mailing to the trade a neat little pamphlet on the subject of electric heating. This book contains a great deal of matter of interest to those who have purchased electric heaters or contemplate buying them. The information is carefully arranged under separate headings, and a clear explanation is given of how, through the slight misunderstanding of simple details on the part of those installing electric heaters, an apparent failure may be caused. The pamphlet is a very practical little volume. Taylor, Goodhue & Ames state that the electric heating business is growing continually, and their sales have been most satisfactory in number.

The Enterprise Electric company, manufacturers' agents and dealers in electrical supplies, is just settling itself in its new quarters at 307 Dearborn street. The change from 313 Dearborn street was made necessary by a rapidly increasing business. The new quarters extend back from Dearborn street to Plymouth place, the store proper facing on Dearborn street. Besides the handsomely equipped salesroom and office in the front, a capacious stock room in the rear with a cellar below it gives the Enterprise company facilities for carrying a large amount of stock to meet immediate shipments. President W. C. McKinlock was recently in St. Louis on business in connection with the firm's branch house and reports trade in that locality as active. Vice-President W. F. Richardson has also just returned from a two weeks' trip East. Mr. Richardson visited the "N. I. R." factory and made arrangements for an immediate shipment of two car loads of this well-known wire. The company states that the demand for this brand of wire is constantly increasing.

BUSINESS.

J. F. Kester has severed his connection with Kester Arc Lamp & Manufacturing company of Ironwood, Mich., and is now at work developing a number of new electrical specialties.

Owing to a very large increase in business during the last few months, the Shawmut Fuse Wire company of Boston has removed from 85 Water street to 161 High street, where, with greatly increased facilities, all orders for tested fuse wire and fuse links can be promptly attended to.

The Electric Appliance company, Chicago, has put in a large stock of electrical toys and novelties for the holiday trade. The company made a special feature of this business last year, and met with considerable success. The results were so satisfactory that it extend its work the coming season.

The Commercial Electric company of Indianapolis has been organized to manufacture motors and dynamos from ¼ to 50 horse power capacity. The officers of the company are Joseph R. Evans, president; S. L. Hadley, secretary; W. A. Evans, treasurer; A. D. Adams, manager. A feature of the machines made by the company is the use of forged wrought iron throughout for the field magnet—no cast-iron being used.

From the following list of firms to which the Jewell Belting company of Hartford, Conn., has made sales of belting, one would be inclined to believe the Hartford firm is getting its full share of business from the electrical companies: Hudson Electric Light company, Hoboken, N. J.; Thomson-Houston company, New York; New York Electric Light company; Jersey City & Bergen Railroad company; Suburban Electric company, Elizabeth, N. J.; United Electric company, Springfield, Mass.; Hartford, Conn., Electric Light company; Chillicothe, O., Electric Railway & Light company; Electric Light & Power company, Van Wert, O.

The Westinghouse company has announced the prices of its new lamp. The list prices will be 35 cents for 25 and 20 candle power lamps, and 30 cents for 16, 10 and 8 candle power lamps. The discounts will be from two and one half to ten per cent., according to the quantity ordered at one time, and ten per cent. regularly to central stations. The allowance for the delivery at the factories of the glass parts of such lamps will be 10 cents each, so that the net price of the 16, 10 and 8 candle power lamps, which form nine-tenths of those used, will be seventeen cents each. The net prices for 20 and 25 candle power lamps will be 21½ cents. The company asserts that the saving to a central station by the return of the glass parts of the lamps and the low prices of the new lamps will equal nearly one per cent. dividend on its capital stock.

The Genett Air-Brake company, 11–23 South Jefferson street, Chicago, is manufacturing a brake that possesses a number of features that should be fully appreciated by electric street railway men. This apparatus is simplicity itself, and where it is used it will doubtless be efficacious in preventing accidents due to electric cars run at high speed. The brake equipment consists essentially of an extremely simple pump, an air storage reservoir and a brake cylinder. The pump is worked by an eccentric on the car axle. The peculiar and most valuable feature of this brake is an automatic valve through which, when the reservoir is sufficiently charged, the pump, although running, does no work and therefore absorbs no power. The action is such that the pump ceases to force in air when the maximum pressure is reached in the reservoir, and it does not begin again to charge until the brake has been applied a number of times and the pressure thus reduced to the minimum carried. General Manager M. L. Rothschild states that the orders already received for the Genett air brake have been of a most encouraging number. The simplicity of this brake certainly entitles it to consideration on the part of street railway men.

Secretary Charles P. Platt of the World's Fair Tower company, Chicago, states that work on the enterprise is progressing finely. This company has just offered an issue of five thousand shares of its capital stock at par, full paid and non-assessable. The capital stock is $2,000,000, divided into 20,000 shares of $100 each. Outside of this issue, the books for which have just been closed, a considerable portion of the capital stock, it is stated, has already been applied for, and will be allotted to the subscribers. Mr. Platt gives the farther information that there is considerable competition among the various electrical manufacturing companies for the contract to build the winding electric railway that will constitute one of the most attractive features of the tower. It is understood, too, that Schuckert & Co.'s big search light will surmount this structure. The tower is located opposite the woman's building, at the eastern entrance of the Midway Plaisance in the World's Fair grounds. Each person in making the ascent and descent of the tower gains a view of the entire exposition buildings. The president and general manager of this company is William Hampden Johnstone already well known to the electrical fraternity.

The Columbia Manufacturing & Supply company is the name of a new concern that has recently started a factory for the manufacture of electrical specialties at 340-342 Dearborn street, Chicago. The Columbia company is directly under the management of Secretary and Treasurer John T. Todd and Superintendent C. R. Baum. These gentlemen are both skilled mechanics, but Mr. Baum makes a specialty of the management of the mechanical department, while Mr. Todd handles all matters appertaining to the introduction of the firm's specialties upon the market. This company has unexcelled facilities for model making, and in fact the manufacture of any electrical or mechanical fixture or novelty. Among the articles which it is now about to place upon the market is a new electric cigar lighter and a machine for registering steam or other pressure, or the rise and fall of water in a tank, etc. This last contrivance, an invention of Mr. Todd, is a most ingenious apparatus, and, for the work it does, its construction is extremely simple. This recording apparatus consists of two essential parts, one of which is placed at the boiler or other apparatus whose pressure is to be indicated, while the other is placed at the distant point to record the condition of the distant apparatus. This distant pressure indicator will undoubtedly find a ready sale, as it is plain to one making only a casual inspection that is a most useful device. In addition to the apparatus already referred to the Columbia company is also pushing the Jupiter dry cell battery. Strong claims are made for this cell, and the company holds itself ready to prove its assertions.

The latest contestant in the electric railway field is the Sperry Electric Railway company. As might be judged from the name of the new company the apparatus it is exploiting was designed by Elmer E. Sperry, so well known from his work in other branches of the electrical business. The practical and commercial success of the Sperry electric mining machine is now to a certain extent an old story, but many will doubtless be somewhat surprised to hear that for the last three years Mr. Sperry has been at work experimenting in a radically new departure in electric propulsion involving the single motor idea. The remarkable success attending the operation of nine equipments which have been in actual service for the last year at Youngstown, O., under unusually severe conditions of heavy grades, railroad crossings (of which there are nineteen), proves that the system is beyond the experimental stage and has led to the formation of a stock company, organized under the laws of Ohio, with a paid-up capital of $250,000, for the purpose of placing the equipments upon the market on an extensive scale. From all accounts the company has good financial backing, and it is composed of young and energetic men of wide experience in commercial and electrical circles. Mr. Sperry has been retained as electrical engineer of the company, and Harry P. Barr, for the last three years connected with the railroad department of the Thomson-Houston Electric company, has been elected secretary and general manager. The company feels that its treatment and solution of the engineering problems involved justifies the claim to superiority over any system upon the market. Although organized in Cleveland its principal office is in New York, at number 29 Broadway.

The New York Steam Power company has recently installed several important plants in connection with isolated electric lighting machinery. This company has now many large contracts under way. Milton Thomas, who represents the company in Chicago, has been making an excellent record for himself and his company. In Chicago, for instance, there are two 75 horse power New York safety engines in the Security building, an equipment of the same kind in the Mallers building, and another in the Monarch brewery. The Northwestern Electric Light & Power company has installed a 50 arc light dynamo and a New York safety engine. The Elmhurst Electric Light & Power company at Elmhurst, Ill., has recently placed an order for an exact duplicate of the former plant, consisting of New York Safety Steam Power company's steam plant and Brush apparatus. An electric lighting plant, with General Electric company's apparatus, and New York Safety Steam Power company's steam plant of 80 horse power capacity is being installed at Higland, Ill. The Washington Park Club, Chicago, has contracted for a New York Steam Power company's 50 horse power engine and Edison electrical plant. The hotel Arragon, Atlanta, Ga., has been furnished a steam plant, consisting of two 50 horse power New York Safety Steam Power engines. The steam power plant for the Kings County farm buildings, Long Island, N. Y., will be furnished by the New York Safety Steam Power company. It will consist of six 350 horse power tandem compound engines. The first engine will be started up about February 1st. The Catskill Mountain company, Catskill, will put in a New York Safety Steam Power company's engine and boiler. The Trenton Brewing company has installed an Edison plant and a New York safety engine. The New York Safety Steam Power company has just shipped a 50 horse power high speed engine to the Tajo Mining company, Mazatlan, Mex., for driving a dynamo for mine lighting. A New York safety engine is to drive the electrical plant of the Harlem Wood & Lumber company, 138th street, New York. Another 100 horse power New York safety engine is being erected in William Campbell's Paper Hanging Manufactory, Tenth avenue, New York, for driving an electric lighting plant. The Philadelphia branch of the New York Safety Steam Power company has furnished the Bullitt building three 100 horse power, the Provident building two 80 horse power, the Brown building one 30 horse power and one 50 horse power, the *Times* annex one 60 horse power, Hotel Stratford one 80 horse power and one 125 horse power, the new deaf and dumb asylum, Mt. Airy, Pa., four 60 horse power plants.

ELECTRICAL PATENTS.

Issued December 6, 1892.

487,242. Electric Motor. Franklin H. Beers, Newark, N. J.

The motor is provided with a Gramme ring armature, one pole of the field magnets being arranged exterior to, and the other interior to the armature and upon opposite sides of the axis of rotation.

487,275. Speed Indicator. Frank L. Johnston and Wendell C. Fletcher, St. Louis, Mo.

487,285. Electrical Heater. Willis Mitchell, Malden, Mass.

A stove is constructed of magnetic material with cores or studs on which an electric conductor is wound so that the current will magnetize the stove.

487,302. Method of Electric Welding. Elihu Thomson, Swampscott, Mass.

The method consists in passing a greater current through one piece to be welded than through another, whereby if one piece be larger than the other it may reach the welding temperature at the same time with the other.

487,306. Resistance Box. John Waring, Manchester, Conn.

A cover is provided for the box provided with holes corresponding with the plug sockets between the blocks whereby the contact blocks are protected.

487,307. Connection for Commutators and Armature Wires. Ernest P. Warner, Chicago, Ill.

The connecting wires are inserted in holes in the end of the commutator bar, and a button is adapted to rest upon both wires and to be pressed against them by means of a screw bearing by its end upon the button intermediate between the wires.

487,310. Method of Heating by Metal Bath. Frederick L. White, Milwaukee, Wis.

487,315. Electric Arc Lamp. James J. Wood, Fort Wayne, Ind.

The feed clutch consists of a sleeve embracing the feed rod and a clutch lever pivoted to the sleeve, having a brake-shoe engaging the rod beneath its pivot, an arm connected to the feed mechanism and an opposite tail engaging an abutment to release the clutch.

487,324. Galvanic Battery. James L. Gethins, Boston, Mass.

The battery comprises a cell, a porous cup therein, a zinc electrode in the cup, and a copper electrode consisting of a cylindrical portion surrounding the sides of the cup and a plurality of radiating wings underneath the cup.

487,329. Electric Motor for Cars. Charles A. Jackson, Reading, Mass.

A crank is provided upon the armature shaft which produces a reciprocating motion that is transformed into a rotary motion at the wheel axle.

487,330. Compass. Pieter J. Kaiser, Leyden Noordeinde, Netherlands.

487,332. Clamp for Electric Conductors. Henry Lindahl, Chicago, Ill.

487,356. Apparatus for Distribution of Electricity. Thomas Tomlinson, London, Eng.

Means are provided for automatically cutting out some of the transformers of an alternating system when the load decreases, and for cutting them in by separate and independent means as the load increases.

487,360. Incandescent Electric Lamp. Eugene W. Applegate, Omaha, Neb.

Means are provided for removing the carbon filament when broken without sacrificing the glass bulb.

487,369. Telephone Holder. Everett C. Lewis, Woonsocket, R. I.

A bracket for holding the telephone receiver is provided with means for adjustment in all directions.

487,437. Electric Bell. Peter Wagner, New York, N. Y.

Two electro magnets are placed in different horizontal planes, crossing each other diagonally, but with coinciding centers, and an armature is pivoted between the magnets and adapted to be attracted by and swung between their respective poles, and a bell hammer is operated by the movement of the armature.

487,448. Jail. David K. Osbourne, St. Paul, Minn.

The jail wall contains a series of tubular electric conductors, and insulated electric conductors contained within the same, both included in open circuit, so that an alarm is given when they are closed together by a saw or other tool.

487,461. Electrical Device for Preventing Cribbing in Horses. George W. Whitefield, Evanston, Ill.

487,462. Connection Plate for Dynamos. James J. Wood, Fort Wayne, Ind.

487,477. Incandescent Electric Lamp. Gustav A. Frei, Springfield, Mass.

The invention comprises a tool for replacing carbons in the globes of burned out lamps.

487,479. Incandescent Electric Lamp. Gustav A. Frei, Springfield, Mass.

A cylindrical globe containing the filament is contained within a pear-shaped protecting globe.

487,510. Coin Controlled Theatrical Show. Edward T. Birdsall, New York, N. Y.

487,519. Thermostat. Franklin O. Elliott, Catawba, N. C.

487,543. System of Electrical Distribution. Oliver B. Shallenberger, Rochester, Pa.

A secondary line is connected with transformers in multiple and in the primary of each transformer is provided means for reducing the voltage, so that the work performed by the transformers may be varied.

487,607. Method of Arc and Incandescent Metal Heating. Charles L. Coffin, Detroit, Mich.

The method consists in heating the material on one side by contact with a conductor in electrical connection with one pole of the generator and heating the material on the other side by a voltaic arc.

487,634. Steam Boiler Indicator. George L. McDermott, Neenah, Wis.

487,644. Process of and Apparatus for Generating Electricity. J. S. Rogers, New York, N. Y.

The process consists in exposing a fusible electrolyte capable of being deoxidized and reoxidized while in a state of fusion in the presence of suitable electrodes to a current of a deoxidizing gas injected in one direction, and to a current of an oxidizing gas injected in the opposite direction.

487,654. Closed Conduit for Electric Railways. Albion A. Vanderpool, Newark, N. J.

487,655. Electro Therapeutic Process and Apparatus. Joshua M. Wardell, Cadillac, Mich.

487,676. Electric Signaling Apparatus. Morris Martin, Malden, Mass.

EUGENE F. PHILLIPS, Prest. W. A. HATHAWAY, Treas. W. H. SAWYER, Sec'y.

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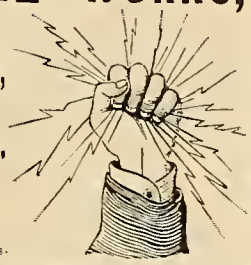
AMERICANITE. MAGNET. OFFICE AND ANNUNCIATOR FARADAY CABLES. WIRES.



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Two 60-light Vandepole, 110 lamps, 7 amp. $1,900.00.
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Nineteen Sperry dynamos all new, all sizes, cheap.
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Four Engines, Automatic, 40, 60, 75 and 100 H. P., smoke stacks, belts, etc.
All the above delivered f. o. b. Chicago, for cash.

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Insulation Guaranteed wherever used, Aerial, Underground or Submarine.

In a letter from the Inspector of the Boston Fire Underwriters' Union, under date of March 29, 1886, he says: "A thoroughly reliable and desirable Wire in every respect."

The rubber used in insulating our wires and cables is especially chemically prepared, and is guaranteed to be waterproof, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather and is not affected by heat. The insulation is protected from mechanical injury by one or more braids, and the whole slicked with Clark's Patent Compound, and especial extra finish, which we have now adopted for all our solid wires as an extra weatherproof protection, and also preventing chafing and abrasion, which is water, acid, and to a very great extent fireproof. Our insulation will prove durable when all others fail. We are prepared to furnish Single Wires of all gauges and diameter of insulation for Telegraph and Electric Lights from stock. Cables made to order. We are now prepared to furnish our Clark Wire with a white outside finish for ceiling cleat work as well as our standard color.

Clark Joint Gum should be used for making waterproof joints. This is put up in half-pound boxes, in strips about one foot long and five-eighths inch wide, and when wrapped about a joint and pressed firmly it makes a solid mass. **FOR RAILWAY and MOTOR** use, we make all sizes of stranded and flexible with Clark insulation.

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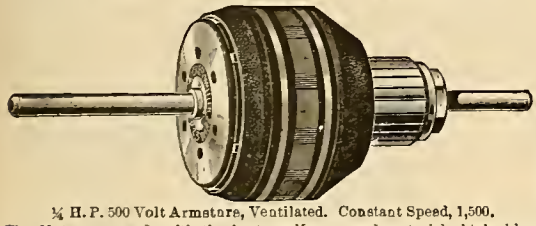

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The Motors are made with the best appliances and material obtainable, and embody every improvement of merit, with the intention that they shall be the Standard of their class.

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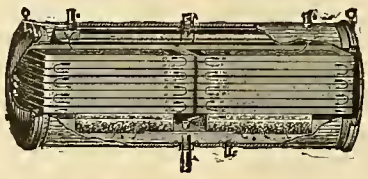

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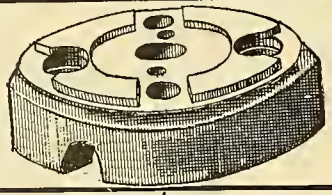

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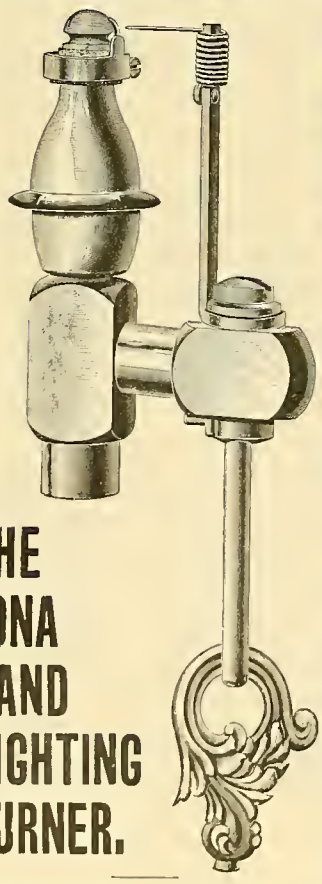

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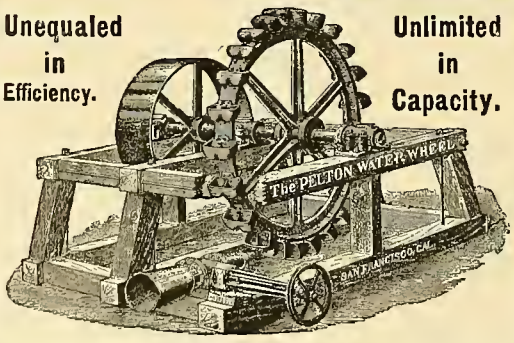

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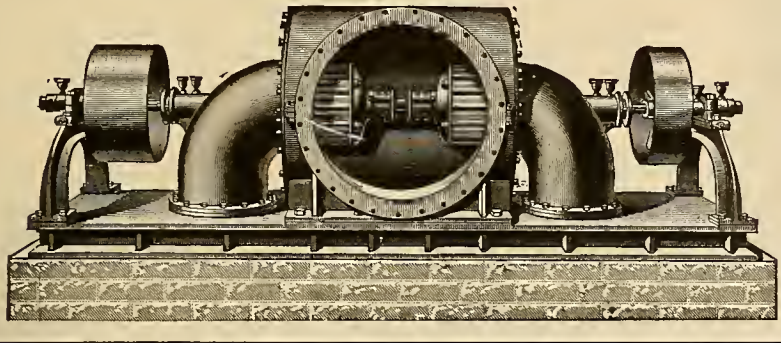

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Graphite Rods of Various Lengths, from 1-5 Ohm to 100 Ohms Resistance to the Inch. Graphite Boxes and Crucibles, Resisting Heats of 4,000 Degrees. Inquiries Gladly Answered.

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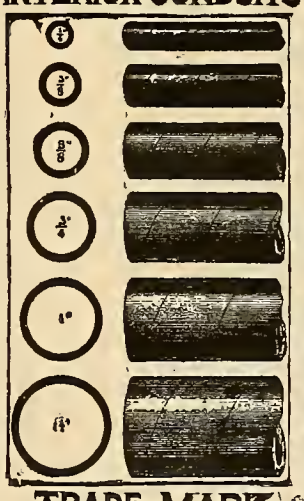

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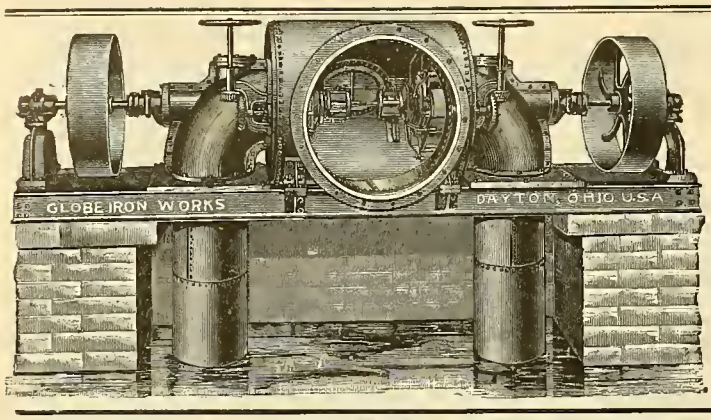

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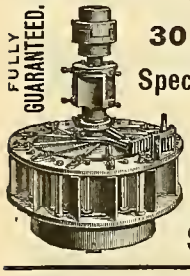

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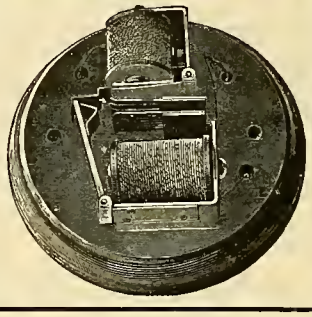

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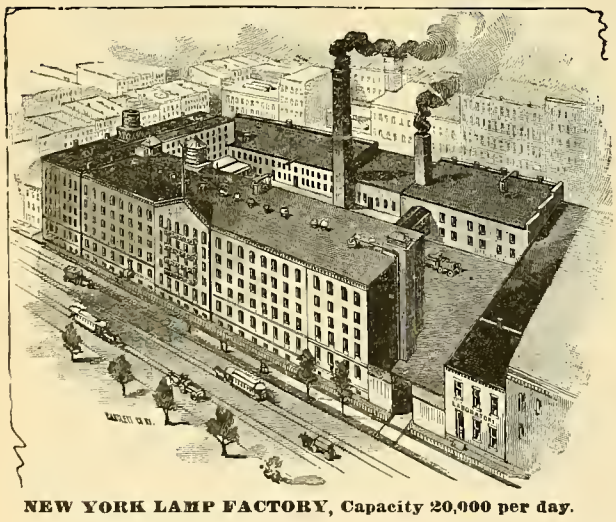

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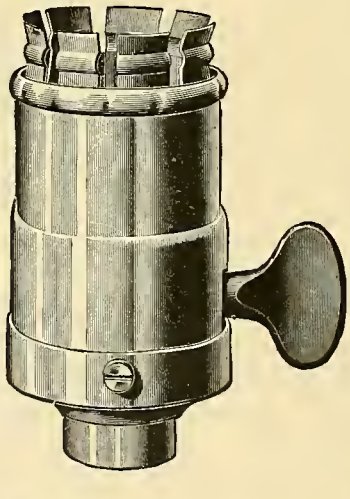

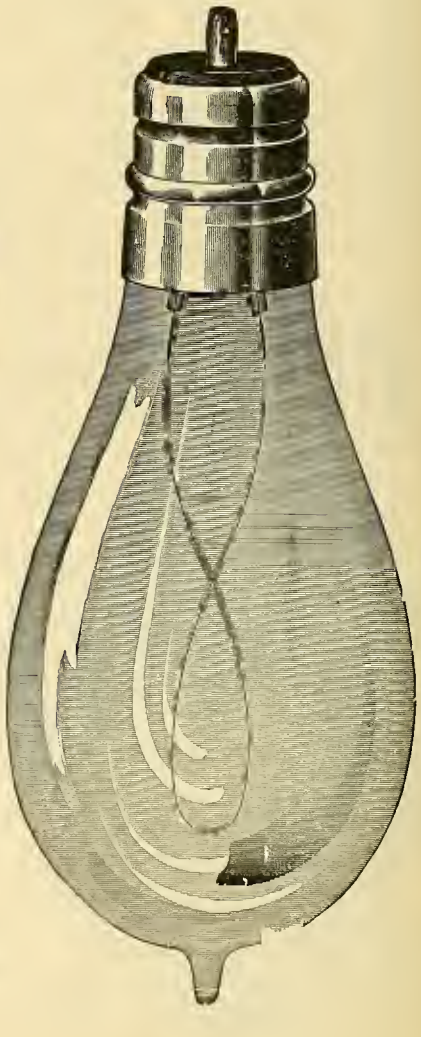

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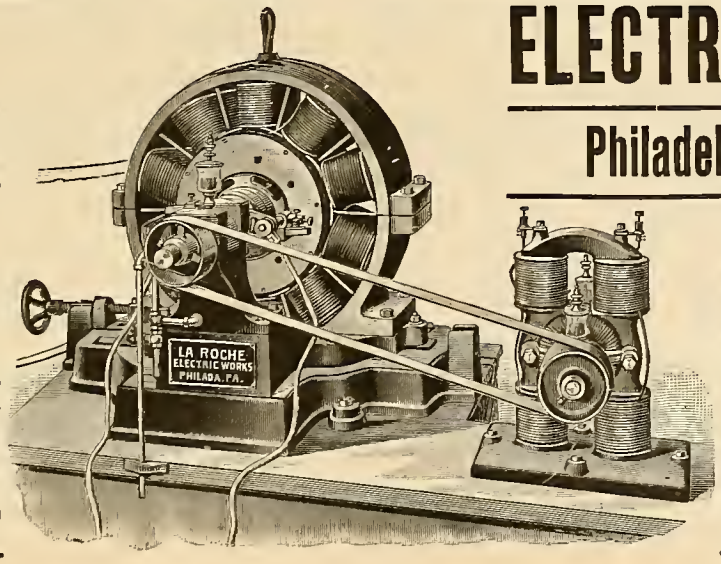

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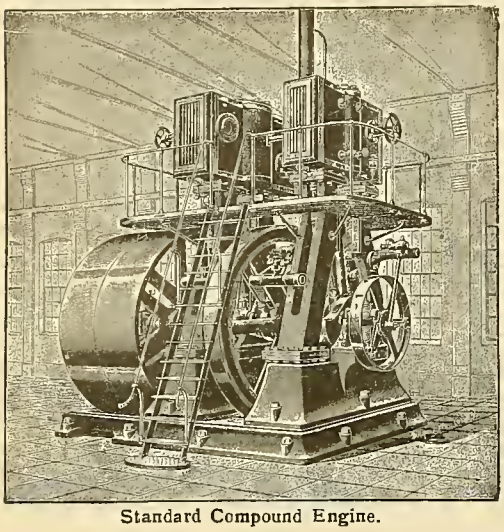

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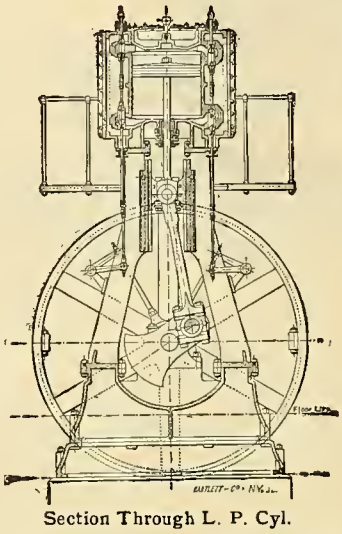

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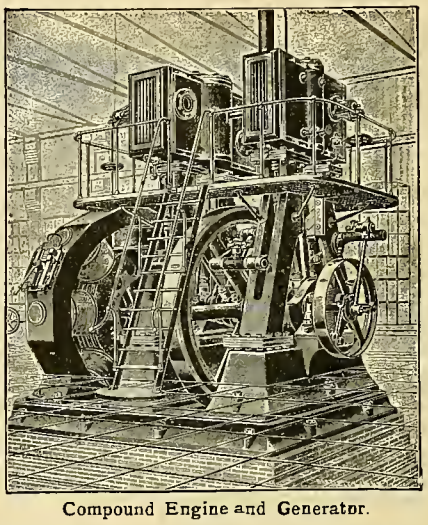

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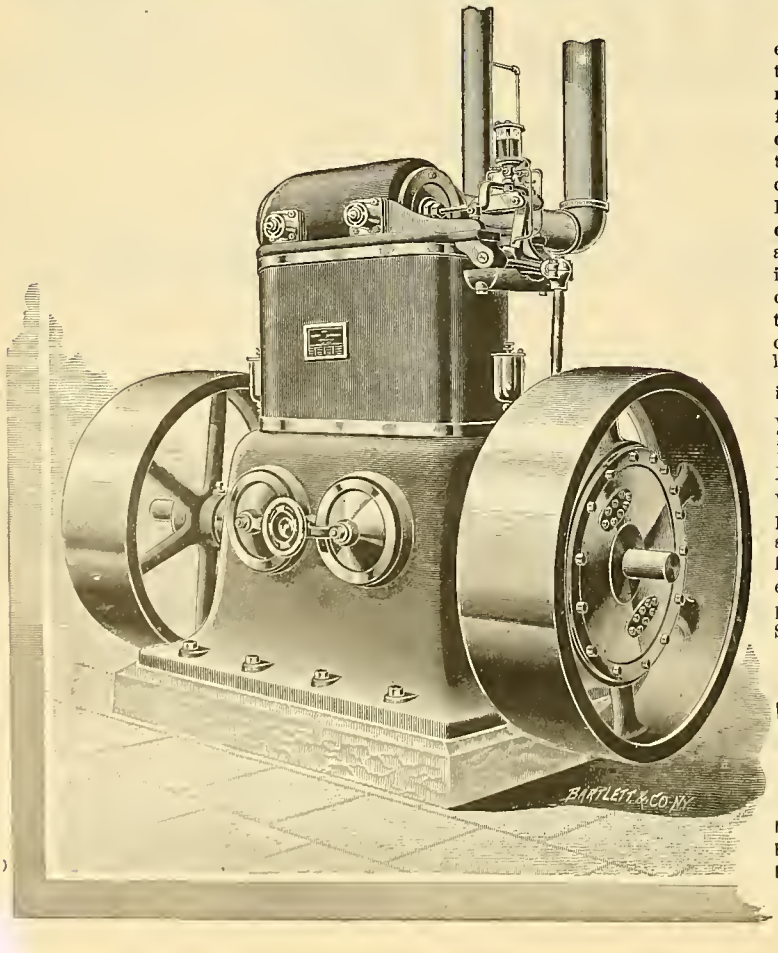

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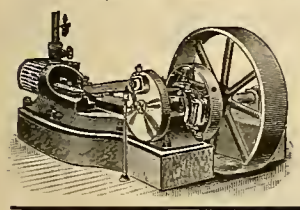

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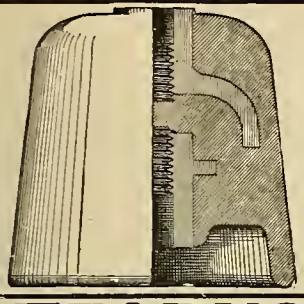

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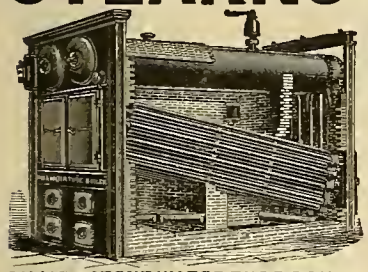

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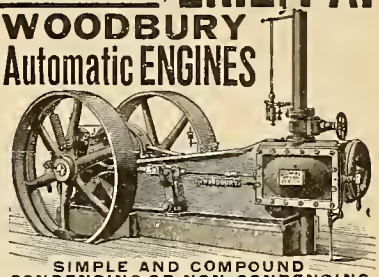

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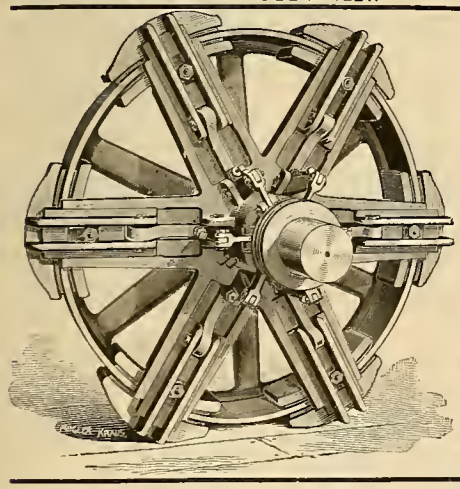

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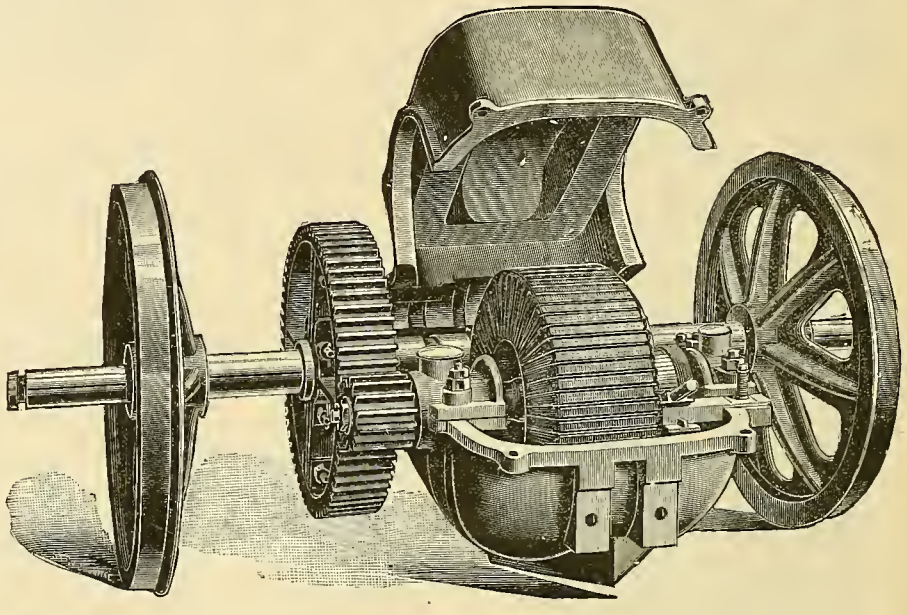

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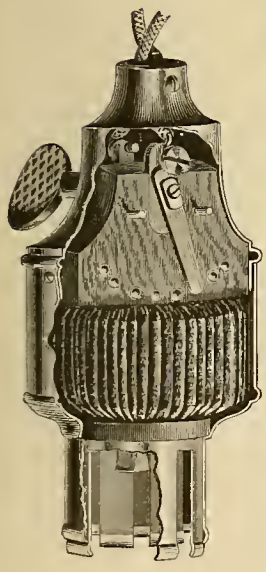
The **RIES REGULATING SOCKET** places Incandescent Electric Lighting, commercially speaking, on a par with gas. It enables the consumer to burn his lamps at any desired degree of brilliancy, from a barely perceptible glow, consuming but a fraction of normal current, up to the full Candle Power of Lamp.



TO THE STATION

It means increased efficiency, increased output, increased dividends. It is easily wired, nothing to get out of order, no straining of lamp filaments, indispensable for stores, private houses, hotels, hospitals, etc. Endorsed by underwriters and leading Electrical Engineers.

TO THE CONSUMER

It regulates the light, it saves the current, it prolongs the life of the lamp. It is compact and simple, efficient and economical, and saves its cost several times over every year.

Further particulars and prices upon application.

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54 and 56 Franklin St., Chicago, Ill.

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Factories, Ansonia, Conn. Cor. Randolph St. and Michigan Ave., Chicago.

THE INDICATIONS are that we will have a "nasty" winter. Several severe snowstorms and swirling blizzards are noted down in the vest-pocket memorandum of the weather clerk. In any event the prudent station manager will wish to have his lines and general equipment in "ship-shape" and of such material that he can rest assured no embarrassing failures will occur lessening the reputation of his company for regularity of light and power.

You are, no doubt, planning for next year, looking over the field, taking trial balances and to some extent determining the policy to be pursued for '93.

Allow us to suggest at this time that IF A GREAT STROKE IS TO BE MADE, TO LEAN ON A SUBSTITUTE IS TO RISK THE GRAND CHANCE.

There is no substitute for Shield Brand Moisture Proof Line Wire. *It will do to lean upon.*

Have you ordered your track brooms

?

We have a stock of steel wire brooms made to our order. We think that they are the best that you can buy.

Don't forget that Shield Brand Wire is *Moisture Proof.* The insulation is tough and will stand by you at the times when it would be exceedingly inconvenient to have a failure.

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For holiday decorations use the **Acorn Shape SUNBEAM Lamp;** we can supply them in **red, green, blue, amber, frosted or plain,** to fit any socket, for any voltage, 10, 16, 20, c. p. They have all the **good qualities** of the regular pear shape lamp.

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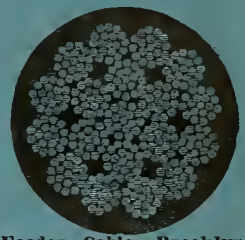
THE RUBBER USED IN

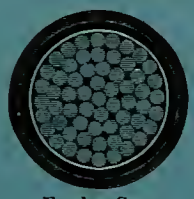
HABIRSHAW INSULATION

IS PURE PARA.



Feeder Cable. Brooklyn Edison Electric Light Co.

Underground Core. N. J. Central R. R.



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Submarine Work. Edison Electric Light Co., Easton, Pa.

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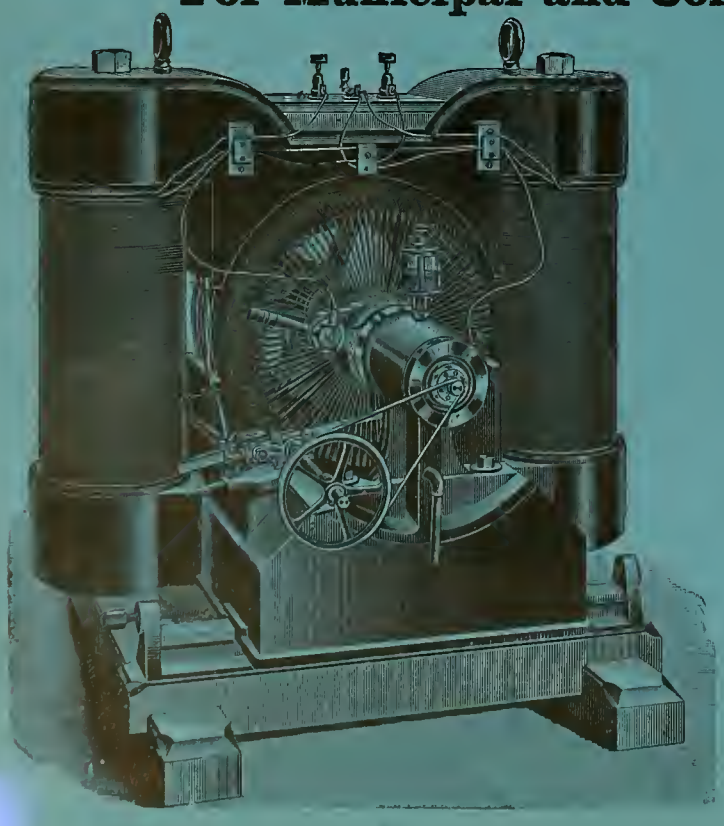

Intelligent, unbiased electricians and arc light users throughout the country verify our claims for **highest efficiency** and **greatest economy in operation and repair.**

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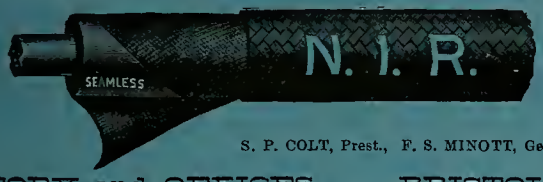

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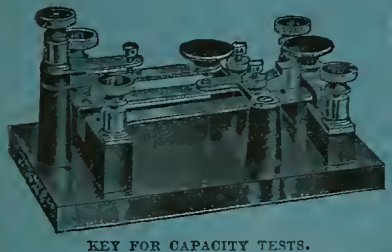

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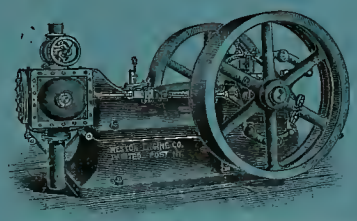

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ALL OTHERS INFRINGE THE EDISON PATENTS AND ARE COUNTERFEITS.

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INDEX AND CLASSIFICATION OF ADVERTISEMENTS.

ALPHABETICAL LIST.

American Battery Co..... iv
American Electrical Mfg. Co..—
American Electrical Works.... xiii
American Engine Co..... xii
Atwood, A. H..... x
Babcock & Wilcox Co., The.... i
Baggot, E xiv
Baker & Co..... xii
Ball Engine Co..... xix
Ball & Wood Co., The i
Beacon Vacuum Pump & Elec. Co... i
Becker Mfg. Co., John.....—
Beggs, J. E., Mch. & Supply Co. xiv
Bernstein Electric Co..... iv
Blanchard, Albert..... xix
Boston Braid Mfg. Co..... xiv
Bowers Bros..... xiii
Bridgeport Mach. Tool Wks.. xii
Brookfield, Wm..... xii
Brush Electric Co xvii
Bryan, W. H.. xiii
Bryant Electric Co.....—
Buckeye Electric Co., The..... ix
Cabell, L. Breckinridge..... ix, xiii
Carpenter Enamel Rheostat Co. xvii
Central Electric Co..... v
Chicago Rawhide Mfg. Co.... iv
Columbia Inc. Lamp Co..... i
Columbia Mfg. & Supply Co. —
Crescent Ins. Wire & Cable Co. xiii
Crocker-Wheeler Electric Co.. xiii
Cushing & Morse..... vii
Cutter, Geo..... —
Cutter Electrical & Mfg. Co... ix
Dayton Globe Iron Works Co.. xvi
Densmore Typewriter Co.....—
Diamond Electric Mfg. Co.... —
d'Infreville, G..... x
Dixon Crucible Co., Jos..... xv
Duplex Electric Co., Ltd..... xii
Eastern Electric Cable Co..... xiii
Eastman Kodak Co..... —
Edwards, W. S. Mfg. Co.....—
Electric Appliance Co xii
Electric Cons. & Supply Co.. xv
Electric Engr'g & Supply Co .. iv
Electric Secret Service Co.... xix
Electrician Pub Co.... x, xiv, xviii
Electrical Eng. & Supply Co. The. v
Electrical Mfg. Co., The..... iv
Electrical Supply Co., The ... xxii
Elektron Mfg. Co..... —
Empire China Works xix
Enterprise Electric Co..... xvii
Falls Rivet & Machine Co..... ix
Ferracute Machine Co..... —
Ford-Washburn Storelectro Co.—
For Sale Advs. .....xii, xiii, xiv
Fort Wayne Electric Co..... vi
General Electric Co..... ii, xx
Great Western Elec. Supply Co. ix
Greeley & Co., The E. S..... I
Gregory, Chas E..... xiii
Hart & Hegeman Mfg. Co.....—
Heisler Electric Co..... —
Hill Clutch Works..... —
Hine Eliminator Co..... xii
Holmes, Booth & Haydens.... xiv
Hood & Co., Wm..... iv
Hughes Bros. Mfg Co..... xvii
India Rubber & G. P. Ins. Co. xxiii
Innis & Co..... xiii
Institute of Technology..... xvii
Interior Conduit & Insulation Co. viii
International Okonite Co..... i
Jewell Belting Co..... i
Johns Mfg. Co., H. W.....—
Kartavert Mfg. Co..... xvii
Klipstein, A..... xiii
Knapp Electrical Works..... xxi
Lake, J. H. & D., Co .....—
Lake Erie Engineering Works. xviii
Lane & Bodley Co..... x
La Roche Electric Works.....—
Leclanche Battery Co., The .. xiv
Lefmann, Julius xv
Leffel, & Co., Jas xvi
Loud, H. M. & Sons Lumber Co. xiv
Manz & Co..... x
Mass. Chemical Co.....viii
Moore, Alfred F..... i
Morse & Co., A. M..... xii
Munsell & Co., Eugene..... xii
National Electric Mfg. Co.... v
National India Rubber Co.... i
New York Insulated Wire Co. xvii
N. Y. Safety Steam Power Co. xix
New York & Ohio Co..... I
Otto Gas Engine Works..... xix
Osborne Steam Engineering Co. xiii
Ostrander & Co., W. R..... xix
Page Belting Co..... —
Partrick & Carter Co..... xv
Pearson & Co., W. B.....xviii
Pelton Water Wheel Co xiv
Penn. Electric Engineering Co xv
Perkins Elec. Switch Mfg. Co. x
Phoenix Glass Co..... —
Porter-Leavitt Elec. Motor Co.—
Queen & Co..... xiii
Racine Hardware Mfg. Co.... xii
Railway Equipment Co.. ix, xxiv
Redding Electric Co..... xvi
Roebling's Sons Co., J. A iv
Rose Elec. Light Supply Co...—
Russell & Officer.. .....—
Samson Cordage Works. xii
Sawyer-Man Electric Co..... xxiv
Scott Electrical Mfg. Co viii
Sechrist, Albert..... xvi
Shawmut Fuse Wire Co..... xv
Shultz Belting Co..... xiv
Siebert, G..... xii
Siemens & Halske Electric Co.—
Sioux City Elec. Supply Co... xii
Sioux City Engine Works.... xix
Smith, A. T..... xii
Sperry Elec. Mining Mach. Co. xvii
Standard Electric Co..... vi
Standard Paint Co x
Stanley Electric Mfg. Co.....—
Stearns Mfg. Co..... xix
Steuben Lamp Works..... xiii
Sterling, W. C..... xv
Stilwell & Bierce Mfg. Co. xlv, xv
Sunbeam Incand. Lamp Co.. xxiii
Taylor Engine Co..... xix
Union Hardware Co..... xiii
Utica Elec. Mfg. & Supply Co. x
Vulcanized Fibre Co..... xv
Waddell-Entz Company..... xii
Washburn & Moen Mfg. Co.. —
Western Electric Co..... x
Westinghouse, Church, Kerr & Co..... xvi
Westinghouse Elec. and Mfg Co.....viii, xi
Weston Engine Co..... ... i
Worthington, Henry R..... —

CLASSIFIED LIST.

Annunciators.
Central Electric Co.
Electrical Supply Co., The.
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Electrical Supply Co., The.
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Holmes, Booth & Haydene.
International Okonite Co., The.
Knapp Electrical Works.
Moore, Alfred F.
National India Rubber Co.
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Sperry Elec. Mining Machine Co.
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Baggot, E
Edwards, W. S. Mfg. Co.
Electrical Supply Co., The.
Knapp Electrical Works.

Electro-Plating Machines.
Brush Electric Co.
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Engines, Gas.
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Ball & Wood Co., The.
Lake Erie Engineering Works.
Lane & Bodley Co., The.
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Racine Hardware Mfg. Co.
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Electrical Eng. & Supply Co., The.
Electrical Manufacturing Co., The.
Electrical Supply Co., The.
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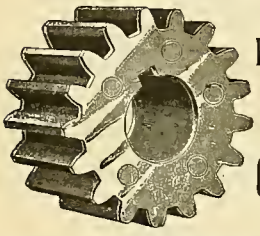

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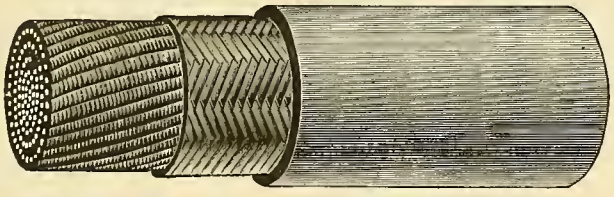

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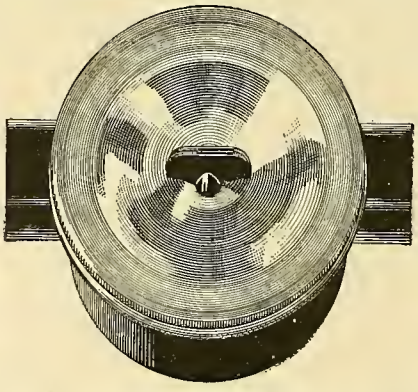

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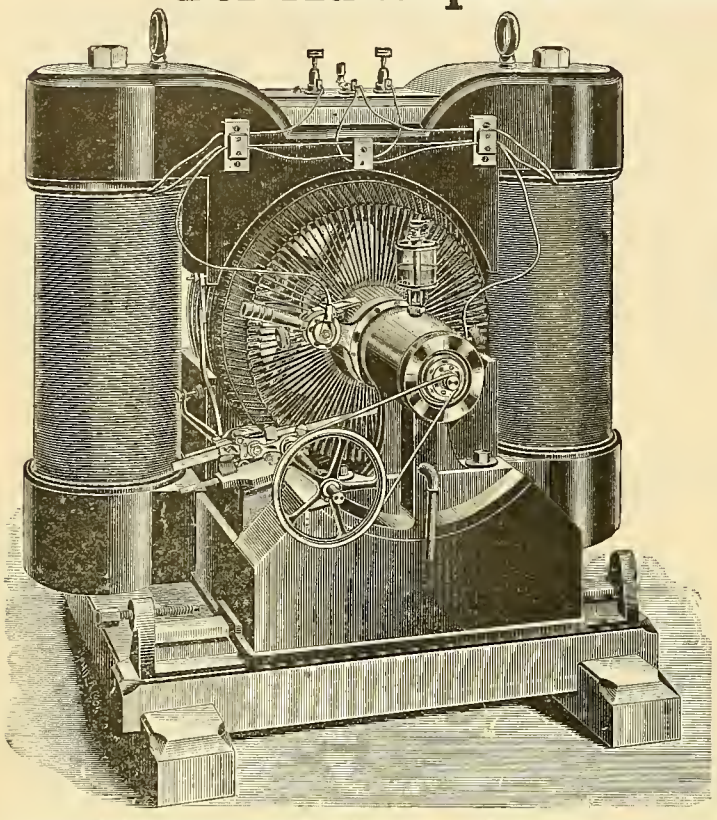

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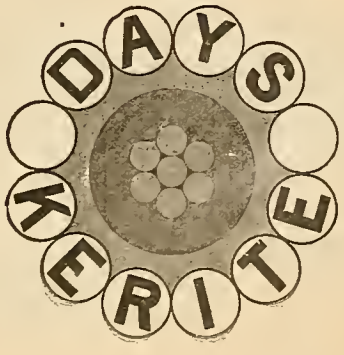
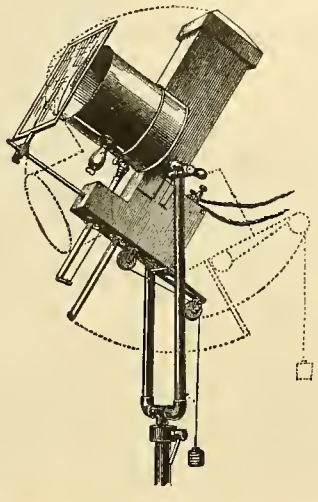


NOTICE.

To whom it may concern:



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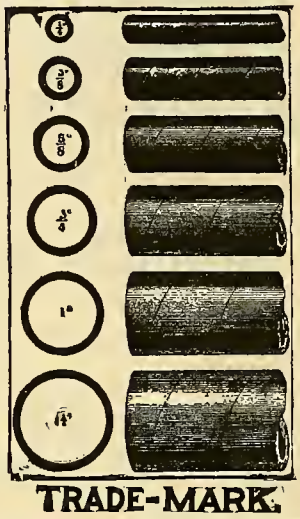

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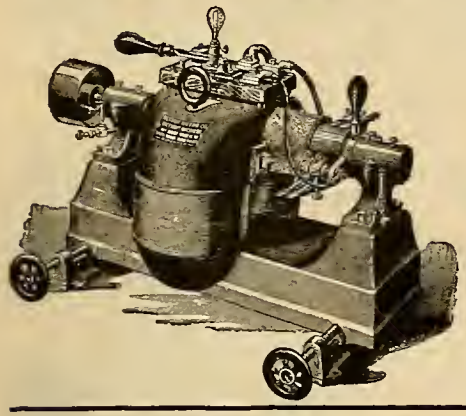

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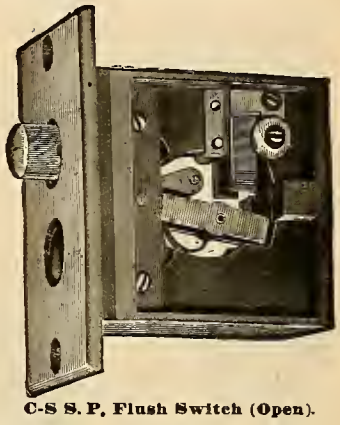

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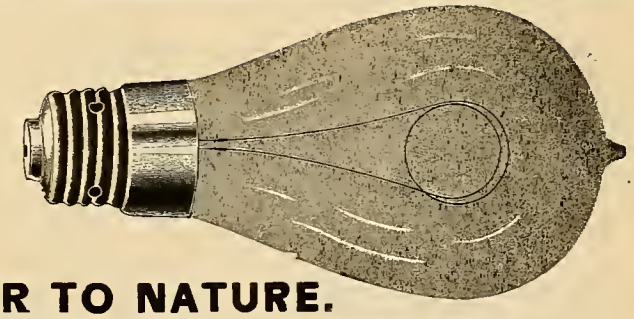

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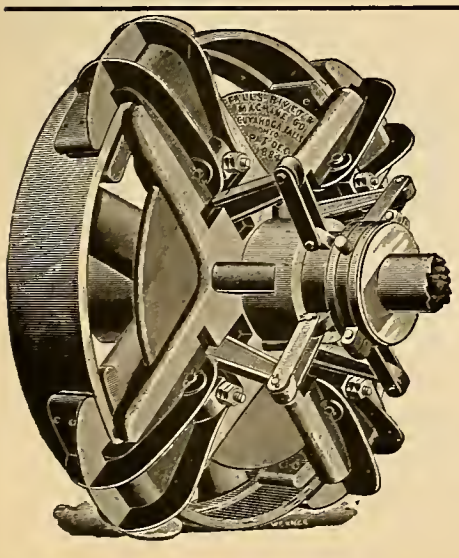

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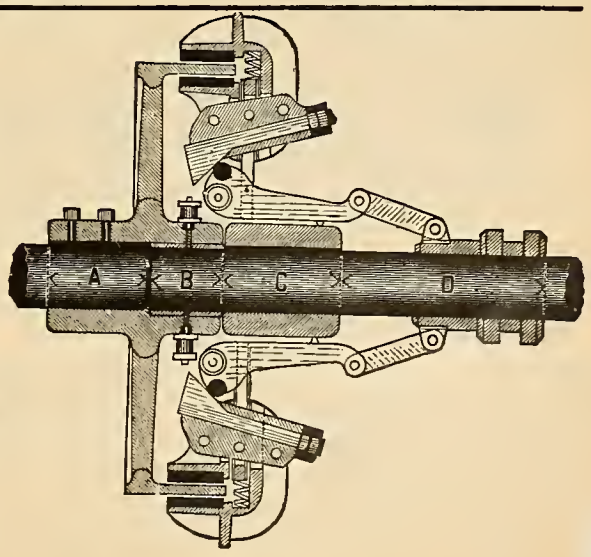

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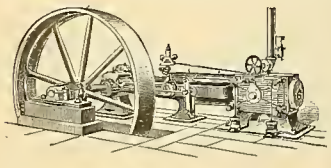

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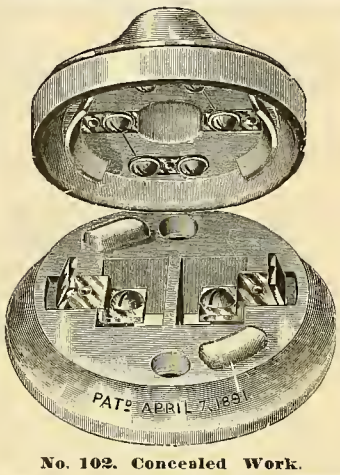

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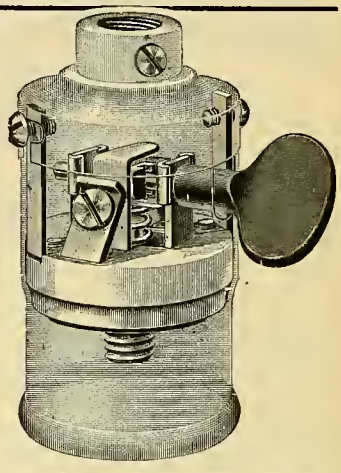

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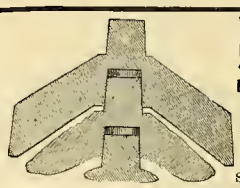

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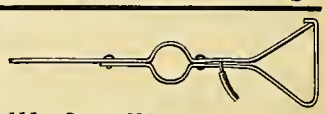

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By reason of economies effected in the manufacture of our new lamp in large quantities by the use of special machinery, we are able to

Quote the following Low Prices:

25 and 20 candle power lamps, - - - - $0.35 List Price.
16, 10 and 8 candle power lamps, - - - - $ .30 " "

DISCOUNTS.

Central Stations 10 per cent. discount, and to all others 2½ per cent. to 10 per cent. according to quantity.

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A credit of ten cents will be given for every unbroken burned-out lamp delivered at the factory of the Company.

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The constant effort of the agents of the General Electric Company to induce our customers to exchange Generating Apparatus of our make for Thomson-Houston Generating Apparatus is fully explained by the fact that

THE THOMSON-HOUSTON COMPANY PAYS US

through the Consolidated Electric Light Company Five Cents for every Incandescent Lamp it makes, for the right to sell such lamps for use in connection with Generating Apparatus of its own manufacture only.

While we do not sell our new lamp for use in connection with Thomson-Houston Generating Apparatus, the present users of the same may avail themselves of our new lamp by substituting our Generating Apparatus, the quality and efficiency of which will fully warrant the cost.

NOTE: A dealer came to our office and stated that he had **the exclusive sale** of second-hand apparatus for the **General Electric Company**; and he offered five of our Number One Alternating Current Generators for sale, to be delivered a few weeks hence as they are still in use. **We can of course Commend this apparatus if in good order.**

An official of a central station lighting company approached us recently for the exclusive right to the use of our apparatus in his town, stating that his company had already entered into a contract, Form D., with the General Electric Company, for the exclusive use of their apparatus. He frankly avowed that his purpose was, by securing a contract with us, to have a monopoly of electric light and power in the district covered by his station.

We thought it better to leave that place open for competition.

We have also been informed that one other Company had executed Form D contract of the General Electric Company. These three are the only instances we have discovered, where they have succeeded in doing business in the direction of inducing users of our apparatus to discard it for apparatus made by members of the Trust.

Although we have many tons of apparatus made by the various members of the Trust, taken in the course of trade, we have not cared to offer it for sale, for we believe the sale of inferior apparatus does great harm to the electric trade in general.

We have perfected devices that can be inserted in the various sockets now in use, thereby making them standard, for the use of our new lamps. The manufacture of these in sufficient quantities to meet the demand has been unexpectedly delayed, so that the delivery of lamps, and these attachments, will be made only from and after January 1st.

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STANDARD SCREW GLASS INSULATORS

MANUFACTURED BY

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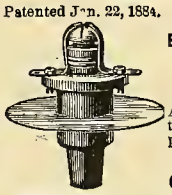

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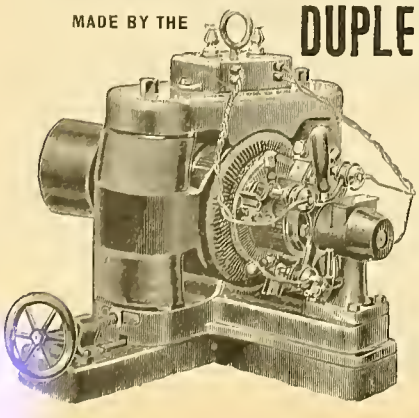

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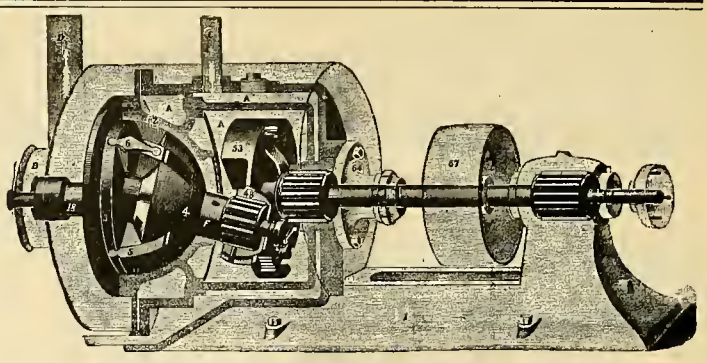

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It has no competitors.
Runs easily and smoothly
1000 REVOLUTIONS and more, in small sizes, and proportionally fast in larger sizes.

Unsurpassed for Economy

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DYNAMOS,
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It's the acme of simplicity. There's great saving in foundations, little or none being required, also in oil consumed and attention required.

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NOT A "ROTARY,"

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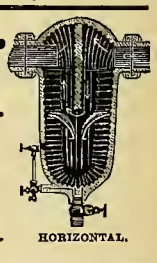

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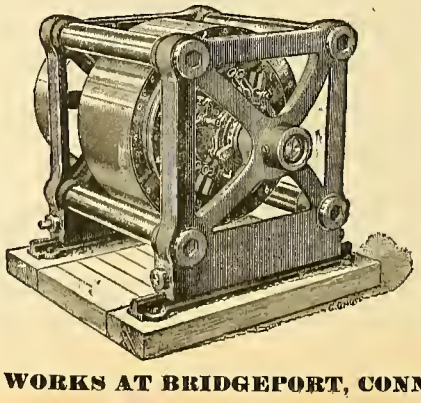

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WORKS AT BRIDGEPORT, CONN.

Western Electrician.

EVERY SATURDAY.

Vol. XI. CHICAGO, DECEMBER 24, 1892. No. 26

Electricity at the World's Fair.

It is announced by the officers of the department of electricity at the World's Fair that the manufacturers of "electric belts," "magnetic rings" and the like will not be allowed to display their wares in the electricity building. Chief Barrett has decided that these imposters do not come within the scope of any legitimate application of electricity, and they will therefore be excluded from the building. The names of several concerns of this kind appeared in the list of applicants for space in the electricity building which was printed in the WESTERN ELECTRICIAN of November 26th, and the department was made the subject of much adverse criticism on this account, the general inference being that the names would not be included in the official list unless it had been decided to admit catch-penny devices of this character. But it is now stated that the names were included simply to make the list complete, and that the fakirs have been notified that they cannot have space in the electricity building. This news will be a relief to exhibitors.

FIG. 1. ELECTRICITY AT THE WORLD'S FAIR.

In the illustration presented on this page is shown a view of the electrically operated transfer table in the annex to the transportation building, which has been tested and is now ready for operation. The table, which is to be used in running the locomotives and coaches of the transportation exhibit upon the tracks, designed for their reception, is about 70 feet long, and travels on seven pairs of wheels. The tracks upon which it is operated are situated about two feet lower than the tracks to be occupied by the exhibits, as shown in the picture. This allows the track on the surface of the transfer table to come on a level with those on which the exhibits are to be shunted. The table has a carrying capacity of 100 tons and can easily transfer the heaviest locomotive and tender. It is operated by electricity, and one man will have complete control of it. According to the amount of weight on it the table can be made to travel back and forth at a speed varying from 120 feet to 400 feet per minute. A Thomson-Houston waterproof motor of 25 horse power furnishes the power for operation. The machinery is installed in the cab at the center of the table. The motor is wound for 500 volts and current is taken from a double trolley circuit, bare copper wires strung about three inches from the ground on Thomson-Houston rubber insulators being used. The trolley wires are about nine feet apart, and, as can be seen in the illustration, are placed near the center rails supporting the transfer table. The car was designed by W. L. Clements, the mechanical engineer of the Industrial Works, Bay City, Mich., which furnished the apparatus, the electrical equipment being installed by the Chicago office of the General Electric company. The manner of shifting the locomotives, coaches, cars, wagons, etc., from the track on which they come into the yard to the one on which they are to be placed on exhibition is a very simple one. The table is run down along its bed until its surface tracks are even with those from which the exhibit is to be removed. The motor is attached to a revolving drum and strong steel cable. The cable is attached to the locomotive, or whatever the exhibit is, to be drawn on. By moving a small lever the man operating the motor sets the drum revolving. The cable, is wound up and the locomotive drawn on to the tracks. Then another train of gearing is started, and the table placed opposite the tracks intended for the exhibit. By running the cable of the drum around a post the locomotive is drawn off in much the same way that it was drawn on.

A view giving the present appearance of a portion of the engine foundations for the electric light and power station in machinery hall is shown in Fig. 2. The piers shown in the foreground are for the Ball & Wood engines that will drive the sixteen Brush arc machines, as shown in the plan of the station published in the WESTERN ELECTRICIAN of October 1st. Farther west are the twin foundations for the big double engine of 2,000 horse power, made by the E. P. Allis company, which will be belted to two Westinghouse 10,000 light alternators. The picture also shows one of the tracks for the electric traveling crane in the southern line of arches. Nearly 500 workmen are now employed in connection with the installation of the engines and boilers. All told, there will be 44 engines in the building, most of these being used to operate dynamos. Great things in the way of cleanliness are expected from the exclusive use of oil as fuel, and it is a standing joke in the mechanical and electrical department that the firemen in the boiler house can attend to their duties in full dress in the evening—provided, of course, that the directors see fit to open the fair in the evening. The steam from all the boilers will be conducted to a great supply main or "header" directly under the visitors' gallery between the boiler house and engine room. This "header" is 36 inches in diameter and extends nearly the whole length of machinery hall and annex, provision being made for the expansion of the metal. It is computed that if such allowance were not made, the "header" would be eighteen inches longer when steam was up than when cold. The crude oil will be piped from the oil fields of Ohio and stored in twelve tanks, eight feet in diameter and twenty-five feet long, sunk below the surface, for safety's sake, in the southeast corner of the grounds. The oil will come to the boiler house through a pipe six inches in diameter. In the evening, if both power and light are being used to the full capacity, one of the tanks will be emptied every hour.

Figs. 3, 4 and 5 show the proposed plans of the Westinghouse office building, for which space south of the machinery annex and directly west of the mechanical and electrical office building has been allotted. The structure will be two stories high, of staff construction, with ground dimensions of 35 by 45 feet. The front elevation is given in Fig. 3, and the rear elevation in Fig. 4. The new lamp is shown wreathed in laurels, and the keystone of Pennsylvania surmounts the whole. The lower floor will be used for reception and store rooms, while the upper story, a plan of which is given in Fig. 5, will be divided into offices for the superintendent and his assist-

ants, with sleeping and toilet rooms. There will be one large office with four smaller rooms.

Chief Barrett and Secretary Hornsby have a suite of six rooms in the electricity building to serve as the headquarters of the department. One will be used as a sleeping room, as it will frequently be necessary for some of the officers of the department to remain on the grounds over night.

Director-general Davis made his report of progress to the board of control on Friday of last week. The report is significant in its urgent demand for immediate completion of the buildings, that the work of installation—already delayed more than a month—may be hurried along. The delay in announcement of prices for light, heat and power, to which he calls attention, was due, he said, to the inaction of the Chicago directors, who have as yet taken no official cognizance of the rules passed by the national commission fixing charges to exhibitors for exposition service. Following are extracts from the report:

The demand is made and has been for more than a year that the cost of power, light and water should be fixed and published. At this date, December 14th, within four and a half months of the opening of the expasition not an officer of the expositon is authorized to state to an exhibitor what this cost will be. Exhibitors of machinery and electrical apparatus decline to accept their space until this question is settled, and this

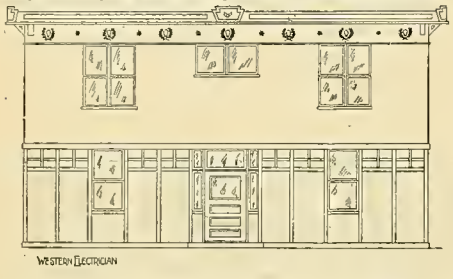


FIG. 3. ELECTRICITY AT THE WORLD'S FAIR.

delay has cost us the loss of some of our most important exhibits.

The chiefs of departments are getting into the buildings they have been directed to assume charge of, and no further delay can be permitted without serious detriment to the exposition. It was the intention that we should have six months in which to install the exhibits—none too long—and there is but little more than four months left for that purpose, and every day lost now in any department is a delay that can not be reclaimed.

The work of the departments and the general work since the council of administration and the departments have been located on the grounds has been greatly improved and is getting better all the time, but the results are not all that could be wished for, and it is necessary, in my opinion, that every contractor and every department should work every available man that can be put on the

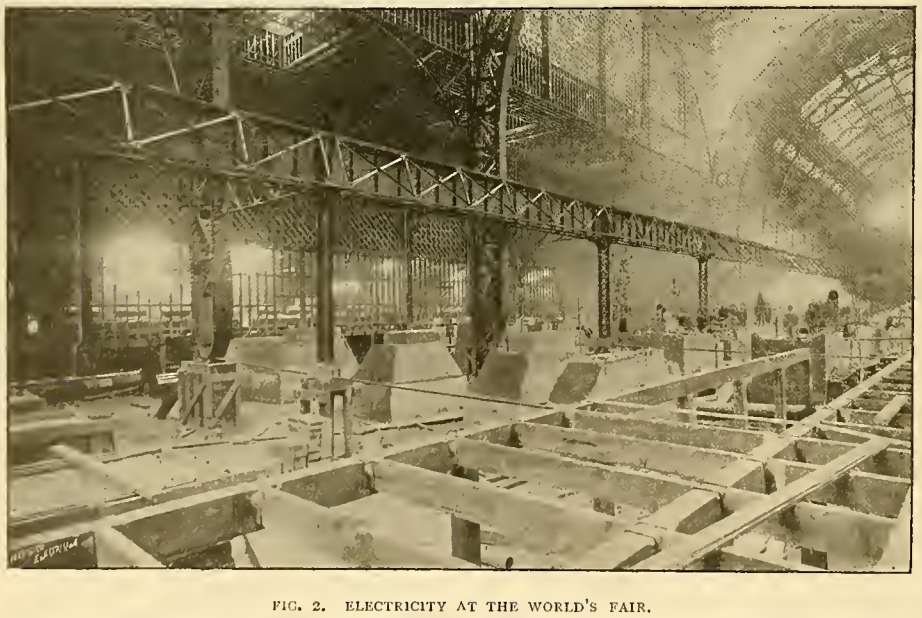


FIG. 2. ELECTRICITY AT THE WORLD'S FAIR.

work from this time forth, else we will be greatly behind. As a whole, the general outlook for efficiency and success is better than when last you met; it is improving all the while. It is not in a fault-finding spirit that I mention these matters, but it is for the purpose of briefly emphasizing the vital necessity for such action by administrative bodies as will not only permit but force the executive officers to united, ceaseless effort in every direction. Any unnecessary formality in details, any too technical methods of procedure, any further needless delay in formulating rules and regulations for the guidance and information of exhibitors, should be done away with and stopped, and the agencies from whose effective employment so great results are demanded urged to their greatest capacity and efficiency. Upon the work of a few short weeks do all the plans of months and a colossal fiduciary investment forever and irredeemably depend. No officer of the exposition can evade the tremendous responsibility assumed by indirection, hesitation or captiousness, or whatever cause, for ever so brief a time.

Another Lamp Decision.

The last decision of the United States Circuit Court of Appeals in the incandescent lamp litigation was handed down

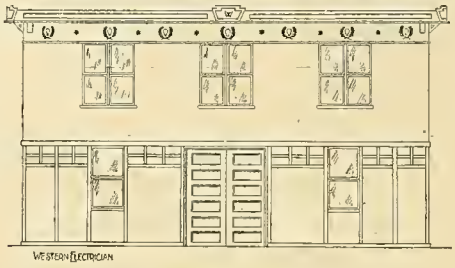


FIG. 4. ELECTRICITY AT THE WORLD'S FAIR.

at New York on December 15th. It is another substantial victory for the Edison interests. The opinion is appended:

This is an appeal from an order of the Circuit Court granting an injunction *pendente lite* restraining the defendant from making, using, or vending the incandescent electric lamps of the patent granted to Thomas A. Edison, January 27, 1880, No. 223,898, of which the complainants are the owners. The order was granted *pro forma*, in view that a final disposition of the questions involved might be promptly made by the decision of this court.

The validity of the patent, and the infringement of its second claim by such lamps as the defendant makes, were adjudged by the Circuit Court for the southern district of New York, July 14, 1891, in a decree at final hearing. That suit was brought against the United States Electric Lighting company, and was defended by the Westinghouse Electric company, a corporation which since October 10, 1888, has been the owner of the business carried on in the name of the present defendant. The business of the defendant consists exclusively in the manufacture of the infringing lamps. The decree of the Circuit Court adjudging the validity of the second claim of the patent, and its infringement by lamps such as are made by the defendant, was upon an appeal affirmed by this court October 4, 1892. That decree among other things awarded the complainants a perpetual injunction. The present suit was brought subsequently to that affirmance.

It is apparent that the order for the present injunction is in effect one to extend the terms of an injunction already granted in a suit determined by the court of last resort between the same parties, or their privies, so as to include a new infringement. For an understanding of the grounds upon which the defendant contends the injunction ought not to have been granted, the following narrative is necessary:

For several years subsequent to 1880 the Edison company and the United States Electric Lighting company were the only manufacturers of incandescent lighting apparatus in this country doing any considerable business. The United States Electric Lighting company began manufacturing incandescent lighting apparatus, including the lamps which have been held to be an infringement of the Edison patent, in the summer of 1880, and continued in such business until a recent period. In May, 1885, a suit was brought against it upon the present patent. Another corporation, Consolidated Electric Lighting company, was organized in September, 1882, and began the manufacture of incandescent lighting apparatus. This company was the owner of and operated under what are known as the Sawyer-Man patents for electric lighting apparatus; and under these patents it assumed that it had the exclusive right to make and sell the lamp claimed in the patent in suit. In May, 1885, suit was brought against it by the Edison Electric Light company upon the patent in suit, and about the same time it brought suit against the Edison company for infringement of its own patent. In 1883 a corporation known as the Thomson-Houston company began the manufacture and sale of electric apparatus for lighting and power. As the result of negotiations between the Consolidated Electric Lighting company and the Thomson-Houston company the Sawyer-Man company, the present defendant, was organized in September, 1886. Nine-tenths of its stock was owned by the Thomson-Houston company. It received from the Consolidated company a license to manufacture lamps under the Sawyer-Man patents, and thereupon began the business of manufacturing the infringing lamp, and has continued in this business to the present time. In August, 1887, all the stock of the defendant, including that owned by the Thomson-Houston company, was sold to the Consolidated company for $120,000 in bonds, and the same amount at par of its stock. In December, 1888, the Thomson-Houston company sold its stock in the Consolidated company to the Westinghouse Electric company. At the same time, by an agreement between the Consolidated company and the Westinghouse company, the fulfillment of which on the part of the Consolidated company was guaranteed by the Westinghouse

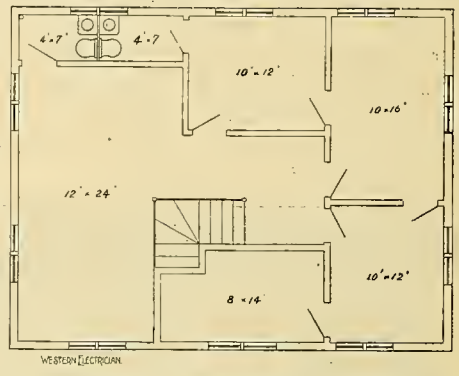


FIG. 5. ELECTRICITY AT THE WORLD'S FAIR.

company, the Thomson-Houston company was licensed under the patents of the Consolidated company to make incandescent lamps for export and use with generating apparatus of its own manufacture in this country; and the Westinghouse company was prohibited from selling incandescent lamps for use with the Thomson-Houston generating apparatus for a period which might, at the option of the Thomson-Houston company, extend to 1902. This agreement recognized the fact that the Thomson-Houston company could during the continuance of the agreement make and sell lamps not covered by the Consolidated company's patent; and in the event of such manufacture and sale, the latter company was released from its obligation not to sell lamps for use in connection with the Thomson Houston generating apparatus. Pending the suit against the United States Electric company, the Westinghouse company succeeded to the business of the United States company, the Consolidated company, and the defendant; and since September, 1888, the defendant has been the manufacturer of lamps for the Westinghouse system. Each of the various companies engaged in the manufacture and sale of electric lighting apparatus has, as a rule, manufactured all the different pieces of apparatus which are necessary for making up a complete "plant," the different parts being constructed with reference to use with each other, and not so as to be adapted for use in the systems of apparatus made by other manufacturers. For the purpose of public lighting from central stations local companies, known as illuminating companies, have been organized in various cities and towns, which have purchased plants from one or the other of the manufacturing companies, and the central stations of such illuminating companies have, as a rule, been equipped wholly with the electrical apparatus made by some one manufacturing company. In many cities and towns there are competing illuminating companies using the system of different manufacturers, some being equipped with the Edison system, some with the Westinghouse system, and some with the Thomson-Houston system.

The United States company has installed about 1 050 plants, with a lamp capacity of about 350,000 lamps. About 300 of these plants were installed before the suit upon the patent was brought against it. The Consolidated company also installed a large number of plants. After the Westinghouse company succeeded to the business of the United States company and the Consolidated company, it also installed a large number of plants.

It is said that the aggregate lamp capacity of the incandescent lighting plants installed with generating apparatus supplied by the Westinghouse company at the present time represents a capital of about twenty-five millions of dollars, and a lamp capacity of over 1,300,000 lamps. The lamps themselves represent but a small part of the cost of the plants, the greater part being represented by the electric apparatus supplied by the Westinghouse company and its predecessors; but the lamps are essential for the continued operation of the plants. Unless the lamps can be replaced as they are worn out, and can be procured when needed, these plants will be crippled and the greater part of the investment in them will be lost. The central station plants supply lights to customers as gas companies supply gas; and if their operation should be stopped great inconvenience to the public would ensue. The various compan-

ies give employment to a large number of men who might be thrown out of employment if the lamps could not be obtained.

In 1889 the Edison General Electric company was organized for the purpose of combining the Edison Electric Light company with various other corporations engaged in the manufacture and sale of electric apparatus, the organization of the subordinate corporations being retained. Prior to April, 1892, the Thomson-Houston company had acquired the stocks of various other companies engaged in the business of manufacturing and selling electrical apparatus, and these companies were carrying on the business in combination with the Thomson-Honston company and under its control. In April, 1892, these two combinations, the Edison General Electric company and the Thomson-Houston Electric company, included substantially all the companies which had theretofore been competing in this kind of business, excepting the Westinghouse company; and in that month the General Electric company was organized for the purpose of combining these two combinations in one which should include all the concerns in this country, except the Westinghouse company, which formerly were competing in the business of making and selling electric light and power apparatus, but the separate organization of the constituent companies was still retained.

The defendaot insists that the preliminary injunction should not have been granted because, (1) owing to the laches of the owners of the patent in asserting their claims and enforcing them, a large capital has been invested in the manufacture and sale, not only of lamps, but also in electric lighting apparatus, which will be greatly depreciated in value unless the lamps can be used with it, and that an injunction will cripple and perhaps ruin the local illuminating companies who have invested in the plants of the Westinghonse companies if they are prevented from using the lamp of the patent, and thereby subject to great inconvenience those whom these plants furnish with light, and displace a large number of persons who are employed in operating the plants; (2) because the complainants and the other corporations with whom the complainants are associated, the competitors of the Westinghouse company, in the business of making and supplying electric power and lighting, have entered into an unlawful combination to stifle competition in that business, and an injunction will be used unconscionably to further the objects of the combination; and (3) because by reason of the affiliation of the Thomson-Houston company with that combination, and prior dealings of that company with the defendant, the Consolidated company and the Westinghouse company, an equitable estoppel has arisen by force of which the complainants, as parties to the combination, ought not to be permitted to have an injunction. The question whether there has been any laches in asserting the patent was considered by the Circuit Court of Appeals upon the appeal from the decree of the Circuit Court, and that court declared that no case was shown to authorize the refusal of an injunction on any theory of laches or equitable estoppel by reason of undue delay in bringing suit, or acquiescence in known infringement. If the owners of the patent proceeded with due diligence as respects the United States Lighting company, no other infringers of the patent can be heard to complain with reason that suit was not brought against them upon the patent previous to the adjudication of its validity in the Circuit Court. It is a matter of notoriety that that litigation was a very expensive and arduous one; and its progress must have been familiar to all those who were extensively interested in having the patent defeated. As regards the present defendant, there are no new facts of importance bearing upon the question of laches to distinguish the case from that shown in the former suit. We see no reason for changing the opinion expressed by this court in the former case, and do not deem it necessary, because the same defense has again been urged upon substantially the same state of facts, to add anything to that opinion.

Every one of the manufacturing corporations, the competitors of the Edison companies, commenced their operations with a knowledge of the existence of the patent in suit. They were controlled by business men of intelligence and experience. Their promoters and managers may have believed, and probably did, that the patent could not be successfully maintained. But they entered upon the business with an understanding of its risks, and of the consequences which would befall them as infringers, if the patent should be sustained. None of them can now be justly heard to say that an injunction which is essential, if not indispensable, to the protection of the owners of the patent and their licensees, ought not to be granted because of the great pecuniary loss which may result. If in consequence of being deprived of the use of the lamps, their investments in other electric apparatus will be greatly depreciated, they must take the consequences.

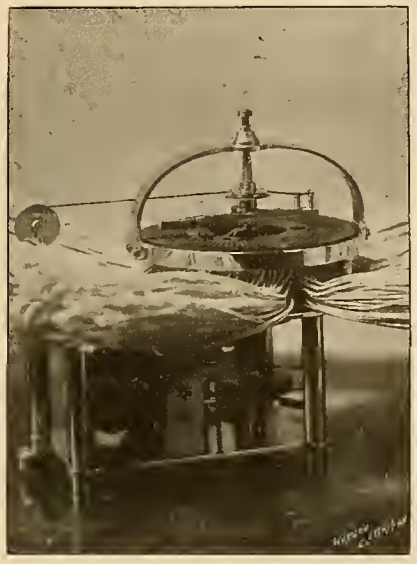


FIG. 2. STROWGER TELEPHONE EXCHANGE AT FORT SHERIDAN.

The users who have supplied themselves with electric lighting plants from the infringers, which required for their operation lamps of the patent, are of course infringers. But those who did so before the decision of the Circuit Court sustaining the patent, and at a time when judicial decisions in foreign countries interpreting the patent were in conflict, and who are now willing to accept their lamps from the complainants upon reasonable terms, have much stronger equities than the manufacturing infringers. These equities the court will not disregard; but what would be reasonable terms if an application were made to the court on behalf of these users is a question which can only be determined in each case upon its particular circumstances.

As to those users, however, who have acquired these plants subsequent to the decision of the circuit court, if they are deprived of the use of the lamps, and as a consequence the value of their plants may be greatly impaired, they must accept the result as a consequence of their own imprudence.

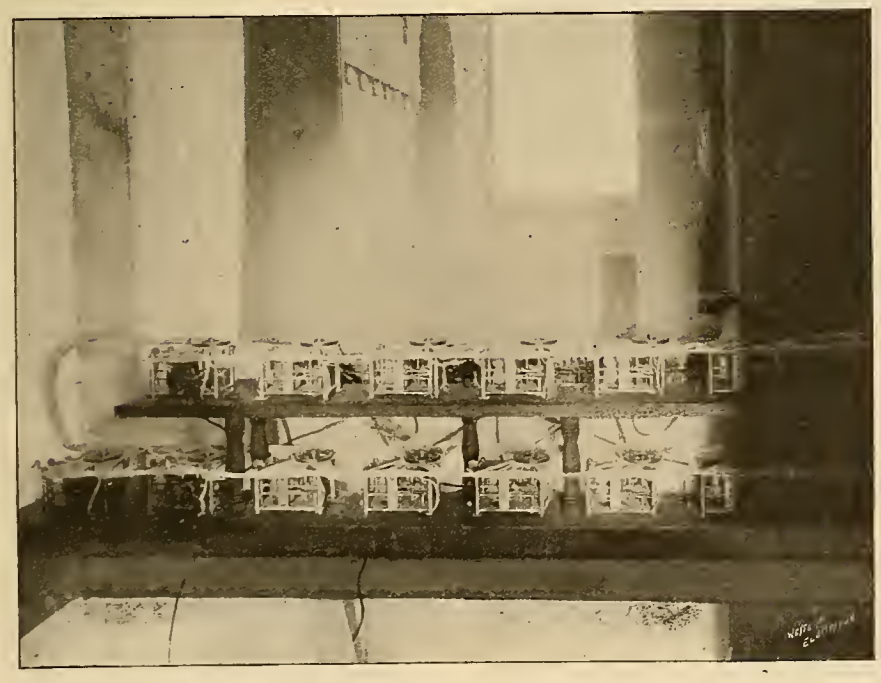


FIG. 1. STROWGER TELEPHONE EXCHANGE AT FORT SHERIDAN.

We are not disposed to investigate upon the present case the character of the combination which has been formed under the name of theGeneral Electric company. Whether that combination is intended to fetter competition, and is illegal as one in restraint of trade, is a question which we should not undertake to decide upon theevidence before us, and in a suit to which it is not a party. The present complainants are entitled by the patent laws to a monopoly for the term of the patent, of the manufacture and sale of the lamps made under it; the right to this monopoly is the very foundation of the patent system. They do not lose that right merely because they may have joined in a combination with others holding other patents securing similar monopolies, which combination may, when judicially examined in a proper forum, be held to be unlawful. We do not feel justified in assuming upon the facts before us in the present suit that the use which the complainants propose to make of the injunction, an injunction which seems necessary to secure their monopoly and make their patent fruitful, will be such as to promote any other monopoly. When it shall be made to appear that some one, to whom in fairness and good conscience these complainants should sell their lamps, has been arbitrarily refused them, save upon oppressive and unreasonable terms, it will be time to consider whether the complainants should be allowed to continue in possession of the injunction.

The alleged estoppel seems to be far fetched and shadowy. The history which has been given shows that before the Sawyer-Man company was organized litigation upon the patent in suit and upon the Sawyer-Man patents had commenced; that in 1887 the stock in the Sawyer-Man company owned by the Thomson-Houston company was sold to the Consolidated company, a party to the suits, and that subsequently, in 1888, the Westinghouse company, an actual party to the litigation, bought that portion of the stock from the Consolidated company which had been owned by the Thomson-Houston company. The estoppel lacks the elements which ordinarily create an estoppel in pais, namely, an injury or a harm to one person resulting from a reliance upon the acts, conduct or declarations of another, in which there was an element of bad faith or wilful neglect of duty. The history of the connection of the Thomson-Houston company from 1886 to 1888 with the Consolidated company and with the Sawyer-Man company, the defendant, shows that all these companies knew of the existence of the litigations in which the life of the present patent and of the Sawyer-Man patent was at stake. There can be no charge of concealment or constructive fraud. When the sale and the agreement of 1888 were made there was no implied obligation upon the Thomson-Houston company to remain in alliance with the Westinghouse system. The contingency that it might enter upon the manufacture of competing lamps was contemplated. Its union with the Edison interests has neither hastened nor facilitated the application for the present injunction. We perceive no adequate reason from the facts why the complainants should not obtain the ordinary results which attend a complainant's success in a suit in equity for the infringement of a patent.

The injunction order appealed from should be modified so as to cover only lamps made in infringement of the second claim of the patent, the other claims not having been infringed according to the adjudication of the Circuit Court or of this court. It should also contain a provision reserving the right to the defendant to move hereafter for the vacation, suspension or modification of the injunction upon proof of specific instances of refusal on the part of the complainants, or either of them, to supply the lamps of the patent upon terms reasonable under the circumstances of the particular case, to the owners of electric lighting plants which were installed before the reedition of the interlocutory decree of the Circuit Court sustaining the validity of the patent.

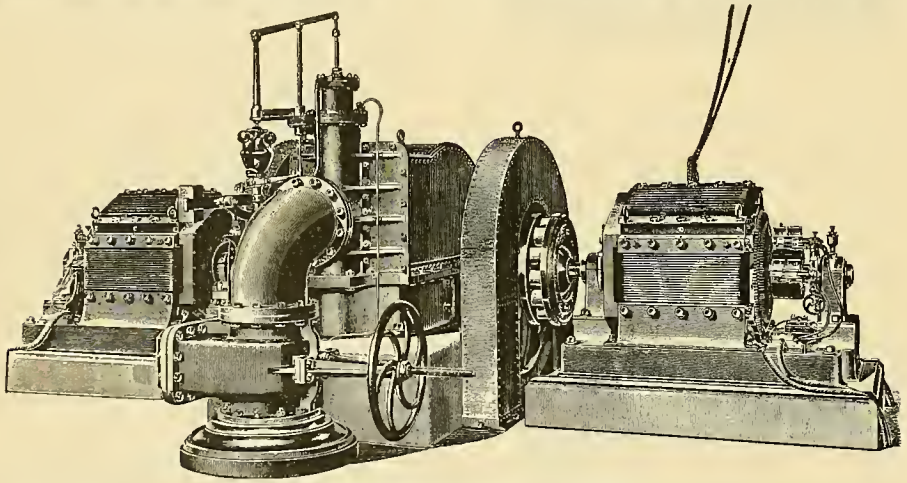
Strowger Telephone Exchange at Fort Sheridan.

A few weeks ago the WESTERN ELECTRICIAN illustrated the Strowger automatic telephone exchange at La Porte, Ind. Since then the company has installed a plant at Fort Sheridan, near Chicago. This latter exchange is small, to be sure, but sufficient to demonstrate the applicability of the system to small towns where the expense of attendants precludes the possibility of using the old system. Fig. 1 represents the central office at Fort Sheridan, occupying a space of six by ten feet. The Strowger equipment is making connections for fifteen telephones, and since its completion not a single "trouble" has been reported. Fig. 2 illustrates the new thousand connective instrument, capable of accommodating a system of one thousand subscribers. A description of this device was presented in the WESTERN ELECTRICIAN August 6th and November 12th. The first exchange equipped with Strowger apparatus was at La Porte, and it has given uniform satisfaction. The mayor of the town had occasion to test its efficiency recently. During a recent illness he transacted all his business by telephone and expressed great satisfaction at the efficiency and reliability of the service. Other subscribers are equally well pleased, and the Strowger company is highly elated over the reception which its system has received.

It is said to be probable that the electric light service of Pecatonica, Ill., will be discontinued, as the plant has not been made to pay.

Direct Water Driven Dynamos in Switzerland.

The central station in Geneva, Switzerland, has an output that is equal to 17,000 8 candle power incandescent lamps, and is increasing rapidly. There are, says London *Industries*, five separate groups of generators, of which four give 200 horse power each, while a small day plant gives 25 horse power. Each turbine drives two dynamos coupled to the three-wire system. The accompanying illustration shows one of these units. The dynamos made by Cuenod, Sautter & Co. give 110 volts and 600 amperes. The turbines, which are driven by water on the town power distribution system, at a pressure of 200 pounds per square inch, run at 350 revolutions per minute. They were built by Faesch & Piccard, who, it will be remembered, are making a number of 5,000 horse power turbines for the Niagara scheme. This firm's automatic turbine regulator is employed. The distribution is carried out on the three-wire system. The cables are insulated with impregnated jute, drawn over with lead tube. This is again insulated, and coated with two spiral servings of strip steel. In laying, bricks are placed immediately over the cables to warn the intelligent workman that there is "something there." In spite of this it is found that the cable must be prepared to withstand the assaults of the pick-axe. These cables show an insulation of over 2,000 megohm-miles in constant use. There are three miles of feeders, and the drop allowed is only 5 per cent. at full load. The network amounts to nearly five miles. The cables so far show no sign whatever of alteration. The increase of the business has necessitated putting down an alternating system at 2,400 volts for the more distant portions. There are alternators giving 180 kilowatts. Siemens & Halske's concentric mains are employed for the alternating system, and they feed 21 transformer substations or local transformers. Street boxes of sheet iron take three transformers each of 10 kilowatts. These feed into a low-pressure three-wire system whose leads are three-conductor concentric mains.



DIRECT WATER-DRIVEN DYNAMOS IN SWITZERLAND.

Driving Portable Drills by Electric Motors.

The accompanying cut from the *American Machinist* is another illustration of the growing popularity of the electric motor for service in connection with machine tools. The picture shows a portable drill as arranged to be driven by an electric motor. The motor is placed at the opposite end of a cylindrical bar, which may be traversed through the clamping plate by means of the rack and pinion movement shown. This machine was devised by James T. Halsey of Philadelphia, Pa.

Electric Light Plant at Havre.

It is stated that the Electric Power company of Havre, France, charges less for incandescent electric lighting than any company on the continent. For a ten candle power lamp the rate is about one-half cent per lamp hour. The station is a small one, and a view of the dynamos is presented in the illustration. The latter are Ferranti alternators, each of a capacity of 100 amperes at a pressure of 2,400 volts. The machines are connected directly to a Corliss engine made at the Farcot Works by means of ten cotton ropes, as shown in the illustration. The ropes have a diameter of thirty-five millimeters.

Although the station is a small one, the number of employes seems by no means small. The list includes for the commercial service one superintendent, one office clerk, one draughtsman; engineering department, one engineer, one foreman for the station, four mechanics, two foremen, one chief electrician, two dynamo tenders; municipal service, one electrician in charge of transformers and meters, one electrician for new construction, one workman. The cut is reproduced from *Le Genie Civil*.

The Therapeutic Effects of the Alternating Current.[1]

With the exception of the interesting communications from our eminent colleague, M. D'Arsonval, who has submitted to you principally physiological questions, I think no medical question has been brought before the society since the death of my lamented friend, Dr. Boudet de Paris, whose abilities as an orator and savant you have all been able to appreciate. However, while you have been occupied with the various problems of electricity as applied to industry, we doctors have not been idle, but have been occupying ourselves with the less brilliant, but not less useful, object of relieving our fellow creatures by means of the new forces introduced by electricity into the healing art. I bring you to-day, on the part of Dr. Gautier, my collaborator and friend, and myself, the result of our researches with regard to the therapeutic application of alternating currents, researches which now seem to us sufficiently firmly established to justify at least the hope that we have in our hands from this time henceforth a mode of treatment which is of considerable power, and very interesting, for alleviating chronic nutritive disorders, *i.e.*, diatheses, and the morbid conditions resulting from them.

The idea that electrical energy is capable of acting powerfully on the inward working of our system is not new; we find traces of it in works written by charlatans at the end of the last century, and since then the greater number of writers on the subject of medical electrology have alluded to this possible, probable, but not demonstrated influence.

M. D'Arsonval based his estimation of the nutritive modifications undergone by the animal experimented upon on the measurement of the respiratory capacity of the blood. This is really the surest of all methods. You know that the red globule, which is the really active part of the blood, is capable, normally, of absorbing a certain quantity of oxygen. This absorption, which takes place in the lungs, varies within certain physiological limits. It is most active when the animal is doing most work, and falls to a minimum when it is at rest.

When the cells, which are the ultimate constituents of all the living tissues, are endowed with greater activity, they demand from the globule more oxygen, and the examination of a determined quantity of blood under the mercury pump shows the increase of what has been called the respiratory capacity of the blood.

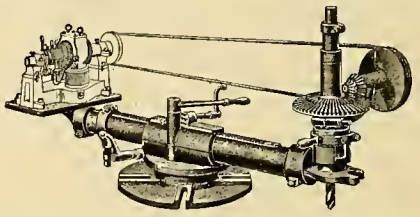
There is, therefore, correlation between the respiratory capacity and the nutritive activity, the first of the terms serving to determine the second.

M. D'Arsonval has examined in succession the various applications of electricity to medical purposes, to see wh a influence they are capable of exercising on these phenomena.

He showed that the continuous current without fluctuations produced no action; that the static current had an action that was appreciable, but feeble, causing the respiratory capacity to vary from 12 to 15 per cent.; while the alternating current produced the augmentation of this same respiratory capacity in the proportion of 50 per cent. As to the faradic current, it certainly produces increased organic combustion; but indirectly, by contracting the muscle that is working, and, consequently, consuming. The interesting and important part about the results obtained with the alternating currents is that the increase in the respiratory capacity manifests itself without any muscular contraction, or even any sensation. There is, therefore, a direct effect on the nervous nutritive function which imparts to the cells their activity.

The alternating current having shown itself so much more efficacious than the other forms of electricity, it was naturally the one chosen for acting upon the sick. M. D'Arsonval, in his experiments, used a current that was strictly sinusoidal. He thus endeavored to dissociate the two effects of the current, the direct nutritive action and the action on the contractile muscular fiber.

The strictly sinusoidal form of the current enabled him to avoid this latter action—the contraction, which, as you know, manifests itself at the moment of the falls of potential. Practically, from the point of view of its application to the sick, the object was slightly different, since on the one hand the alternating current increases the nutritive action on the nervous centers by a mechanism which, although as yet obscure, is undeniable, and since, on the other, the faradic current, by the muscular contractions which it provokes, leads indirectly to a similar result it would be beneficial, we thought, to associate these effects, which would thus reinforce one another. The problem being set, it remained for us to solve it from an instrumental point of view. The current supplied by our medical coils was far from giving us the solution required. The current produced by battery elements in connection with an inductor and an interrupter, and working an induced coil, is certainly alternating, but the breaking current, weakened by the extra current, is considerably weaker than the starting current; moreover, the duration of the passage of the current is very short, and the time lost is at least two-thirds of the time utilized. As to the coil known as Constantine Paul's, and used by that physician for the faradic baths, it is less suited to our purpose than any other; it gives the extra current from a thick wire coil, and, consequently, a current of the same nature and of excessively short duration. In short, the current supplied by these coils only act by the muscular contraction which they provoke.



DRIVING PORTABLE DRILLS BY ELECTRIC MOTORS.

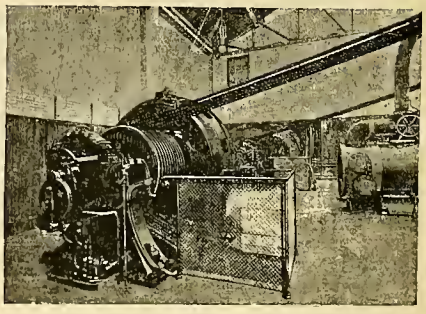
We were, therefore, led to conclude that the best and most practical plan was to borrow our current from the alternating circuit supplied for lighting purposes by the Halles Electrical Works, and generated by Ferranti-Patin dynamos. This current comes to us under a potential of 110 volts, and by means of a little transformer and an intercalary resistance with a soft iron core, we are able to use from 1 to 100 volts; as to current, our starting point is one milliampere. The number of alterations is 10,000 a minute. The graphic representation of this current indicates that its sinusoid is more acute than that furnished by D'Arsonval's apparatus, but it is regular nevertheless.

As regards the mode of application, we thought that as we required to produce general effects, it was expedient to enlarge, as far as possible, the active surface of the electrodes; this object is attained by placing the patient in a porcelain bath, so that he is in derivation, and only takes a fraction of the current passing through the water in the bath.

Such an installation is extremely practical. The regulation of the quantity of current supplied is very simple, and it can be increased quite progressively. I will now briefly relate the results attained.

You know that there is a large class of maladies that have been grouped by Prof. Bouchard under the title of maladies caused by failing nutrition (*maladies par relentissement de la nutrition*). Among these maladies, which are all, it seems, brought about by a failure of the nutritive powers, taking different forms according to individuals, races, temperaments, etc., may be included gout chronic rheumatism, obesity, diabetes, etc.

It is to patients of this class, those suffering from defective nutrition, that our endeavors have been directed. To obtain our starting point, and ascertain the state of the oxidations which, as we have seen, are among the primordial phenomena constituting cellular life, we could not, like M. D'Arsonal, measure the respiratory capacity of our patients' blood. We contented ourselves with analysing the urinary discharges, which show unfailingly the processes of organic combustion going on in the living tissues. But of course this method is not wholly reliable.



ELECTRIC LIGHTING PLANT AT HAVRE.

The diet of the patient considerably affects the quantity of nitrogenous products discharged in 24 hours; a meat diet increases the quantity of urea, as we know, and a vegetarian diet considerably diminishes it. This is why, when experimenting upon animals, we subject them to a strict regimen, consisting of rations which are invariably the same, both in quantity and quality. We could no ask our patients to submit to a regimen of this kind; bu I think our figures may be considered correct, on accoun

1. Read by E. Larat before the Societe Internationale des Electriciens.

of the number of analyses made with regard to one patient, which enabled us to establish mean values.

In a general way, we may say that with those patients in whom the quantity of urea is too low, we note that this quantity rapidly increases, reaches the normal value, and often exceeds it.

With gouty subjects suffering from an excess of uric acid, this acid acts in a contrary manner, diminishing in quantity. In two out of three cases of diabetes, the sugar diminished; in another case it remained stationary. The quantity of urea in patients of this class being very high in consequence of over-alimentation, no modification was observed in the excretion of this product. Moreover, it is only by continuing and multiplying these chemical researches that it will be possible to draw certain deductions from them. The physical functions do not proceed as simply in a sick person as in an animal, or a healthy person, experimented upon in a laboratory. But what has struck us is that the great majority of our patients have been wonderfully improved.

We treated several patients suffering from excessive corpulance, who lost from 5 to 10 kilogrammes in a few weeks; and some suffering from chronic gout, who had been confined to their rooms for months, and who now go about in comfort.

Several dyspeptics, with dilatation of the stomach, have also undergone a decided improvement in their general health and in their digestions. The details of our cases will shortly be laid before medical societies; I need not dwell further on them here, but if I had to state my general impression as to the results of the treatment by baths traversed by alternating currents, I should say that the nervous system which is depressed or the functions of which are turned aside from their regular course seems to be deeply and favorably influenced. Our attention was also directed to chronic diseases of the skin, especially eczema. Three cases of eczema were so quickly improved that we were encouraged to continue our efforts. We take this opportunity of thanking Profs. Besnier and Hallopeau, who have been kind enough to entrust some of their patients to our care, and who follow our researches with interest.

The domain of electro-therapeutics, which has been up to the present almost confined to local applications, or, if used for general treatment, has been restricted almost exclusively to nervous affections, is being greatly extended, as you see, since it now deals with the nutritive disorders that constitute diatheses, which are the sources of a number of chronic maladies. As to ourselves, we do not claim to have discovered this action of electricity on the system generally which has been glanced at by several of our predecessors, which was, so to speak, in the air, but which M. D'Arsonval has clearly and accurately defined. We simply claim priority as far as concerns the systematic application of electricity to diatheses, especially in the form of sinusoidal currents.

Factory Driving by Electricity.

In the WESTERN ELECTRICIAN of October 8th there appeared an illustration and description of a 500 horse power direct connected dynamo, constructed at Liege. This dynamo has been installed in a new factory established for the manufacture of small arms at Herstal, Belgium. The advantages of electrically over mechanically transmitted power were recognized by the builders of this plant. It was accordingly decided that the whole works should be driven by electricity. The first proposal was to drive a shaft from the engine by belting, and transmit the power by belts to two dynamos. This was rejected owing to the disadvantage of belting, and finally it was decided to place one dynamo of 500 horse power upon the engine shaft. The engine had already been ordered, and was to run at sixty-six revolutions per minute. A new type of dynamo had therefore to be designed, and the fly-wheel was done away with, and the bearings moved further apart. Even if two dynamos of 250 horse power each were used it would be no advantage, as the work must go on throughout the establishment regularly. A view of the dynamo and engine room is presented in the accompanying illustration.

The Societe Internationale d'Electricite undertook the work in order to compare the efficiency of electrical transmission with other kinds; the most eminent firms were asked for details as to the power necessary at the engine to deliver a given power to the machines, but not one would give a guaranty as to the efficiency of a mechanical method of transmission. There are in all—

9 shafts requiring 12 horse power each=108
2 shafts requiring 16 horse power each= 32
2 shafts requiring 30 horse power each= 60

Total 200 horse power

For these the following motors were put in, to be well above requirements:

9 motors of 16 horse power=144
2 motors of 21 horse power= 42
2 motors of 37 horse power= 74

Total 260 horse power

Of these the guaranteed efficiencies were 16 horse power, 87 per cent.; 21 horse power, 87 per cent., 37 horse power, —89 per cent.; making 296.9 horse power required; 2 per cent. loss in leads, 5.93; total, 303 horse power.

The efficiency of the generating dynamo is 90 per cent., so that the efficiency of the transmission between the brake horse power of the engine and the shafts of the motors is 77.2 per cent. The efficiency of the engine was guaranteed to be 92 per cent., but tests have shown it to be 94 per cent., so that the power delivered by the motors is 72.5 per cent. of the indicated horse power of the engine. Allowing another 4 per cent. between the motor shaft and the actual countershafts of the tools 69.5 per cent. is obtained. The use of one dynamo has been criticized, but, it is explained, two dynamos of 250 horse power each could not well have been built to run at sixty-six revolutions only, and if they could the cost would be $6,000 in excess of that of one large machine. There are, however, two commutators, and these enable the dynamo to run at half load. A noteworthy fact is that, owing to the absence of all belt transmission, the power necessary to drive the engine idle is only 28 horse power instead of 40 horse power. A great advantage in the shops is that the shafts need not be parallel to one another.

An efficiency of 70 per cent. for the electrical machinery was guaranteed, and this was really exceeded. In the cables for transmitting the power, which are of course short, there is 5.14 tons of copper, and the loss is 2 per cent. The motors vary in size from 3 horse power to 37 horse power, and are of the usual type. The dynamo was the object of careful study. The Gramme winding was considered the only type suitable, and the magnet cores had to be made of mild steel, as the price of wrought iron was prohibitive, and cast iron would not give good enough results.

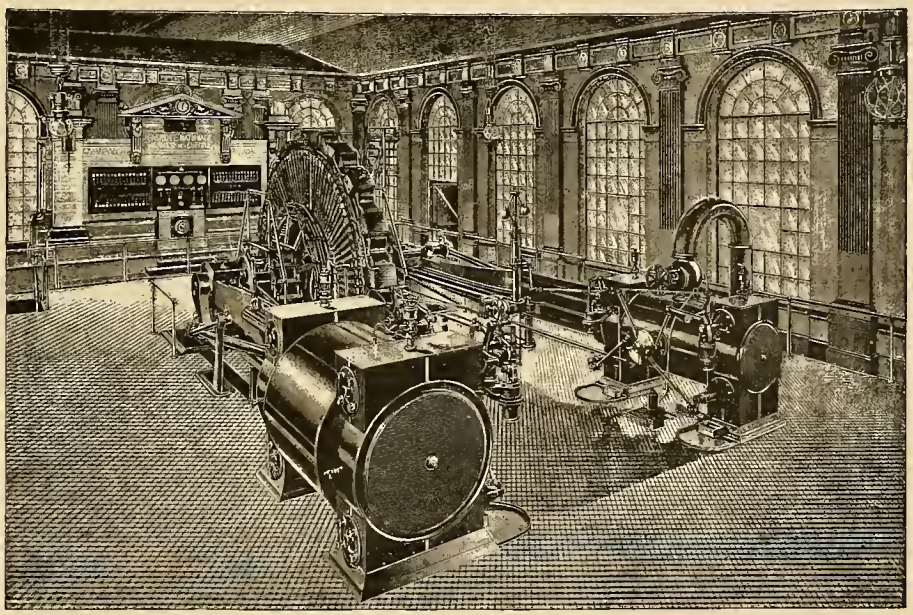
The field magnets are shunt wound and arranged in a ring consisting of ten pieces bolted together and having twenty pole pieces. The air space is .245 inches wide. The magnets were fixed in position, then dismounted to allow the armature to be wound; this had to be done in position owing to the size of the machine; the ring was then finally erected. The armature was constructed as follows: First, a boss was forced upon the shaft by hydraulic pressure, and a hollow saucer-shaped casting was bolted to each side to take the place of the arms of an ordinary fly wheel. The circumference of the castings is formed into a hundred teeth, and these grip the core of the armature, which is 15.8 feet diameter, and formed of iron plates .275 inch thick; these are placed side by side, and make a total width of 15.8 inches; the radial length of the plates is 5 1 inches. This mass of iron forms the rim of the fly-wheel, and possesses ample weight to insure regular motion. Through fifty of the teeth bolts are passed to hold the core plates together, while the other fifty support cross bars upon which the plates rest. All are carefully insulated from the plates, and the latter are covered with paper. The winding consists of flat wire .158 inch by .196 inch, insulated with cotton and shellac. Only one layer is wound outside, but there are two layers inside, as the wires have to pass between the teeth of the side castings. The whole armature has 2,400 of these windings, and carries two commutators, to which alternate windings are attached. All the wires were bent to template, and are very easily dismounted and replaced. The top of one winding and bottom of the next on the same side of the armature are soldered to a copper plate, which conducts the current to a bar of the commutator, one bar corresponding to each winding. The commutators are 8.2 feet in diameter. Binding wires of phosphor bronze, .059 inches in diameter, are used for holding the winding in position. Eighty brushes collect the current, and these are lifted and lowered simultaneously by special apparatus, and the lead can be easily regulated.

This machine can develope 2,400 amperes at 125 volts, and four cables lead the current to the switch-board. The efficiency is 90 per cent., and the density of the current is 1,940 amperes per square inch in the armature wiring and 7,000 amperes in the magnet windings.

The boss of the armature weighs ten tons, the armature core six tons, the side castings eight tons, the copper in the magnets two tons, and in the armature 1,320 pounds. If a short circuit should occur in the works, the armature will be subjected to an action like that of a brake, but it will not have the bad effect which would be produced if the armature did not itself constitute the fly wheel. There are only two bearings, one on each side of the machine. The two sets of cables are connected in parallel at the switch-board, where the requisite instruments are fitted up, so that the pressure in either half of the machine or in the shops can be noted, and suitable cut-outs are fixed.

There are 116 arc lamps, two in series, using 10 amperes and 200 16 candle power incandescent lamps in use in this factory.

The current for the latter is taken from a ring main supplied by twenty-four feeders, and the total loss of pressure is 7 volts when all the lamps are lighted at once. The ring and feeders are of bare wire, except in the cable tunnel. All the motors are of the Gramme type, with two windings. The base plate and the top yokes are attached in casting to allow of boring the interior easily, and the magnet cores are cylinders of wrought iron shunt-wound. Carbon brushes are used on the motors, and have so far given no trouble.



FACTORY DRIVING BY ELECTRICITY.

The following is a list of the motors used throughout the works, or rather the list of those which were ordered at first:

Situation.	Horse power.	No. of motors.	Guarantee efficiency.
Main shop	16	9	87 per cent
Woodworking department	21	1	87 "
Forge	37	2	89 "
Stamping and drawing shop	16	1	87 "
" " "	7	1	84 "
Feed pump	10	1	85 "
Fans	3	1	80 "

The average efficiency can, of course, be obtained by multiplying the number of motors by their respective efficiencies. Taking this sum and dividing by the total number of motors, this gives 87.2 per cent.

Eventually the 7 horse power motor was countermanded, and a 16 horse power motor put down for the polishing shop, and one of 21 horse power for the cartridge shop. On some of these motors the load is very variable, and several are exposed to dust and dirt, so that with 90 per cent. efficiency of the dynamos, 98 per cent. of the conductors, 87 per cent. of the motors, the net result is 76.6 per cent. power delivered. As the lost work in belt driving is practically a constant quantity for all loads, or at least is usually considered to be, the power required to turn the shafting and pulleys, at the normal speed when no work is being done on the machines, it follows that taking 79.4 per cent. as the final output in two cases, one of electrical and the other of mechanical transmission, at a load of 20 per cent. the electrical system would still give 47.2 per cent. useful effect, and the mechanical nothing at all. The cut is reproduced from the *Engineer*, London.

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CORRESPONDENCE relating to electricity, or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

PAGE.

Electricity at the World's Fair. Illustrated. 317, 318
Another Lamp Decision..... 318, 319
Strowger Telephone Exchange at Fort Sheridan. Illustrated... 319
Direct Water Driven Dynamos in Switzerland. Illustrated..... 320
Driving Portable Drills by Electric Motors. Illustrated..... 320
Electric Light Plant at Havre. Illustrated..... 320
The Therapeutic Effects of the Alternating Current..... 320, 321
Factory Driving by Electricity. Illustrated..... 321
Editorial..... 322
M. M. M. Slattery. Portrait..... 323
Book Table..... 323
Effects of Electric Welding..... 323
Keep the World's Fair Open Evenings..... 323
Electric Display at Cincinnati..... 323
Barnes Friction Clutch Pulleys. Illustrated..... 324
Sectional Water Tube Boiler. Illustrated..... 324
Cutler Non-Inductive Voltmeter. Illustrated..... 324
An Electric Vapor Engine. Illustrated..... 324
Commercial Dynamos and Motors. Illustrated..... 324, 325
Electric Plant on the Whalehack Pillsbury. Illustrated 325
Chicago Electric Club..... 325

DEPARTMENTS.

Correspondence..... 325, 326
New Incorporations..... 327
Electric Lighting..... 327
Electric Railways..... 327
Telegraph..... 327, 328
Trade News..... 328
Business..... 328
Electrical Patents 328

CHIEF BARRETT of the department of electricity of the World's Fair announces that the applications for space in the electricity building by the dispensers of "electric belts" and similar fakes have been refused. This decision will be received with general rejoicing among reputable electrical concerns.

IT may be well for the electrical fraternity at large to note the removal of the office of the department of electricity, World's Columbian Exposition, from the Rand-McNally building on Adams street to the electricity building at Jackson Park, Chicago. All mail matter should now be directed to the latter address.

IT has been stated that Prince Bismarck has displayed a fondness for American securities, and now it is announced that during Henry Villard's recent visit to Milwaukee he confided to some of the citizens of that place that the great old German was interested in the electric street railway syndicate of the Cream City. Many other notable foreigners have invested liberally in electrical securities under the direction of Mr. Villard, and it is believed that they are all thoroughly satisfied with their ventures.

ATTENTION was recently directed in these columns to the phenomenal growth of the electric railway in New England. Not only is this true of the large cities of that section, but there is a tendency to extend the lines into the surrounding territory and open up residence districts removed from the noise, dirt and confusion of the city. A contemporary remarks upon this point: "Thus we are gradually building long distance electric lines throughout New England, piece by piece it is true, and without a very definite idea of what we are coming to, and yet increasing all the time the available mileage in almost any given direction, and so evolving what cannot fail to be in time a most important system. Already forty miles of straightaway track in Massachusetts are under the control of a single company, and it does not take the exalted vision of inspired prophecy to see what a consolidation like this signifies. Eastern Connecticut, moreover, promises to have an extensive electric circuit before long." There seems to be a healthy and good natured rivalry among the New England states to excel in the efficiency of their railway service. This feeling should be encouraged.

THE application of electricity to the operation of machine shops has advanced considerably in this country during the last few years, but comparatively little has been done in Europe in this line—at least that is the impression that has prevailed on this side of the water. It would appear, however, from an article elsewhere in this issue that in some parts of Europe, at least, the advantages of using electricity for operating machinery in large shops are being appreciated. The interesting plant described has several features that will appeal to manufacturers generally. It has demonstrated the superiority of the electric motor for efficiency, reliability and economy—points that have already been conceded in this country. Commenting upon the installation the London *Engineer* says: "Such satisfactory results of the application of electricity to factory driving must attract attention, and will doubtless lead to great changes in transmission, both in this country and on the continent. Whether in the case of large machine tools it would not be better to discard shafting and belts altogether, and supply a special motor to each tool, is a question which must be settled for each individual case which may arise; the current could be switched on or off just as easily as the belt is now thrown from the loose to the fast pulley, and *vice versa*." Engineers may anticipate considerable activity in this line, especially where water power is available.

EXPLOITERS of electric heating apparatus are now beginning to have experiences similar to those undergone by the electric light pioneer. In the early days the canvasser for central stations had to combat the gas man and sell his product at a higher price. It seemed to many in those days that it would be an impossibility to make any serious inroads in the territory occupied by an illuminant so comparatively cheap and long tried as gas. But when one takes a retrospective view of the progress made and studies the difficulties that were overcome, the secret of electricity's success becomes evident. In a word, no one would now venture to assert that the incandescent lamp was not in every way superior to gas; and it is, too, in one sense a more expensive illuminant. Electric light is now the best artificial light obtainable, and it is for this reason that so many demand it in preference to gas. It is this superiority, therefore, of the electric lamp over its rival, gas, that secured its general adoption.

As it was with the incandescent lamp, so, apparently, it will be with the electric heater. The same ground, doubtless, will have to be gone over. The cries of "uneconomical," "too expensive," "a luxury," etc., are already beginning to be heard. But this time the electric heating pioneer has a good precedent to employ in his arguments—in fact he has two precedents, for applications of the electric motor furnish also most excellent illustrations of the benefits to be derived through the employment of an apparatus that does not make necessary the consumption of fuel at the point of service. Almost every day marks a new application of the electric heater under circumstances where, say, steam heat is not easily obtainable or the ordinary stove desirable. For instance, the electric heater has found its way into the conservatory, and the latest and most novel suggestion is that through the use of a special form of heater, electricity be employed in the hospital to heat the poultice and warm the sick man's bed.

There is no doubt that the electric heater has come to stay. For a time, though, it will be employed in special lines of service. But its field of usefulness will unquestionably be a rapidly broadening one.

THE last decision in the incandescent lamp litigation, which was handed down in New York last week and which is presented elsewhere in this issue, is another Edison victory, sustaining as it does the decision recently made by Judge Lacombe; yet there is cause for congratulation on the part of lamp makers who are not operating under the Edison patents. While granting the injunction against the Sawyer-Man company the court decides that the injunction order "should contain a provision reserving the right to defendant to move hereafter for the vacation, suspension or modification of the injunction upon proof of specific instances of refusal on the part of the complainants, or either of them, to supply the lamps of the patent upon terms reasonable under the circumstances of the particular case to the owners of electric lighting plants which were installed before the rendition of the interlocutory decree of the Circuit Court sustaining the validity of the patent." This is undoubtedly the most important advantage gained by the rivals of the Edison interests, and it may be used by them to effect a settlement. For instance, if the owners of the Edison patents should follow up their present advantage and proceed against other lamp makers they could not hope to obtain an injunction more favorable than the one just granted. This being the case, they could only close up their rivals' factories by undertaking to supply lamps to all customers. It is conceded by the Edison interests that their factories have a capacity of only about one-half the number of lamps consumed in this country. The capacity of these factories could not be doubled on short notice or without the expenditure of a large sum of money. In the meantime should the Edison interests succeed in postponing the execution of the provision of the injunction already quoted such a policy would have a very bad effect upon its business, as it would abridge the market for incandescent lighting dynamos. This would be a very serious matter.

In view of these facts it would seem as if the owners of the Edison patents and the lamp makers who are not operating under these patents would speedily effect a settlement by which the latter might continue to make lamps under a license from the former. This would prove a very desirable compromise so far as the electrical business generally is concerned, and it would seem at present as if such an arrangement might be made.

IN his report to the board of control of the national commission last week Director-general Davis had something to say about the anomalous and highly unsatisfactory state of affairs in relation to the rules of the World's Fair. A brief reference to this important matter was made in the last issue of this journal, and the need of immediate action is sufficient justification for further reference to it. The simple fact of the matter is that the World's Fair has no official rules, and that exhibitors have no means of knowing what will be required of them. Colonel Davis puts the case mildly when he says: "The demand is made and has been for more than a year, that the cost of power, light and water should be fixed and published. At this date, December 14th, within four and a half months of the opening of the exposition, not an officer of the exposition is authorized to state to an exhibitor what this cost will be. Exhibitors of machinery and electrical apparatus decline to accept their space until this question is settled, and this delay has cost us the loss of some of our most important exhibits."

It is true that the subject of rules, especially those that relate to the supply of electric light and power, is a perplexing one, and that it is no easy task to reconcile the many conflicting interests at the fair. But it cannot be supposed for one moment that if a resolute and united effort had been made to devise a proper set of regulations the work could not have been satisfactorily accomplished months ago. The idea is absurd. The trouble and delay are traceable to that conflict of authority which has ever been the menace of the World's Fair. This selfish policy on the part of many in authority has resulted in muddling the question of rules very effectually, until now exhibitors who desire to furnish free service to the exposition are holding aloof, not knowing in what shape the rules may finally be adopted. It is high time that the directors should make some definite announcement of their intentions in relation to the commissioners' rules. The service of the exposition, especially that portion furnished for the electricity building, will be seriously crippled unless definite regulations relating to light and power be speedily adopted. The management of the fair will also find ample scope for its ingenuity in devising some plan for reconciling the conflicting provisions of the existing contracts, which have been entered into in the absence of rules.

M. M. M. Slattery.

Marmaduke M. M. Slattery, whose portrait is herewith presented, died at his residence at Fort Wayne, Ind., Wednesday afternoon, December 15th. The deceased had been in poor health for two years, but had been able to attend to his business most of the time. He contracted a severe cold on Thanksgiving day and two days after was compelled to take to his bed. He failed rapidly, but on Wednesday he rallied and sat up for a time. During the afternoon he had a severe hemorrhage of the lungs and died in a few hours. On Saturday, December 17th, the funeral services were held at Fort Wayne and were attended by a large concourse of people. The employes of the Fort Wayne Electric company attended in a body, and several local organizations of which Mr. Slattery had been a member were represented. There were many floral offerings.

There were few men in the electrical fraternity better known than "Duke" Slattery, as he was generally styled. He had a bright, engaging manner and was everywhere welcomed. He was an exceptionally entertaining after-dinner speaker and possessed considerable literary ability. In scientific circles Mr. Slattery held a prominent position as the inventor of a successful electric lighting system. Most of his work in this line was done in the West, but he was well known in electrical circles throughout the United States and in fact had gained some distinction before coming to this country.

Mr. Slattery was born in the city of Limerick, Ireland, in 1851. He attended the schools of that city and prepared for college. He was graduated at Marlboro college, Marlboro, Eng., in 1873, and received his B. A. degree. After leaving college he was associated with St. George Lane-Fox in experimental work and was thoroughly equipped as an electrical engineer when he came to this country in January, 1880. He entered the service of the United States Electric Lighting company at New York and did valuable work in the engineering department of that company. He was prominent in the organization of the Sun Electric company of Boston. In 1887 he moved to Fort Wayne, Ind., where he developed his alternating current system of electric lighting, which was his most notable achievement. At the time of his death he was connected with the Fort Wayne Electric company, which manufactured his apparatus. During the last few years he devoted considerable attention to the development of the storage battery and made many valuable improvements in that line.

In Masonic circles Mr. Slattery was a prominent figure. He was a member of the Indiana consistory of Scottish Rite Masons and had received the thirty-second degree. He was also a Mystic Shriner and ex-president of the Shrine club of Fort Wayne. At the time of his death he was valiant grand master of ceremonies in Darius Council, Princes of Jerusalem. In the Fort Wayne lodge of Elks the deceased also took an active interest. Mr. Slattery was a member of the Chicago Electric club and the Society of Arts of Boston.

M. M. M. SLATTERY.

BOOK TABLE.

ORIGINAL PAPERS ON DYNAMO MACHINERY AND ALLIED SUBJECTS. By John Hopkinson. W. J. Johnston company, Limited, New York. Two hundred forty-nine pages, 98 illustrations. Price, $1.

This book is a collection of Prof. Hopkinson's contributions to electrical literature. From a practical as well as theoretical view, they may be considered as among the most valuable series of technical articles that have been published. With a few changes of minor importance the papers are presented in their original form, though the chronological order is somewhat changed. This change will be found an improvement inasmuch as it places all papers on one subject in their order. For instance, the papers on the continuous current dynamo are grouped and they form the first part of the book. There are four papers on converters, which will be found especially interesting. These are followed by a note on alternate current machines and a paper on the application of electricity to lighthouses. In the first paper that invaluable aid to the study and design of dynamos, the characteristic curve, was first announced, and the three following papers are devoted to the development of its applications. The fourth and fifth papers, on the theory and design of continuous current dynamos, furnished the fundamental principles upon which the design of such dynamo is now based. The sixth paper established the important principles in regard to coupling alternating current machines. The next three papers are on the transformer, and the two remaining are on the theory of the alternate current dynamo and electric light houses respectively. The majority of the papers contain no mathematical formulae.

ELECTRICITY AND MAGNETISM. By Edwin J. Houston, A. M. W. J. Johnston company, Ltd., New York. Cloth, 306 pages, 116 illustrations. Price, $1.

This is on the same general plan as the original primers published by Prof. Houston in 1884, but the present work is prepared on somewhat different lines and is in reality a new series. The new far more advanced, as might be expected from the corresponding advancement that has been made in the application of electricity. This volume contains eighteen primers in all, the last one being a review, which sums up the salient features of the several topics treated. The subjects considered relate to the sources and phenomena of static and current electricity, and of magnetism, with practical deductions and applications. The chapters on atmospheric electricity and the phenomena of the earth's magnetism, the electro-magnet, electro receptive devices, and frictional and influence machines are practical in their scope. A feature of the work is the abstracts from standard electrical authors at the end of each primer, which generally have reference, and furnish an extension, to some important point in the primer, and at the same time give the reader an introduction to electrical literature.

Effects of Electric Welding.

A section of the men employed at the Kolomna Iron Works, situated near Moscow, has lately had some unpleasant experiences with electric welding, which, with the aid of 500 accumulators, is there practiced according to the Benardos process. While engaged on the trying work, the artificers' eyes were of course protected by tinted glasses, but the skin being exposed, the following symptoms were manifested: Burning sensation on the skin and in the eyes; in from three to four hours, discharges from the nose and the eyes; three to four hours later, a dry cough; four to five hours later, swelling of the skin and development of other symptoms; eight to ten hours from the commencement of the disorder, continuous irritation of the eyes, lasting from four to six hours; and finally, coloring of the skin. Then the various effects ceased, and the skin began to peel. On the third day the cuticle had completely decorticated, and by the sixth all the painful symptoms disappeared, but for weeks afterward the skin remained colored. These effects, it would seem, are exactly the same as those which are induced under scorching by the sun. The best protection which can be afforded the workmen against the evils mentioned, Moos. Maklakoff, the manager of the works, believes consists in a covering of yellow waxed cloth or red and green veils. The electric welders, however, object with characteristic Russian dignity to the assumption of the feminine facial appendages, alleging that, although they may improve the general appearance of the fair sex, they will rather excite ridicule when they are worn by stalwart workers.

Keep the World's Fair Open Evenings.

The question of closing the World's Fair evenings is attracting the attention of electrical people on the other side of the water as well as in this country. In England it is regarded as a monumental blunder and the protest of the American electrical fraternity is approved wherever the subject is discussed. The subject still occupies the attention of the newspapers, as will be seen from the following editorial comments:

Popular Electric Monthly: To open the Columbian exposition on Sunday from 11 A. M. to 6 P. M. will give the workingman seven hours; to open it from 8 P. M. to 11 P. M. six nights in the week will give the workingman eighteen hours of sight seeing every week. We say "workingman," because the cry on every hand for opening the World's Fair on Sunday is that the poor workingman could see it. The newspapers, through their various writers, correspondents, and editors, have shown a wonderful and growing interest in the poor workingman, and he makes an excellent battering-ram to knock down the Sunday gate. While the papers have been filled with the clamor for Sunday opening in order to give their protege seven hours of the fair on that day, it is intended to deliberately cut off eighteen hours of time which is even more auspicious and available for the workingman. This rule of closing the fair at night should receive the greater condemnation from all the press; and some of the space devoted to the Sunday question might be far better employed in advocating keeping the fair open in the evening. To close the exposition during the evening is also a grave slight to the electrical industries, and they are too important to be treated in this manner. The exposition must be opened during the evening. The WESTERN ELECTRICIAN merits much praise for the vigorous protests it has made on behalf of the electrical interests on this question of a closed fair in the evening.

Electricity, London: Quite apart from the fact that an exhibition restricted to the hours of daylight would never pay the exhibitors of electrical appliances intended for electric lighting, an exhibition without the electric light—the early closing of an exhibition opened during the summer months would virtually amount to this—seems a perfect absurdity. We well remember the dismal aspect of the Vienna exhibition during the first fortnight, when the arrangements for electric lighting were not sufficiently advanced to illuminate the exposition after nightfall, and we can assure the managers of the Chicago exhibition that the financial results of the first fortnight at Vienna were simply disastrous. It is true, the Chicago exposition is not an exclusively electrical one, but we feel sure that the electric light display will prove one of its greatest attractions, as it has done at all the recent exhibitions.

Electrical Display in Cincinnati.

The electrical display last night was the finest ever seen in this city, says the *Cincinnati Times-Star* of recent date. The trolley wheels on every car were like balls of fire, and the flashing of the electricity illuminated the sky like heat lightning. Many people in the suburbs and on the hilltops, not aware of the real cause of the display, grew fearful, thinking it was the fateful comet of Biela bombarding the earth from behind the clouds. The cause of the display, as explained by Superintendent Harris, was that the ice forming on the wires broke the current, resulting in the flashes. This meant a great loss of power, and for an hour from 8 to 9 o'clock the cars could move but slowly about the city. On up grades they could barely crawl along. The men on the Main street line took the precaution to grease the trolley wire early in the evening, and by thus preventing the sleet lodging on it escaped serious inconvenience. The Newport and Covington lines seemed to suffer the most, and great flashes of lightning made the river glorious. It was found necessary to run these cars by twos and threes in order to make any headway at all. The entire city was covered with a sheet that glared like glass, and with the electric lights red, white and green playing over it, the solemn old town looked like a magic city. The maze of telephone, telegraph and electric light wires about Fountain Square every one coated in its cold varnish, lighted up by the strange flashing, made it appear that a race of giant spiders was wrapping the city in an inextricable web of silk. The storm coats of the motormen on the cars were sheathed in mail and the gongs also, so that instead of the merry clanging there came only dull thuds from the bells. It was a city of strange silence. By 11 P. M. all cars were running smoothly. The street car companies report no serious damage, merely a loss of power for the time being. Hundreds of people viewed the display from the Kentucky hills. The light would flash against the Ohio hill, be reflected to the river and then seem to be born again out of the very waves. Residents of the Kentucky hilltops pronounce it the greatest display of fire they ever saw.

Barnes Friction Clutch Pulleys.

The accompanying cnts represent the principal of one of the latest improvements in the line of friction clutch pulleys and cut-off couplings manufactured by the J. H. & D. Lake company, of Hornellsville, N. Y.

Fig. 1 is a sectional side view of the Barnes screw lever friction pulley in released position, showing the driving hub keyed to the shaft. Fig. 2 is a sectional end view illustrating the friction hub encircled by friction ring, the

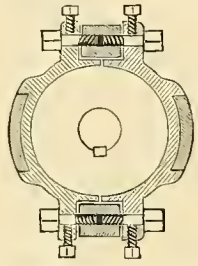


FIG. 2. BARNES FRICTION CLUTCH PULLEYS.

former of which is cast in one solid piece with the pulleys. Projecting lugs on opposite sides of the driving hub of the ring drop into lugs, or lug cavities, of the friction ring; and when the clutch is on, these lugs take all the driving power. This, it is claimed, is an improvement over the old belt fastening system, the bolts of which are more liable to be affected by the twisting strain upon the hub from the friction of the clutch.

At the extreme top and bottom of Fig. 2 is shown a view of a simple device which, it is believed, evades the necessity of the use of much complicated machinery. The contrivance is a lever nut on each side of the friction ring,

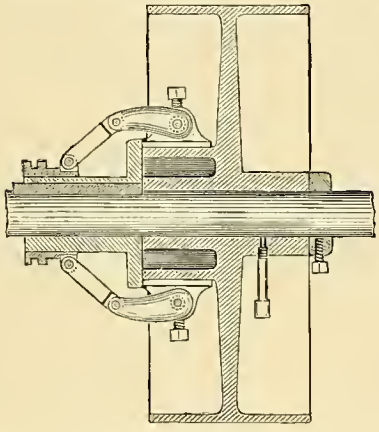
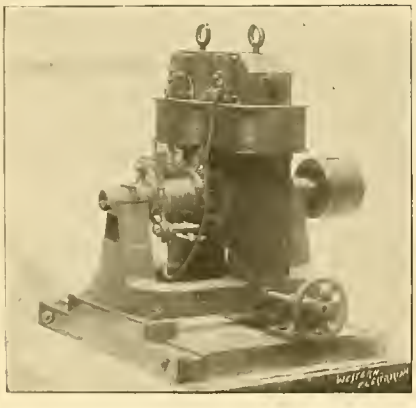


FIG 1. BARNES FRICTION CLUTCH PULLEYS.

one-half of the nut being cut with a right thread and the other half with a left thread. Contraction is effected by means of right and left thread screw bolts entering the lever nut from opposite sides, secured by set screws. Duplex levers are attached to these nuts at their upper section and to the hub at their lower section. When the shipper sleeve is thrown against the flange by the operating lever, the duplex lever turns the nut sufficiently to produce a strong grip. The screw bolts are adjustable to any



COMMERCIAL DYNAMOS AND MOTORS.

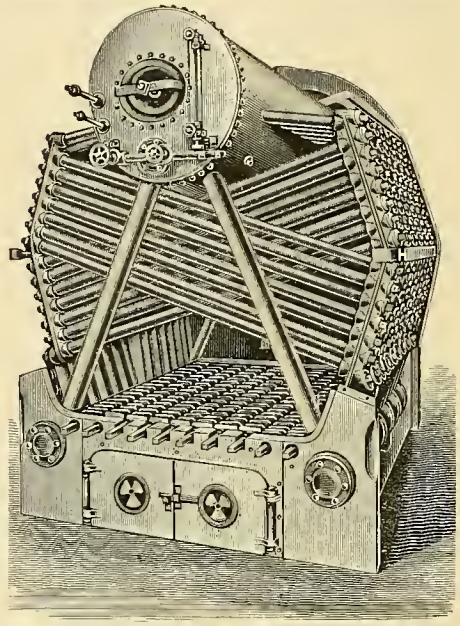
desired pressure, however, in case the clutch should become lax.

The Barnes screw lever friction clutch pulleys and cut-off couplings are adapted to both heavy and light work.

A new street railway company is being organized at Lafayette, Ind.

Sectional Water Tube Boiler.

The accompanying cut illustrates the sectional water tube boiler of the New York Safety Steam Power company. The interior is accessible from the outside in every part for examination, cleaning or repairing. The surface extends under the entire boiler, and will admit any kind of fuel. The tubes are arranged in transversely inclined series, and every tube is wholly in the furnace directly over the fire and exposed to the full effect of its heat. Every tube is lap-welded and the end connections are expanded. The heating surface and water ways are so arranged that the movement of the water in the boiler is constant and rapid. The headers for tubes are made of steel or iron according to the service required. They are placed close together, side by side, forming complete inside walls to the furnace and affording a limited amount of effective heating surface. Outside the furnace, opposite each end of each tube, a hand-hole of proper size to admit the tube or tube expander is provided, fitted with a cap held in place by a cross bar and bolt. The furnace is lined with firebrick. The only other brick required to erect a stationary engine consists of two foundation walls of proper depth. The front is of ornamental design, made partly of cast iron. Hinged doors are provided on front and rear and on both sides opposite the upper and lower headers, so as to afford access to the interior of the boiler. An advantage claimed for this boiler is that in case of explosion the damage would be



SECTIONAL WATER TUBE BOILER.

limited to one or two tubes which could be easily repaired. Each section of tubes or headers is tested at the works under a pressure of 500 pounds. The circulation is also claimed to be unusually good in this boiler, which is a matter of great importance. It can be seen from the design that the boiler is very compact, and consequently its capacity per cubic foot of space occupied is very large.

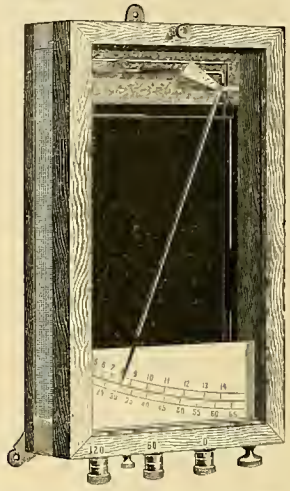
An Electric Sleigh.

C. J. Schminskey of Baltimore has applied for a patent on an electric sleigh which he has invented. Accumulators concealed beneath the seat of the sleigh furnishes the power to the motor which propels the vehicle. This power is transmitted to a single wheel in front of the sleigh by means of an endless chain. The face of the wheel is furnished with cutters which imbed themselves in the snow and prevent the wheel from slipping. Mr. Schminskey says that a speed of 12 or 15 miles an hour can be attained by his sleigh. A lever to control the steering gear and another lever to regulate the speed of the sleigh are placed near the occupants' seat in the sleigh.

Cutler Non-inductive Voltmeter.

The instrument herewith illustrated is designed for use in alternating current plants, and is known as the Cutler non-inductive voltmeter. It is built on the same general plan as the ammeter recently illustrated in this journal, the movements of the needle depending on the difference in expansion of two fine wires. One of these carries the current and does the measuring, while the other compensates for changes in temperature of the room. The binding posts are protected by rubber covers and are placed at the lower edge, while the resistance used in series with the expansion wire is put back of the instrument proper. The heating effect is the same for continuous, pulsating or alternating currents of a given pressure, so that this voltmeter is equally well adapted for any system.

The Cutler instruments are perfectly dead-beat, as it is impossible for the needle to move farther than the expansion of the wire will permit. In the Cutler voltmeter the needle swings to the proper mark and stops without any vibration, thus enabling a series of readings to be taken in very quick succession. These voltmeters are made with



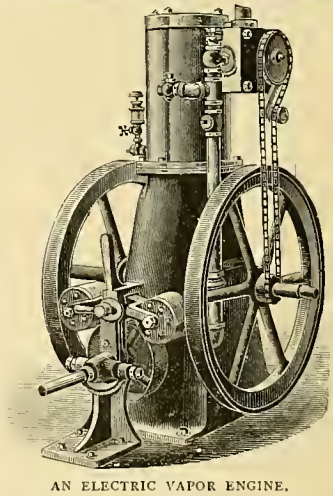
CUTLER NON INDUCTIVE VOLTMETER.

either a single or double scale to meet the varying requirements. Some built for storage battery work allow the needle to swing clear across the scale with less than three volts pressure, while those for street railway work range as high as 850 volts. Quite a number have been in use during the last year, and the maker, George Cutter, of Chicago, is well pleased with the results.

An Electric Vapor Engine.

Illustrated herewith is a vapor engine, the peculiar feature of which consists in the ignition by electricity of the gas that operates upon the piston. An ordinary electric battery similar to that used to ring a door-bell is employed, and the connection with the engine is such that the spark obtained therefrom operates at the proper moment to ignite the gas inside the engine cylinder. The electric exploder is arranged entirely out of sight, and, as will be readily understood is operated automatically by the engine.

This engine is now being manufactured by the Safety Vapor Engine company of New York. It may be placed in a boat either before or after the propeller shaft is put in. It is always set upright and may be made to conform with any angle of the propeller shaft. The engine can be operated instantly at high, low, or intermediate speeds. One special feature claimed for the engine by its maker is that beyond the igniting spark there is no fire about the engine, and also that the electromotive force of the current employed to make the igniting flash is less than that of an ordinary medical battery. These features the company believe will commend themselves to those building small



AN ELECTRIC VAPOR ENGINE.

pleasure yachts, or in fact to anyone that objects to the use of the bulky steam boiler.

Commercial Dynamos and Motors.

Constant potential motors and dynamos of moderate capacities may now be fairly said to have become a staple article of manufacture. In every large town and city hundreds and thousands of these machines may be found doing the numerous classes of work for which they are so well adapted. The line of machines from ¼ to 50 horse power, manufactured by the Commercial Electric company

of Indianapolis, Ind., under A. D. Adams' patents, is designed to meet the exacting requirements of this extended use. The aim in the construction of these machines has been to produce only the best, and the following are some of the characteristic features of the Commercial machines: The field magnet frames are made of forged wrought iron throughout, no cast iron being used. As a result of this construction a lighter, more sightly, more efficient machine is obtained.

The Gramme type of armature of large diameter is employed in machines of from ¼ to 10 horse power, giving ample room for the many turns of wire required on these small machines for high pressure, and insuring non-liability to burn-outs and ease of repair. Armatures in machines from 1 to 10 horse power capacity are wound with but one layer of wire for the 110 volt pressure, and but two layers for the 220 and 500 volt pressures—another feature which renders burn-outs unlikely and repairs easy.

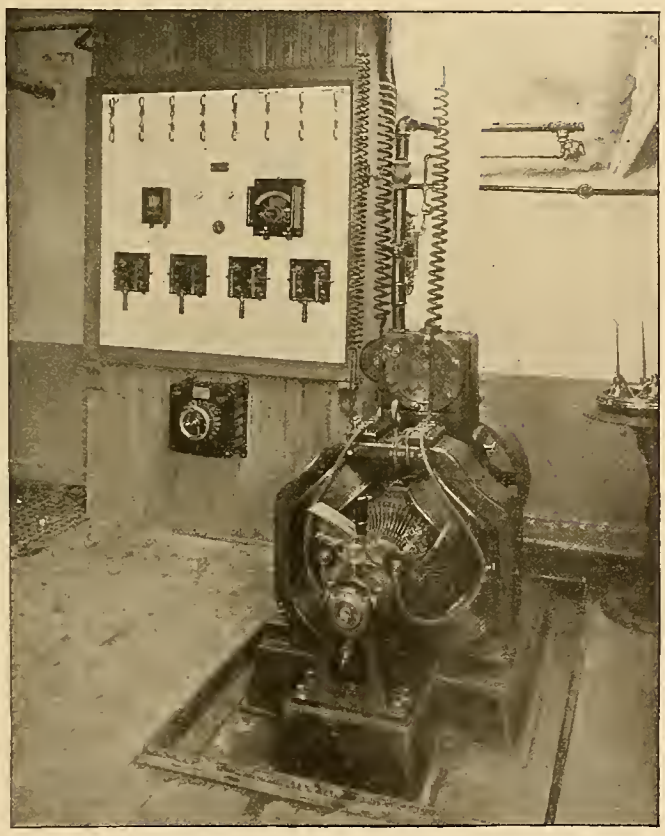
The point of commutation, it is claimed, is constant under all changes of load, within the capacity of the machines, on account of the great strength of the field magnet and the few turns of wire on the armature.

The starting boxes and rheostats for these machines are constructed entirely of incombustible material, and are provided with slate fronts. All terminal boards for mounting connections on dynamos and motors are of slate. Machines of 1 horse power and over are provided with insulating sliding bases and belt tighteners.

The company claims further that, while field magnet frames, composed entirely of forged wrought iron, are used almost exclusively for bi-polar dynamos by the best makers in England, there are few, if any, makers in the United States that are at present using this material throughout for field magnet frames.

Electric Plant on the Whaleback Pillsbury.

In the accompanying cut is shown the first electrical plant ever placed upon a steamship of the whaleback type. It was installed on the Pillsbury when building at West Superior, Wis. Considerations of space entered largely into the question of this installation, and as a small room, eight feet square, was all that could be spared, the employment of a belt connected plant was precluded, and a generating set of the General Electric company was adopted. The dynamo is of the four-pole type, and is of 150 lights capacity. It is directly coupled to a 15 horse power engine, both having a common bed plate. Behind the engine and attached to the wall is the white marble incombustible switch-board. The dynamo room is located in the after portion of the vessel on the first lower deck. The vesse .is wired for 150 lights.



ELECTRIC PLANT ON THE WHALEBACK PILLSBURY.

Chicago Electric Club.

The second meeting of the season of the Chicago Electric club was held on Monday last. The paper of the evening, entitled "An Ideal Central Power Station," by C. J. Field, E. J. Cook and F. Bourne, was read by Mr. Field, who had come to Chicago from New York for that purpose. It was generally conceded that the paper was a most creditable one—in fact among the best that the club has listened to. To show its appreciation of Mr. Field's work and the readiness with which all questions were answered, the club passed a special vote of thanks.

The meeting was called to order by W. B. Pearson, and after the usual routine work the club passed the following resolutions on the death of G. H. Meeker and M. M. M. Slattery:

WHEREAS, It has pleased the Almighty to remove from our midst two honored and beloved members of this club, and

WHEREAS, We acknowledge the wisdom of God while we cannot fathom His infinite designs,

Resolved, That we feel in the demise of George H. Meeker and M. M. M. Slattery the club has lost two members of whom all were justly proud, as fellows and friends, genial and upright men, whose removal will leave a blank space in our circle, and whose presence will be missed at our social and literary meetings.

Resolved, That we deeply sympathize with the relatives of the deceased and earnestly commend them to the Father of all for the consolation He alone can give.

Resolved, That copies of these resolutions be properly certified and transmitted to the families of the deceased, and published in all the electrical papers.

The paper of the evening provoked a lively discussion, which was participated in by an unusually large number of club members. The meeting adjourned after the club had approved a motion by Charles E. Gregory to appoint a visiting committee for sick members. It was agreed that the committee should be composed of two members each from the North, South and West Sides.

Dr. Morris Gibbs, in analyzing the causes of the decrease in the numbers or the absolute extinction of certain birds, says that the lighthouses of our great lakes and coasts sacrifice many thousands each year, and possibly hundreds of thousands, the birds killing themselves by dashing against the lights when migrating seasonally. He also doubts whether there exists an invention, with the exception of the gun, more deadly to birds than the electric light. Another indictment is brought against the headlight of the locomotive and also against the telegraph and other wires which form a network through the country. All these causes unquestionably contribute in a greater or less degree to the destruction of birds, but it has been conclusively proved that when the number of birds destroyed at any particular place by any of these agencies has been carefully examined by a series of daily records the result has inevitably been such as to lead to the belief that the accounts given of the aggregate destruction of birds by various forms of the electric light have been greatly exaggerated.

CORRESPONDENCE.

New York Notes.

NEW YORK, December 17.—On Thursday a decision was handed down by the United States circuit court of appeals, Judges Wallace, Lacombe and Shipman sitting, in the case of the Edison Electric Light company against the Sawyer-Man Electric company, sustaining the decision of the circuit court granting a preliminary injunction against the Sawyer-Man people, restraining them from making any incandescent lamps infringing on the Edison lamp patent. The most important point in the decision from the view point of the Westinghouse interests, is the following provision: "The injunction order appealed from should be modified so as to cover only lamps made in the infringement of the second claim of the patent, the other claims not having been infringed according to the adjudication of the circuit court or of this court. It should also contain a provision reserving the right to the defendant to move hereafter for the vacation, suspension or modification of the injunction upon proof of specific instances of refusal upon the part of the complainants, or either of them, to supply the lamps of the patent upon terms reasonable under the circumstances of the particular case to the owners of electric light plants which were installed before the rendition of the interlocutory decree of the circuit court sustaining the validity of the patent."

The Edison people consider the decision a great victory, and are naturally much elated over the result, but the Westinghouse interests do not appear to be disturbed, and they claim that while they opposed the granting of the injunction they had no hope of success. They do not anticipate much trouble, as they announce that the new Westinghouse lamp, which was illustrated in the WESTERN ELECTRICIAN, will be ready for the market on January 1st. The decision had the effect of advancing the General Electric company's stock, however. The representatives of the Westinghouse company announce that the decision will not affect the World's Fair work.

The annual wrangle between the city officials and the electric lighting companies over the prices for lamps to be used for street lighting is occupying considerable attention. The gas commission has awarded the following contracts:

United States Illuminating company, 351 lamps at 40 cents a night per lamp; Brush company, 232 lamps at 40 cents per lamp per night, and 72 lamps at 45 cents; Thomson-Houston company, 277 lamps at 40 cents per lamp per night; Mount Morris company, 314 lamps at 40 cents per lamp per night; Harlem Lighting company, 194 lamps at 40 cents, and 19 at 50 cents per lamp per night; Manhattan company, 52 lamps at 40 cents per lamp per night, and the North River company 633 lamps at 45 cents per lamp per night.

The United States company bid 50 cents per lamp for seventeen lamps; the Brush company bid the same for forty-two of its lamps, and the Thomson-Houston company asked 50 cents for forty-five of its lamps. The first two of these fifty cent bids were rejected, and the Thomson-Houston bid of fifty cents was laid over for further consideration. The bid of the Edison Electric Light company for lighting the fifty new lamps on Fifth avenue was also laid over. It was stated at the meeting that the residents of Fifth avenue wanted more electric lights. Mayor Grant said that if that was so they would have to pay for them themselves.

Mayor Grant and Commissioner Gilroy expressed the belief that the companies had combined to keep up prices, but on the other hand it was explained that on the streets on which bids were rejected there was little other electric light business, and that the companies could not afford to do the street lighting any cheaper.

The Bureau of Incumbrances sent notices to the electric lighting companies and to private citizens who have wires stretched in the public streets without a permit, that they must be removed, or the gangs of men from the bureau will chop them down.

The Kings County Electric Railway company filed with the secretary of state in Albany on Monday a certificate of the extension of its route for a distance of sixteen miles, running from Cooper avenue, Brooklyn, along Hamburg avenue to Greenwood cemetery, also from the corner of Cooper and Hamburg avenues along the latter to and along Morgan avenue, Johnson avenue, Union avenue, South Fifth street, Marcy avenue, Broadway, South Eighth street and Kent avenue.

The Supreme Court, General Term, has affirmed the judgment, with costs, in the case of the W. J. Johnston company against Walter T. Hunt and the *Electrical Age* Publishing company. The plaintiff sought to restrain Mr.

Hunt from working for the *Electrical Age* Publishing company, but Judge Truax at the Special Term on the 12th day of May last dismissed the action in favor of the defendants. This judgment was appealed from with the result already stated.

Sherman H. Hubbard, who died from an attack of pneumonia recently, was buried from his late residence last Monday at Sea Side Park, Bridgeport, Conn. Mr. Hubbard was a patent lawyer and represented several electrical concerns.

The General Term has fixed the salary of members of the Rapid Transit commission at $5,000 each. In its opinion the court says: "An allowance of, say, $5,000 to each commissioner may seem inadequate, but it represents the medium between what would be paltry and what would be burdensome. Such an allowance is certainly reasonable, for it eliminates every consideration save the character and the extent of the services rendered and their value to the community. For the special quality of services and for their individual sacrifice the commissioners must look to public gratitude for their reward."

W. F. O.

Milwaukee, Wis.

MILWAUKEE, December 17.—When the common council committee on railroads met to consider the proposition to establish an iron-clad time-table for the operation of Milwaukee street railways Henry C. Payne, representing the Villard interests, appeared before the board and succeeded in securing a postponement. He, as Mr. Villard had done before him, laid the blame for the recent trouble upon the Edison people. Milwaukee's electric railway system, he said, was designed by nobody less than Edison himself. It had been a hobby with Edison, Mr. Payne asserted, to so arrannge the machinery that in case of a break-down, part of the power-generating plant could be shut down, instead of suspending operations on the whole system. The plan looked well on paper, but it was a failure in practice, according to Mr. Payne. To carry out Mr. Edison's idea, plugs and fuses had been placed at various points along the line. When break-downs occurred, the plugs were taken out, but the trouble was not confined to the particular section where it originated, as other fuses would burn out and cripple the rest of the system. Mr. Payne declared that his company had become sick and tired of that sort of thing and was engaged in changing the system. Mr. Payne said that trouble had also been caused by an attempt to run too many cars with the power at hand. He thought that it would not be just to burden the company with schedule regulations until the system was complete. The aldermen were convinced by Mr. Payne's eloquence and decided to delay the consideration of the matter until the Allis people had supplied from its shops temporary power for operating the South Side lines, which will be about the end of the month. At the meeting of the committee Mr. Payne hinted at a five-minute schedule being put on all the lines when the system is complete. At present the schedules on the lines vary from 4½ to 9 minutes.

Sheboygan has put in 25 more arc lights for street purposes, making 125 in all, for which the city pays $10,000 yearly.

Wausau is likely to have an electric railway in the near future. The common council of that city has been requested to grant a franchise for a term of thirty years to J. D. Ross, B. E. Jones, Walter Alexander and Hiram Dunfield, all prominent lumbermen of that city. They agree to commence work on the line within twelve months and to have one and a half miles of the system in operation within six months after work is commenced. The matter was referred to a committee, but there is no doubt of the franchise being granted.

Ocooomowoc's common council has located twenty-one arc lights, with which the city will be illuminated after May 1st.

The application of Receiver Melms of the Hinsey electric railway for permission to sell the line came up in court last Saturday, but Attorney W. H. Timlin, representing Francis E. Hinckley of Chicago, secured a short continuance. Attorney Quarles urged that the road be sold at once, as the question of sale had figured in the case from the start and the road was running behind every month. Mr. Timlin, however, stated that his client was the principal stockholder and desired a delay. The course pursued by Hinckley tends to confirm the report that he is trying to raise money to prevent the sale of the road to the Villard syndicate at less than $350,000.

An electric road eighteen miles long, to run between Janesville and Johnstown, is projected. The line would take in Emerald Grove.

People living in the fashionable Seventh ward assert that the smokestack of the Edison power house is a public nuisance. They have petitioned the common council to compel the company to adopt some effective smoke consuming apparatus.

The double track on the Milwaukee and Wauwatosa electric line will not be completed until next spring.

Prince Bismarck, the man of blood and iron, is a stockholder in the Milwaukee Street Railway company. This interesting fact leaked out during Henry Villard's recent visit to Milwaukee. It appears that Villard met Bismarck when he was in Germany for the purpose of arranging the consolidation of the Milwaukee lines. Paul Lindau, the well known German writer, visited Milwaukee last year in the interest of the Villaid syndicate, and an article that he wrote is said to have attracted the attentinn of the great statesman. At any rate, Bismarck took stock to the amount of 200,000 marks, or $50,000, in the Milwaukee electric railway project. The sturdy old man of state is said to be well pleased with his investment and to regard Milwaukee as a very solid city.

The executive committee of the American Street Railway association held a meeting at the Plankinton house a few days ago. The committee decided that the meeting should be held at the Exposition building during the third week of October. The committee paid a visit to the exposition and pronounced it a very satisfactory place for the convention. The members also thought that the hotel facilities would be ample. It is expected that the convention will be the greatest ever held by the association. The European street railway managers will be well represented at the World's Fair, and it is expected that many of them will come to Milwaukee. The convention will last two or three days, and the exhibition which will be connected with it is to be open from a week to two weeks. The executive committee consists of D. F. Longstreet, president of the West End Street Railway company, Denver, Colo., president; A. Everett, president of the East Cleveland Railway company, Cleveland, first vice-president; Joel Hart, president of the Atlanta Consolidated Railway company, Atlanta, second vice-president; John Crimmins, president of the Metropoliton Traction company, New York; Thomas J. Minary, general manager of the Louisville Railway company; James R. Chapman, vice president of the Consolidated Street Railway company, Grand Rapids, Mich.; Benjamin E. Charlton, president of the Hamilton Street Railway company, Hamilton, Ont. The members of the committee were entertained by Henry C. Payne

The Villard syndicate's new power house on the South Side will not be completed until the year 1894. The Milwaukee Street Railway company itself will build the new plant. The machinery for the new plant will undoubtedly be furnished by Milwaukee manufacturers. The preliminary arrangements for the plant are now being made. Work will be begun in the spring.

The annual meeting of the Wisconsin Electric club was held last week. The new officers are: President, Prof. A. J. Rogers; vice-presidents, J. D. McLeod, E. C. Wall, George H. Benzenberg, Don J. Whittemore and Warren S. Johnson; secretary, J. B. May; treasurer, W. H. Hyde; managers, the officers and J. C. McManman, J. Bradshaw, C. N. Harrison, J. Schroeder, and C. L. Goss; committee on membership, H. Fountain, H. P. Andrae and H. F. Boggis. The club is in a flourishing condition.

C.

Northwestern Notations.

MINNEAPOLIS, December 17.—The village council of Lakeside, a suburb of Duluth, has caused some commotion by its action in contracting at this time for electric lights for the village. The unusual feature of the case is the fact that in a few days the village is to be merged in the city of Duluth, and the Hartman General Electric company was naturally figuring on lighting Lakeside under its contract with the city of Duluth. The village council has directed the Lakeside Light & Water company to construct an electric light plant of sufficient capacity to furnish Lakeside with thirty arc lights for street lighting. This was under an ordinance passed some two or three years ago. The price fixed was a trifle more than Duluth is paying, but the manager says he will make the rate the same. William Craig has gone East to buy an outfit for the plant.

The Western Union Telegraph company has been sued by Rev. J. W. Dunjee, a colored clergyman, to recover $165 damages, alleged to have been caused by the failure of the company to deliver on time a message in regard to a lecture. The lecturer and audience did not get together.

President Lowry of the Twin City Rapid Transit company came back from the East in time to experience part of the commotion over the new transfer deal. He promised to straighten out several matters complained, of and it is now reported that the whole scheme will be modified, so as to avoid the main troubles complained of.

Little Falls, Minn., has outgrown its electric light plant and some extensive additions have become necessary. Two new and improved dynamos of 1,000 16-candle power lamps each, have been ordered from the Westinghouse company of Pittsburg. New shafting is being placed in the dynamo room. The new machines will give the plant a capacity of over 3 000 lights. One water wheel will not supply all the needed power, and arrangements are being made so that both water wheels can be operated on the dynamos. The company is figuring on some plan for furnishing heat as well as light.

A practical test of the Conper-Hampton patents has just been completed. The patents include electric pumps and elevator motors, and the result of the test is pronounced highly satisfactory. The company recently organized to develop the patents will now proceed. The pump and elevator will be manufactured here and the motor in New York.

The plan for putting an electric car line between Morristown and Faribault, Minn., is receiving much encouragement.

The new electric car line to St. Louis Park, the enterprising suburb of Minneapolis, has at last been completed, and regular service will be inaugurated Sunday.

It has been decided to abandon the operation of the electric line from St. Paul to White Bear—that part of it at least between Silver Lake and Wildwood. The light travel and heavy expense of keeping the tracks clear of snow are the reasons given. Special attractions will be maintained at Silver Lake instead of at Wildwood, as originally planned. The line has proved itself successful, and operations will be resumed, of course, in the spring.

W. B. Joyce, manager of the telephone exchange of St. Paul, has resigned and on January 1st will take a responsible position with a guaranty bond company in St. Paul. Mr. Joyce has been identified with the telephone company for many years, first in Michigan, then at Stillwater, Minn., as manager and for three years as St. Paul manager.

The ordinance granting the Midway Electric Light company the right to string wires in the interurban district has finally been passed by the St. Paul council, with the provision that the right be forfeited unless one mile of wire is up by July 1st, 1893.

The incorporators of the International Carpenter Electric Heating Manufacturing company of St. Paul are Geo. H. Finn, John C. Bullett, J. L. McMurran, Chas. P. Coleman and Joseph K. Bacon.

The St. Paul council passed an ordinance requiring the street railway company to build a cross-town line on St. Albans street from Fairmount within a year, with the option of building the line along the zig-zag route previously mapped out. St. Albans street is not sewered. The council voted to allow the company to use the T rail on all lines, requiring on unpaved streets granite pavement between the rails and where there are two tracks between them.

It is reported that negotiations are well advanced looking toward removing the plant of the Great Western Electric & Supply company of Chicago to Duluth and adapting the old Iron Bay plant to the needs of the company. A new company with $1,200,000 is talked of. Gov. W. R. Merriam of St. Paul is said to be interested.

The electric line between Sauk Rapids and St. Cloud, Minn., is now in good running order and giving excellent satisfaction. Business men feel the effects on trade already.

Earl P. Wetmore, Chas. H. Alexander, and Josiah Bowden have incorporated the Dillon General Electric company at Helena, Mont., with $40,000 capital.

Heron Lake, Minn., expects to have electric lights soon.

A rapidly increasing demand for electric lights is reported at Fairmont, Minn.

General Manager Norvel is receiving many compliments from the citizens of Superior, Wis., on the way he has rushed work on the Sixth street extension.

There is some talk of shutting down the electric light plant at Alexandria, Minn., on account of a shortage in the city treasury.

C. P. Wainman, superintendent of the Minneapolis telephone exchange, has been called to Texas by the death of a brother.

H. C. C.

PERSONAL.

W. J. Johnston of the *Electrical World*, New York, is in Chicago.

William S. Hine, well known in the electrical trade as general district agent of the Westinghouse Electric &

Manufacturing company, resigned his position recently, and is now general sales manager of the J. T. Case Engine company, of New Britain, Conn.

NEW INCORPORATIONS.

Citizens' Electric Railway company of Corning, N. Y., Corning, N. Y.; capital stock, $100,000; street surface railroad.

Boulton Carbon Manufacturing company, North Tonawanda, N. Y.; capital stock, $60,000; to manufacture carbons, electrical machinery, etc.

Waco Water Power & Electric company, Waco, Tex.; capital stock, $50,000; to supply light, heat and electric power; Eugene Williams, Waco, Tex.

Electric Brake company, Kittery, Me.; capital stock, $500,000; to manufacture and deal in electrical apparatus and machinery; E. K. and B. Phillips, Lynn, Mass.

Farmington Electric Light & Power company, Peoria, Ill.; capital stock, $12,000; electric light and power plant in Farmington, Ill.; E. R. Hillman & Co., Peoria, Ill.

Luzerne Heat & Power company, Luzerne, Pa.; capital stock, $2,000; supplying heat or power by means of electricity to Luzerne borough, Luzerne county, Pa.; G. I. Clark, Wilkesbarre, Pa.

Nevada Light company, Kansas City, Mo.; capital stock, $100,000; to supply the city of Nevada with gas, electricity, etc.; Robert B. Cone, Seventh and Wyandotte streets, Kansas City, Mo.

North American Electric Storage company, Portland, Me.; capital stock, $1,000,000; to manufacture and deal in secondary batteries and in electrical appliances; N. & H. B. Cleaves, Portland, Me.

Marietta & Maytown Electric Street Railway company, Marietta, Pa.; capital stock, $24,000; constructing and operating an electric street railway in Marietta borough, Pa.; Jas. Duffy, Marietta, Pa.

McEntee Electric company; Chicago, Ill.; capital stock, $10,000; electrical construction and equipment and electrical material, appliances and devices; Creager & Pettis, 1401 Ashland block, Chicago, Ill.

West End Electric company, Pittsburg, Pa.; capital stock, $5 000; to manufacture electricity for light, heat and power at the South Side of Pittsburg; A. C. Robertson, 110 Diamond street, Pittsburg, Pa.

Central Power company, Seattle, Wash.; capital stock, $150,000; to manufacture, generate, produce, furnish, supply and sell steam and steam heat, electricity Preston, Alberton & Donworth, Seattle, Wash.

Modesto Electric Light company, San Francisco, Cal.; capital stock, $50,000; to operate in Modesto, Stanislaus county, electric machinery and appliances for all purposes; F. W. Eaton, San Francisco, Cal.

Marshfield Electric & Gas company, Portland, Ore.; capital stock, $40,000; lighting and furnishing of heat and power and to manufacture and sell light, heat and power; Paxton & Paddock, Portland, Ore.

Cincinnati Cab Call Company, Cincinnati, Ohio; capital stock, $1,000; building, maintaining and operating and renting an automatic electric line, placing call boxes upon same, etc.; Howard Ferris, Cincinnati, Ohio.

New York Electrical & Development company, Jersey City, N. J.; capital stock, $45,000; to manufacture, sell and repair electrical supplies, novelties and articles; Mason & Nichols, 146 Broadway, New York, N. Y.

Jonesboro Power company, Jonesboro, Ark.; capital stock, $7,000, owning and operating an electric light plant and ice plant in the city of Jonesboro and a system of water works; J. W. Hawthorne, Jonesboro, Ark.

Wachtel Electrical Manufacturing company, Newark, N. J ; capital stock, $50,000; manufacturing and selling of motors, dynamos, electrical apparatus, tools, machinery, etc.; Gleu & Posinger, 741 Broad street, Newark, N. J.

Dillon General Electric company, Dillon, Mont.; capital stock, $40,000; generating, producing and delivering electricity for heating, lighting, power and other purposes in the city of Dillon, Mont., and elsewhere in said vicinity.

Altoona & Logan Valley Electric Railway company, Altoona, Pa.; capital stock, $175.000; constructing and operating an electric street railway from Holidaysburg to Altoona to Bellwood with two branches; A. J. Riley, Altoona, Pa.

Dravosburg Light, Heat & Power company, Dravosburg, Pa ; capital stock, $20,000; to manufacture and supply light, heat and power by means of electricity in Dravosburg, Allegheny county, Pa.; J. S. and Ely Ferguson, 408 Grand street, Pittsburg, Pa.

Keithsburg Electric Light & Power company, Peoria, Ill.; capital stock, $15,000; electric light and power plant in Keithsburg and furnish city and citizens with electric light and power, buy and sell electrical merchandise and apparatus; E. B. Hillman & Co., Peoria, Ill.

Hancock County Electric Light & Power company, Peoria, Ill.; capital stock, $15,000; electric light and power plant in Warsaw, to furnish city and citizens with electric light and power, buy and sell electrical merchandise and apparatus; E. B. Hillman & Co., Peoria, Ill.

Boyertown Light, Heat & Power company, Boyertown, Pa.; capital stock, $1,000; supplying light, heat and power or any of them by means of electricity to the public in the borough of Boyertown, Berks county, Pa., and to such persons and partnerships residing therein and adjacent thereto as may desire the same; M. G. Taylor, Pottstown, Pa.

Philadelphia, Castle Rock & West Chester Railway company, Philadelphia, Pa.; capital stock, $90,000; constructing and operating an electric railway from Market street at the line between Philadelphia and Delaware counties along West Chester turnpike to Newton; J. U. M. Shimer, 251 South Fourth street, Philadelphia, Pa.

Ambler Electric Light, Heat & Motor company, Ambler, Pa.; capital stock, $15,000; manufacturing and supplying light, heat and power by means of electricity to the public of the borough of Ambler, county of Montgomery, Pa., and to such persons and partnerships and associations residing therein and adjacent thereto as may desire the same; Biddle & Ward, 505 Chestnut street, Philadelphia, Pa.

Marble City Consolidated Light & Power company, Rutland, Vt.; capital stock, $125,000; purchasing the capital stock, machinery, tools and fixtures, real estate and plant of the Rutland Electric Light company and the Marble City Electric Light company of Rutland, and the manufacturing, generating, producing, diffusing and selling artificial light and power in the city of Rutland and its vicinity, and of assuming or funding the debts and liabilities of the Marble City Electric Light company and the Rutland Electric Light company, and issuing bonds therefor secured by mortgage; Harry M. Bates, Rutland, Vt.

ELECTRIC LIGHTING.

The resolution of the board of aldermen to raise $21,000 for the purchase of an electric light plant was voted down at the special election held in Batavia, N. Y., recently.

The Tampa, Fla., Electric Illuminating company's plant has been purchased by the Consumers' Electric Light & Street Railroad company. The plant will be considerably improved.

The question of granting a 20 year franchise to a local stock company in Franklinville, N. Y., for putting in a $10,000 electric light plant will be voted upon by the citizens if the proposition is recommended by the city trustees at the next meeting.

A recent fire at Palouse City, Wash., destroyed the electric light building and plant and the Palouse planing mills. Both belonged to H. W. Bassett. The loss is $15,000, on which the insurance is $7,200. The origin of the fire is unknown.

A new central station company will soon be organized in Baltimore in place of the Maryland Electric company, which it will supersede. The capital stock will be $2,000,000, and it is intended to erect a power house having a capacity of 6,000 horse power. It is intended to supply current for street railway work as well as for lighting and power. The Edison system will be used.

The Thomson-Houston Electric Light company has obtained a franchise for lighting the city of Henry, Ill., with electricity. It will furnish twenty 2,000 candle power lights to burn all night, for $1,800 a year. In addition to this the company agrees to place, at its own expense, a light in the park at an altitude of 50 feet, to place a light near the power house and furnish incandescent lights for the council rooms and engine room.

The electric light station on Court street of the General Electric company in Buffalo was burned on December 16th and most of the machinery was ruined. The fire broke out at the switchboard, near the rear of the building. The night men were at work in the building and an alarm was quickly turned in. This was at 4:55 A. M. There is apparatus in the building for fighting fire, and the men endeavored to use it, but the flames spread so rapidly that their efforts were unavailing. When the firemen arrived the fire was fierce. In a few minutes it was found that the fire was upstairs, having followed the wires from the switchboard, and in a short time thereafter it had jumped 100 feet to the repair shop on the Pearl street side. There was an extensive blaze in the repair shop, and between it and the switchboard there was a considerable space almost untouched. Down stairs in the big room, the wires running in all directions carried the fire to diffrent points, and the blaze was a hot one in a brief time. The loss will reach $50,000. There were in the dynamo room nine arc machines four incandescent dynamos and a power generator. The dynamos and generator were practically ruined. The switchboard and wiring were utterly destroyed. The loss is covered by insurance.

By the end of the year it is expected that the works undertaken by the corporation of Glasgow, Scotland, for the supply of electric current to the public for lighting and motive power will be finished and in working order. The works are situated in the central district of the city at the southeast corner of Waterloo and Main streets, where a building 90 feet square and 80 feet in height has been erected, in the basement of which the working plant is being placed, while the two stories above are reserved for offices, meter testing rooms, and other purposes connected with the work. The steam is supplied by five tubular boilers of the marine type to seven engines, placed in the northern part of the basement. Two of these are of 80 horse power, two of 150 horse power, and three of 250 horse power. In the southern part of the basement are placed the storage batteries. The plant now being put down is sufficient for 12,000 incandescent lamps, but the buildings are sufficiently large to allow an addition of plant capable of supplying 45,000 lamps. In addition to this two additional engines are to be put down for the purpose of supplying current for street lighting, and it is intended to erect a considerable number of lamps in some of the principal streets of the central district.

ELECTRIC RAILWAYS.

The changing of the Roanoke, Va., and Salem dummy line to an electric road is talked of.

Ground has been broken at Edinburg, Ill., for the power house of the Chicago-St. Louis electric railway.

The electric road which will connect Webb City and Carterville with Joplin, Mo., will be completed by early spring.

The Kentucky & Indian Bridge company is planning to operate an electric railroad across its bridge from New Albany, Ind., into Louisville.

The tunnel that Austin Corbin proposes to construct under the East River, connecting New York and Brooklyn, will contain a line of electric cars. It will also be lighted by electricity.

The Calumet Electric Street Railway company of Chicago has executed a trust deed to the Title Guarantee & Trust company to secure an issue of $1,000,000 6 per cent. semi-annual gold twenty-year bonds, to be expended in extensions and betterments.

The North Shore Electric Street Railway company has secured an entrance to Chicago. By arrangement with Mr. Yerkes, president of the North Side Cable company, the electric cars will connect with the Clark street cable line, transfer checks being given.

The Thomson-Houston Electric company has filed a petition asking for a receiver for the Metropolitan Street Railway company, which owns a line lately built and put in operation to Bellevue, a suburb about four miles from Macon, Ga. If the receiver is appointed all the electric roads in Macon, about fifteen miles in all, will be controlled by the Thomson-Houston Electric company.

A press dispatch from Winnipeg, Man., December 14th, says: A decision was given to-day in the celebrated Winnipeg street railway case. Action was begun some time ago by the horse car company against the electric company, the former claiming exclusive rights to the streets of Winnipeg. The electric system was authorized by the city council, despite a charter granted the horse car company many years ago. The decision to-day was in favor of the electric company, the motion for an injunction being dismissed with costs.

The full bench of the Supreme Court of Massachusetts has rendered a decision on a new point of law in the case of Albert E. Beal against the Lowell & Dracut Street Railway company. The plaintiff was riding on the front platform of an electric car, and was thrown to the ground in an accident caused by a defective switch. The court overrules the exceptions and sustains the decision of the lower court, which found the plaintiff guilty of negligence, because there attends the employment of electricity the same dangers that might attend the employment of steam; while it is not necessarily negligence for a passenger to ride on the front platform of a horse car while in motion.

A company has been organized to construct a railroad from Chicago to Waukegan, with branches running east and west, and to furnish electric light and power to towns through which the road will pass. The principal office will be in Chicago and the capital stock is $500,000. Behind the company are about 1,000 property owners who live in the northern part of the city and in the suburban towns along the lake shore. They have become weary waiting for the construction of a line by some one, and have now decided to take matters into their own hands. The new company will be a property owners' enterprise, and will be for the purpose of aiding them in securing better transportation facilities and at the same time increase the value of real estate.

TELEGRAPH.

A telegraph operator named Hogshead was recently dismissed from the Western Union office at Meridian, Miss., for spreading a false report of yellow fever.

The Western Union directors have declared the regular quarterly dividend of 1¼ per cent. The report of the company for the quarter ending December 31, 1892, shows: Surplus, October 1, 1892, $14,476,155, of which there has been capitalized, by issue of additional capital stock distributable to stockholders December 3, 1892, $8,619,316, deducting which leaves $5,856,838; net revenue for quarter ending December 31st (partly estimated), $2,000,000; total, $7,856,838; interest on bonds and sinking funds, $243.335; total, $7 613.503; dividend, 1¼ per cent., $1,185,250; surplus, $6,428,253.

Six of the general officers and eight of the division superintendents on the Big Four commenced as telegraph operators. There are ten chief train dispatchers on the system who receive $125 per month, an average of six train dispatchers to each division who receive $100 per month, and some 140 agents and telegraph operators at stations on the system who receive from $75 to $100 per month, according to the importance of the station. In speaking of this an official of the road said that no position in railroad service brought about more promotions than does the telegraphic department. If an operator is bright and disposed to be exact in his work he soon finds himself advancing in position and salary increasing.

An injunction restraining the Western Union Telegraph company, the Union Pacific, Denver, Leadville & Gunnison, and the Denver, South Park & Pacific Railroad companies from tearing down or interfering with the line of the Postal Telegraph Cable company, has been granted by Judge Rising, of Denver, Colo. The last named company among other lines operates one between Denver and Leadville. Between the stations of Bath, in Park county, and Buena Vista, in Chaffee county, the Postal company's line parallels the tracks of the railroad companies referred

to. The Postal company alleges that the Western Union company has entered into a conspiracy with those companies whereby it was agreed that the Postal company's line between Bath and Buena Vista should be injured. Hence the application for the injunction.

TRADE NEWS.

The Butler Hard Rubber company, of New York, is making a specialty of hard rubber cells. This company also reports an active market for telephone receivers and other devices which it manufactures. The outlook for the coming year in this line is very bright.

The Hine Eliminator company, of New York, reports among recent sales, several orders from the Illinois Malleable Iron company, Chicago; Pierce, Butler & Pierce, Syracuse, N. Y.; Phillip & Wiggs Manufacturing company, Birmingham, Ala.; Charles Ward, Charleston, W. Va.; Paris Electric Light & Railway company, Paris, Tex., and C. S. Wentworth & Co., Minneapolis, Minn.

The Enterprise Electric company, Chicago, reports a large increase in sales of the National India rubber covered wire. Other electrical supplies are in great demand, and since moving into new quarters, the company has been fairly rushed. It is about to put on the market a new flush switch, for which it has secured the exclusive agency. The company also reports a good business from its St. Louis branch, of which W. H. Ferris is manager.

The Electric Appliance company, Chicago, is placing on the market an improved ceiling rosette in the line of an improvement on the Shaefer cut-out with a removable cap. The cap is attached without screws by a quarter turn to the right and detached by a similar turn in the opposite direction. To prevent the possibility of the cap jarring loose, a supplementary phosphor bronze spring has been added making loosening almost an impossibility. The cut-out is placed on the market under the name of the Acme ceiling cut-out.

Queen & Co., Philadelphia, are meeting with much success in exploiting their standard portable testing sets. One purchaser says: "The portable testing set referred to, has been in use constantly since we received it, and we find it to be first-class in every respect. We have used it on all kinds of work, for both high and low measurements, and think it is about as complete an instrument of the kind as I have ever used." Other equally complimentary testimonials have been received. These instruments are made in a strictly first-class manner, and are adapted for use under the most exacting conditions, such as in a manhole or close to dynamo machinery.

The Hanson Battery, Light & Power company, Washington, D. C., is exploiting a primary battery for use where small amount of power is required. It is claimed for this battery that ten 50 volt 16 candle power lamps can be operated with thirty-five cells. The cost of running the lamps will not exceed one-half cent per hour for each 16 candle power lamp when in use, it is claimed, and the local action does not amount to one per cent. Three cells will run a 10 inch fan motor or a sewing machine. Hanson batteries have supplied current for operating the launch Electric, which carries twelve passengers and attains a speed of seven miles per hour on the Potomac river.

BUSINESS.

The Sioux City Engine Works have had a very prosperous year, having increased the output 40 per cent above that of 1891. Taking into consideration the severe competition, prices have been satisfactory. The demands of the trade have been for engines of larger capacity, fully 50 horse power more than last year. Among the notable plants are those put in for the Burlington Electric Lighting company, Burlington, Iowa; the United States Electric Light & Power company and the Dubuque Street Railway company at Dubuque; The Sioux City Electric Light company at Sioux City, Iowa, a twin compound 20 and 36 x 42; the city of Hannibal, Hannibal, Mo., and a large twin compound for the Imperial Mills at Duluth. They intend increasing their capacity fully one-half for the year 1893, which speaks well for the outlook in their territory.

The Railway Equipment company, Chicago, reports a very large business in the Ahearn electric heaters. Orders for car heaters have been received from Amsterdam, N. Y., Peoria, Ill., Williamsport, Pa., Kokomo, Ind., Great Falls, Mont., Camden, N. J., Jackson, Mich., Albany, N. Y., Lynn, Mass., Burlington, Ia., Fitchburg, Mass., Cairo, Ill., Des Moines, Ia., Allentown, Pa., Rockford, Ill., Cleveland, O., Detroit, Mich., Brooklyn, N. Y., Spokane Falls, Wash., Alexandria, Va., Kansas City, Mo., Quincy, Mass., Salt Lake City, Utah, Chicago, Natick, Mass., Terre Haute, Ind., Marquette, Mich., Elwood, Pa., Escanaba, Mich., Kankakee, Ill., New Haven, Conn., Galesburg, Ill., and Hammond, Ind. Large orders have also been received for the Ahearn electric stoves and other devices. The Equipment company states that in its opinion the Ahearn heater is the most reliable and satisfactory of any electric heater in the market.

ELECTRICAL PATENTS.

Issued December 13, 1892.

487,702. Speed Indicator. William H. Abbott, Lennoxville, Canada.

487,703. Electric Meter. Charles W. Ayton, New York, N. Y.

At periods of time a magnet attracts the needle in a direction at right angles to its normal direction of movement, whereby it acts as a circuit closer, and closes one or more circuits according to the amount of current which actuates the needle. Electromagnets in these circuits operate a circuit breaker in a circuit containing a magnet, the intermittent vibration of whose armature actuates a ratchet wheel and indicating pointers.

487,713 Thermostatic Vessel. Henry Carmichael, Malden, Mass.

487,735 Conduit for Electric Railways. John W. Hayden, Fort Wayne, Ind.

487,745. Spring Motor. William C. Johnston, Melrose, Mass.

487,755. Armature for Electro-Magnetic Machines. Robert Lundell, New York, N. Y.

The core of a Gramme ring armature is provided with a series of poles through it near each side face, and a series of U shaped conductors are adapted to extend through the holes to form the working coils.

487,795. Multiple Switchboard Signal. Giles Taintor, Keene, N. H.

A high auxiliary resistance is placed in circuit with the call annunciator, and the insertion of a plug in the answering jack short circuits the resistance, thus enabling the calling drop to serve as the ringing out drop of that one of the two connected lines which initiated the call.

487,796. System of Electrical Transmission of Power. Nikola Tesla, New York, N. Y.

The invention embodies a multipolar alternating current machine, the armature of which is provided with coils which overlap, so that there may be a difference of phase in the electromotive forces generated by the coils.

487,808. Trolley Catcher. Joseph Werling and James F. Agnew, Minneapolis, Minn.

487,813. Electric Railway Trolley. Adolf Worner, Buda-Pesth, Austria-Hungary.

The trolley is in the form of a roller or cylinder of practically the width of the car, and extending transversely of the car and making contact with the under surface of the trolley wire.

487,816. Automatic Safety Device for Dynamo Electric Machines. Francis B. Badt, Chicago, Ill.

A responsive device is placed in the armature circuit of a dynamo electric machine, and is adapted when the current reaches a predetermined strength to close a circuit through an auxiliary resistance box stationed in the field magnet circuit; whereby the strength of the current is reduced.

487,834. Manufacture of Secondary Battery Electrodes. William W. Griscom, Haverford, Pa.

The method consists in subjecting a plate to the action of an alkaline solution, thereby first producing honey-combs in the surface of the plate, and subsequently chemically depositing on the plate active material and then forming the plate electrolytically in the usual way.

487,839 Galvanic Battery. Harry T. Johnson, New York, N. Y.

487,846. Casing for Bases of Incandescent Lamps. George R. Lean, Boston, and Charles B. Burleigh, Chelsea, Mass.

487,852. Multiple Switchboard Circuit. Alfred H. McCulloch, Boston, Mass.

The invention consists in combining a peculiarly constructed call annunciator and the main circuit within which it is included with two sources of electricity, and means for connecting both with the circuit at the same time by the act of sending the outgoing signals, the two sources being enabled to act oppositely upon the annunciator, whereby it is made irresponsive to the outgoing currents.

487,853. Multiple Switchboard Busy Test Circuit and Apparatus. James L. McQuarrie, Boston, Mass.

487,854. Busy Test Apparatus for Multiple Switch-Boards. James L. McQuarrie, Boston, Mass.

487,881. Automatic Switch. Nelson Newman, Springfield, Ill.

487,890. Manufacture of Incandescent Electric Lamps. Casimir Pauthonier, Boston, Mass.

The method of attaching the filaments to the leading in wires consists in clamping the filament to the leading in wire, passing a current through the joint while the same is inserted in a hydro-carbon, whereby the temperature is raised, causing a decomposition of the hydro carbon and a deposition of finely divided carbon at the joint.

487,936. Automatic Key Board Operator. Henry S. Prentiss, Elizabeth, N. J.

The invention consists in providing a series of switches which are set for the operation of any one particular key by the passage of a perforated strip between suitable contacts, the particular perforation or combination of perforations under the contacts determining the position of the switches.

487,981. Printing Telegraph. Charles L. Buckingham, New York, N. Y.

A wheel provided upon its periphery with type impressions is connected with several electromagnetic devices, each adapted to rotate the wheel through a particular distance, whereby any letter may be brought in position by the actuation of the proper electromagnetic devices.

487,982. Printing Telegraph. Charles L. Buckingham, New York, N. Y.

487,983. Printing Telegraph. Charles L. Buckingham, New York, N. Y.

487,984. Synchronous Multiple Telegraph. Charles L. Buckingham, New York, N. Y.

487,985. Printing Telegraph. Charles L. Buckingham, New York, N. Y.

487,986. Printing Telegraph. Charles L. Buckingham, New York, N. Y.

487,996. Electrolytic Apparatus. Thomas Craney, Bay City, Mich.

488,002. Lightning Arrester. William R. Garton, Keokuk, Iowa.

Two serrated plates are placed in parallel positions, the lower one being connected with ground; a carbon contact rests upon the upper plate, and is secured to the core of a solenoid, the core and carbon being connected in series with the winding of the solenoid. The carbon contact is placed in an air tight chamber so that when current of abnormal strength passes through the solenoid and the carbon to earth the carbon will be raised and an arc formed which will be extinguished when all of the oxygen in the air tight chamber has been consumed.

488,012. Electric Gas Lighter. Lucien M. Kilburn, Council Bluffs, Iowa, and Scott Van Etten, Omaha, Neb.

488,013. Electric Belt. Ole Kjorstad, Eau Claire, Wis.

488,016. Armature for Electric Machines. Benjamin G. Lamme, Pittsburg, Pa.

A drum armature core is provided with radiating teeth between which separately wound coils are placed, each coil spanning several teeth.

488,022. Electric Railway Trolley. David Mason, New York, N. Y.

The trolley pole is mounted upon a flexible resilient support adapted to turn round a vertical axis.

488,023. Electric Railway Trolley. David Mason, New York, N. Y.

The trolley pole is connected with a spiral spring coiled on a horizontal axis, and connected with the car and exerting an upward pressure on the pole.

488,027. Electric Coupling. John J. Purcell, Washington, D. C.

488,033. Spring Jack Switch. Charles E. Scribner and Ernest P. Warner, Chicago, Ill.

Two springs of different lengths and adjusted to normally press toward each other upon contact points or connections, and a tube or guide is placed in front of the free ends of the springs and adapted to receive a plug whose end engages with the springs to lift them from their contacts.

488,034. Means for Preventing Induction in Cables of Multiple Switchboards. Charles E. Scribner, Chicago, Ill.

Contact points are included in one side of a loop having its two sides twisted together in a double strand which are adapted to open the loop when separated, and a third wire is connected to that side of the loop which is adapted to be opened, whereby it is separated from the permanently closed side when the loop is open.

488,035. Multiple Switchboard System for Telephone Exchanges. Charles E. Scribner, Chicago, Ill.

An individual annunciator is provided at the central station having two coils adapted to act differently or oppositely through suitable mechanism upon an indicator, one of the coils being included in the telephone line circuit and the other in a branch to earth.

488,036. Multiple Switchboard System for Telephone Exchanges. Charles E. Scribner, Chicago, Ill.

A normally open shunt or short circuit is provided about the individual annunciator of the line, and means actuated by an electro-magnetic device are provided in the line circuit to close the shunt circuit when signaling current is sent over the line circuit while a connection exists through the line.

488,037. Telephone Switchboard Apparatus. Charles E. Scribner, Chicago, Ill.

The invention relates to self-restoring annunciators and is designed to avoid waste of current by providing a normally open break in the line circuit adapted to be closed only by the flow in the line circuit of such current as would tend to operate the annunciator.

488,038. Multiple Switchboard System for Telephone Exchanges. Charles E. Scribner, Chicago, Ill.

Contact pieces of the spring jacks are normally disconnected from the line circuit and an electro-magnetic device is adapted when energized to connect the contact pieces of the spring jacks with the line circuits.

488,041. Electric Motor. Imle E. Storey, Boulder, Colo.

The field magnet is composed of a hollow cylinder with pole pieces projecting from its inner surface, a removable cap being placed over the commutator, whereby all parts of the motor are completely sealed.

488,046. Insulator. Charles Wirt, Chicago, Ill.

488,053. Test Circuit for Multiple Switchboards. Oro A. Bell, Brooklyn, N. Y.

The invention embodies a spring jack with two springs adapted to engage with contacts on the plug, the portion of the plug where it passes through the test ring being insulated.

488,064. Magnetic Separator. Harvey S. Chase, Boston, Mass.

The separator is of that type in which a belt passes around pulleys and beneath a series of magnets, one end of the belt being adapted to pass through a tank of water.

488,107. Time Meter for Electric Lighting Systems. Judson O. Ball, Mount Pleasant, Iowa.

488,121. Automatic Regulator. Edward J. Houghton and William White, London, Eng.

The regulator comprises a spiral wire resting upon a metallic plate and forming a portion of the circuit; to the apex of the spiral is attached the core of a solenoid, which, in its travel, brings a greater or less number of turns of the spiral in contact with the metallic plate, thus altering the resistance of the circuit by changing the length of the wire of the spiral included in the circuit.

488,123. Electrical Safety Cut Out. Henry S. Keating, London, Eng.

488,138. Electric Signal Circuit. John V. Young, Boston, Mass.

488,139. Incandescent Lamp. Eugene W. Applegate, Omaha, Neb.

488,141. Process of Insulating Electric Conductors. Charles Cuttriss, New York, N. Y.

The method of preparing cotton silver for application to electrical conductors consists in drawing the silver in its natural state through a boiling insulating fluid, such as oil and then matting the same and expressing the surplus oil taken up by it.

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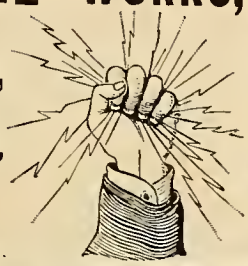

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The rubber used in insulating our wires and cables is especially chemically prepared, and is guaranteed to be waterproof, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather and is not affected by heat. The insulation is protected from mechanical injury by one or more braids, and the whole slicked with Clark's Patent Compound, and special extra finish, which we have now adopted for all our solid wires as an extra weatherproof protection, and also preventing chafing and abrasion, which is water, acid, and to a very great extent fireproof. Our insulation will prove durable when all others fail. We are prepared to furnish Single Wires of all gauges and diameter of insulation for Telegraph and Electric Lights from stock. Cables made to order. We are now prepared to furnish our Clark Wire with a white outside finish for ceiling cleat work as well as our standard color.

Clark Joint Gum should be used for making waterproof joints. This is put up in half-pound boxes, in strips about one foot long and five-eighths inch wide, and when wrapped about a joint and pressed firmly it makes a solid mass. **FOR RAILWAY** and **MOTOR** use, we make all sizes of stranded and flexible with Clark insulation.

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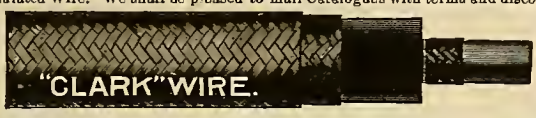

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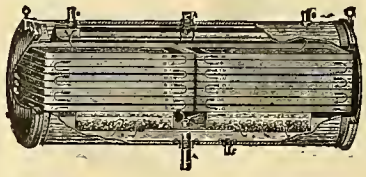

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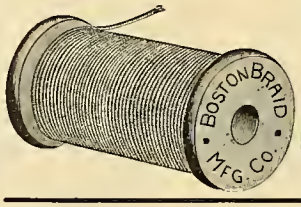

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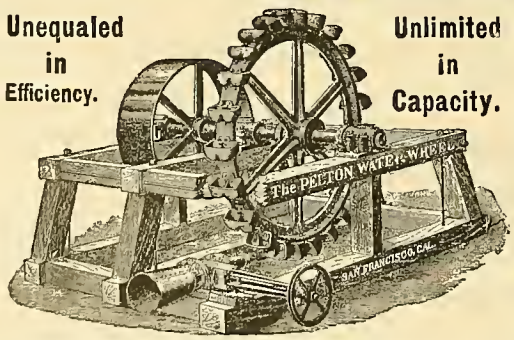

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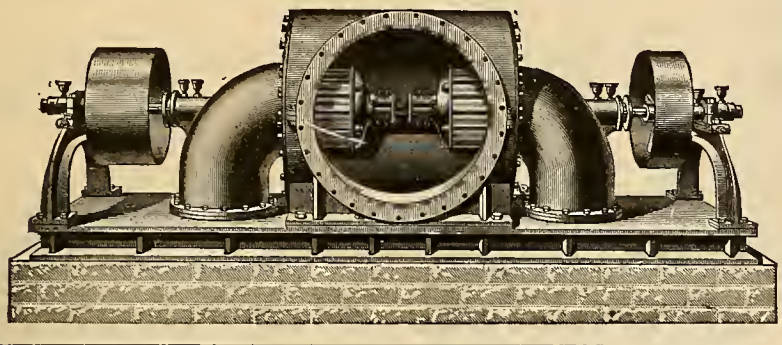

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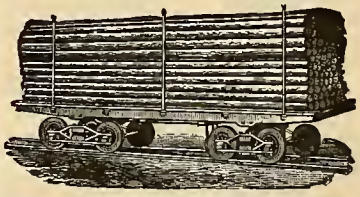

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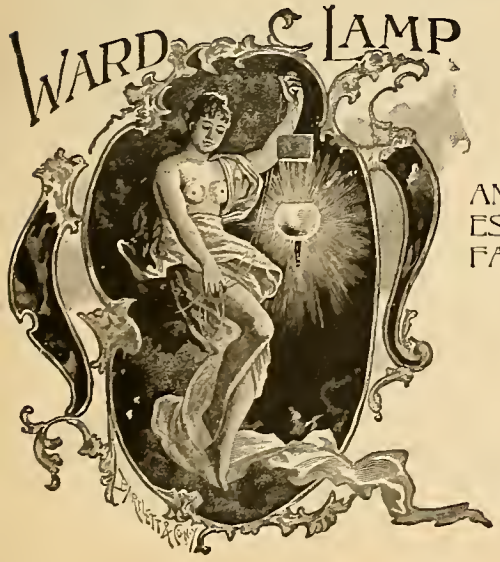

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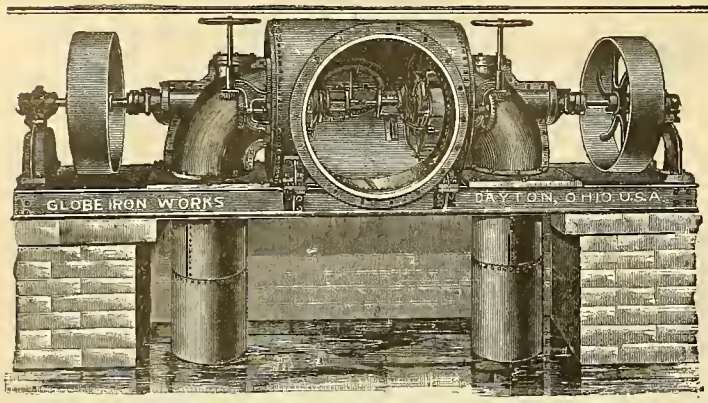

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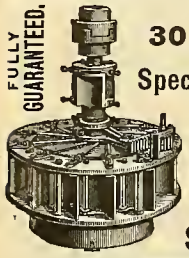

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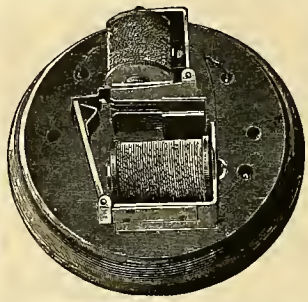

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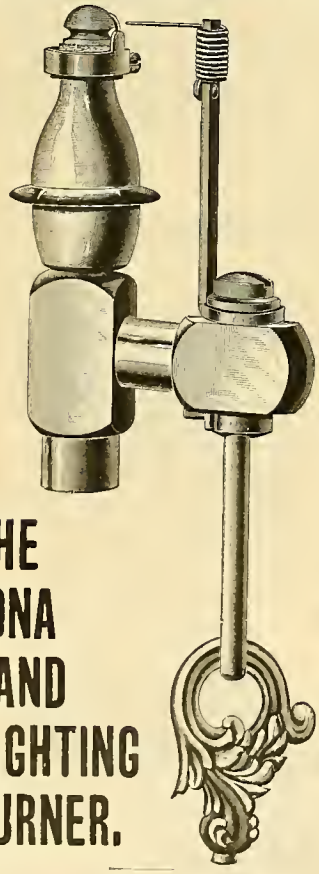

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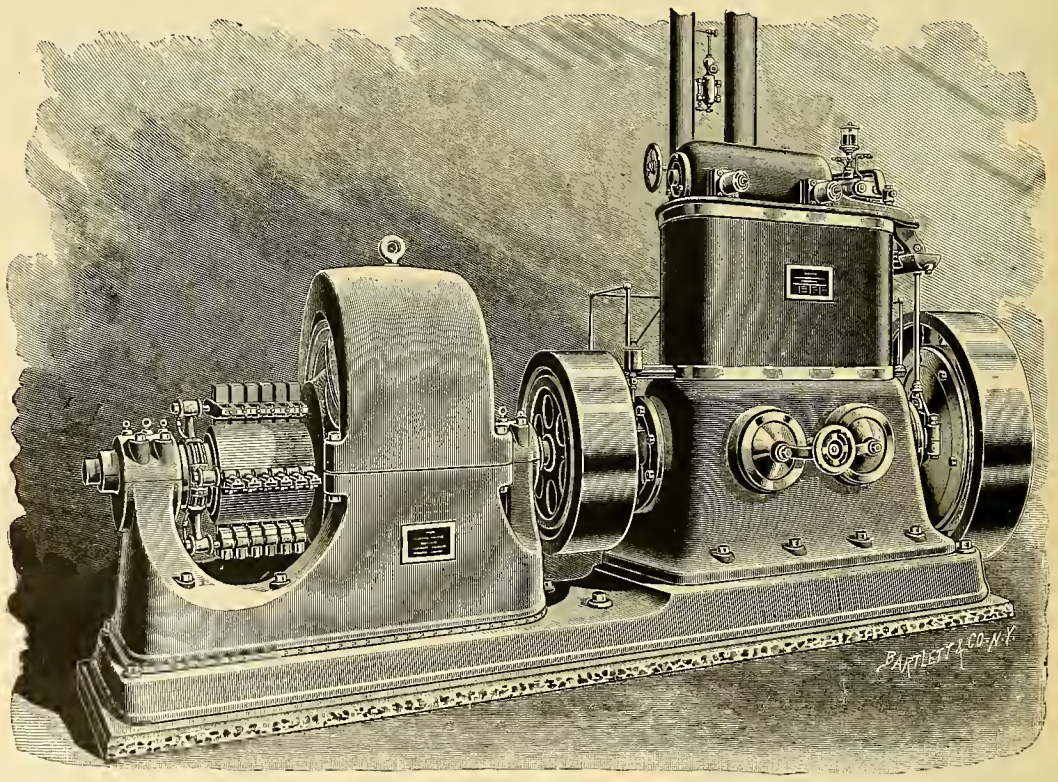

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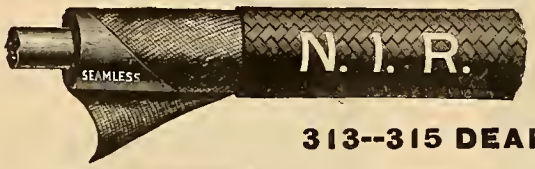

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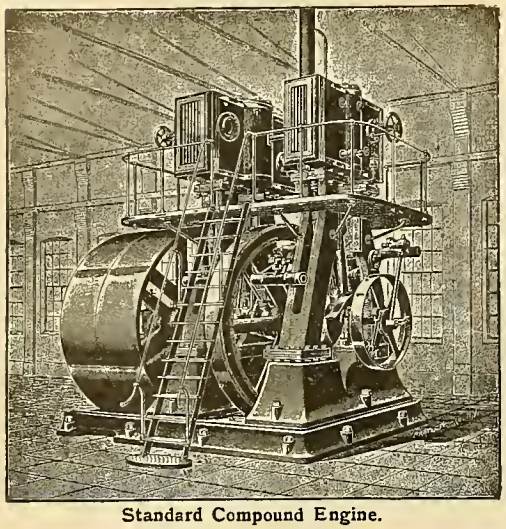

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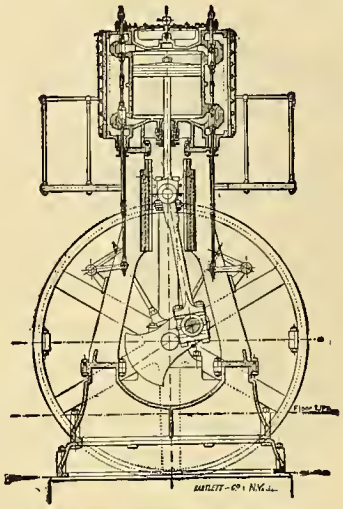

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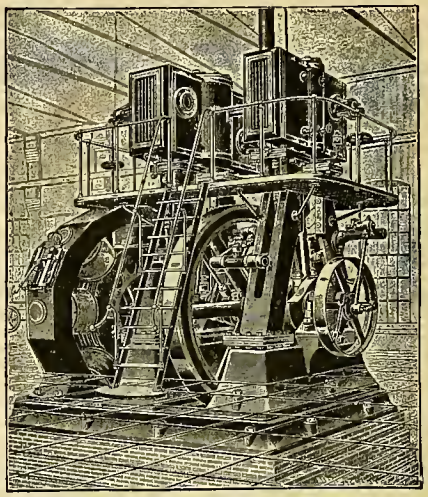

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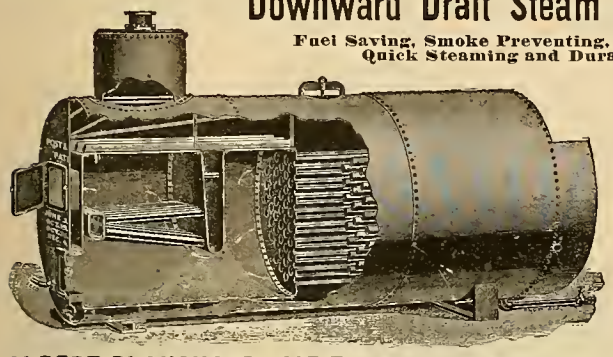

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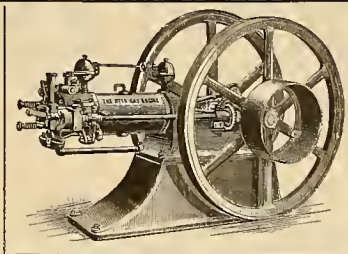

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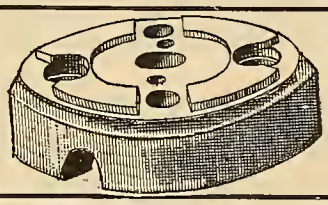

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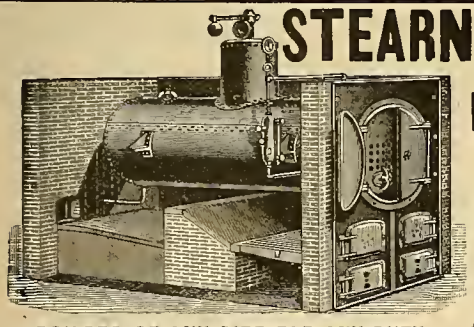

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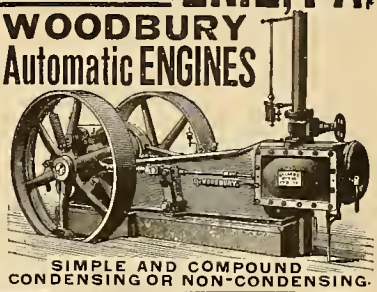

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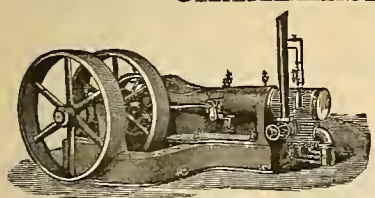

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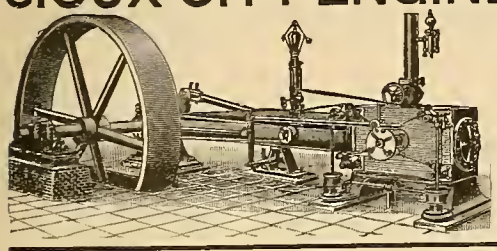

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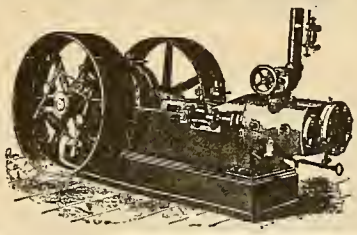

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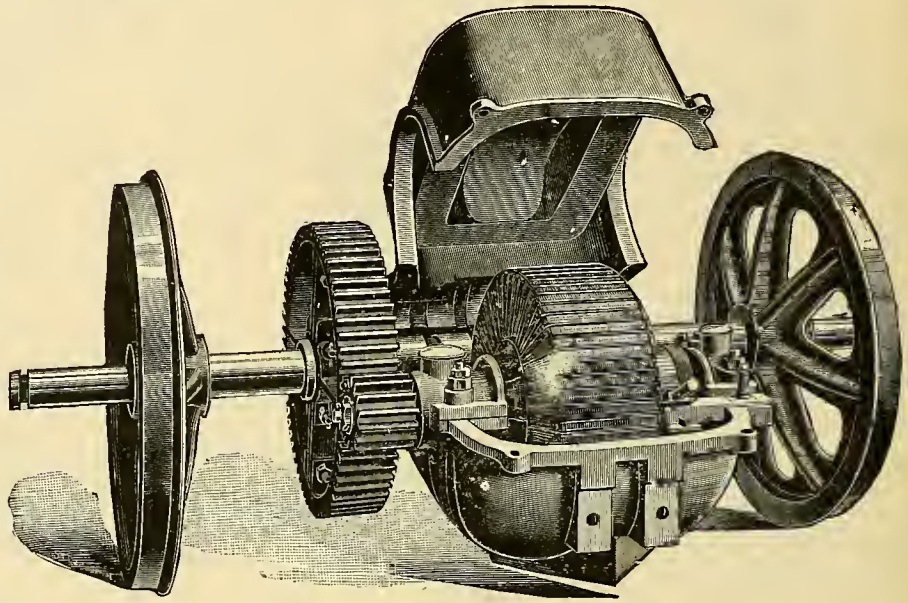

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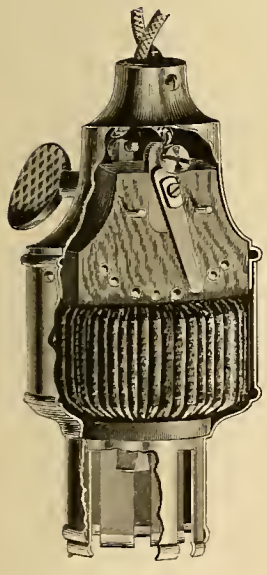

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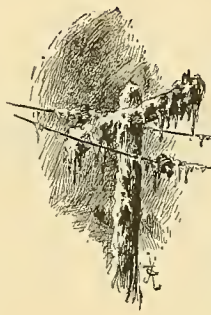

THE INDICATIONS are that we will have a "nasty" winter. Several severe snowstorms and swirling blizzards are noted down in the vest-pocket memorandum of the weather clerk. In any event the prudent station manager will wish to have his lines and general equipment in "ship-shape" and of such material that he can rest assured no embarrassing failures will occur lessening the reputation of his company for regularity of light and power.

You are, no doubt, planning for next year, looking over the field, taking trial balances and to some extent determining the policy to be pursued for '93.

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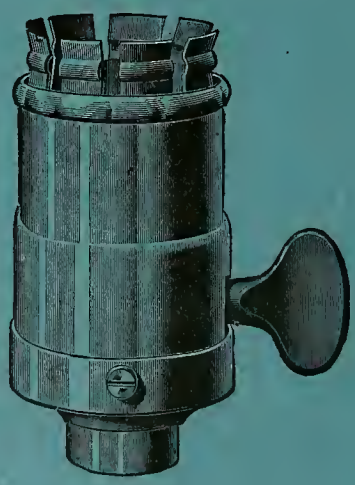

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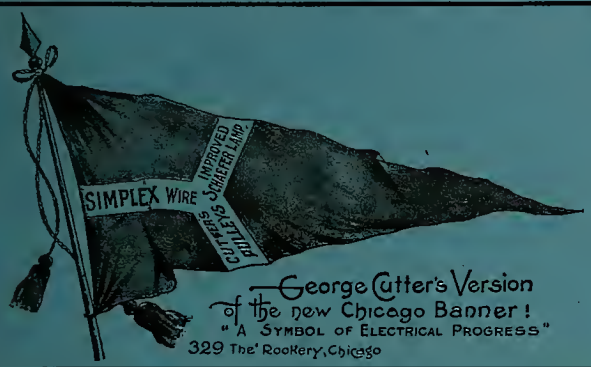

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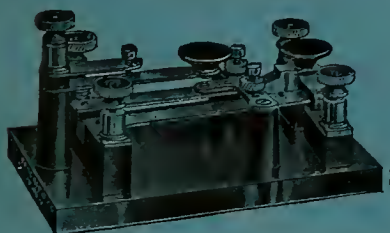

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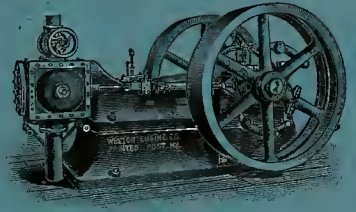

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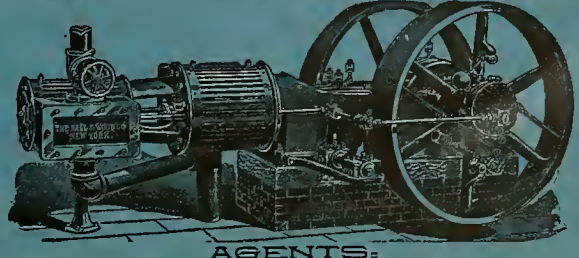

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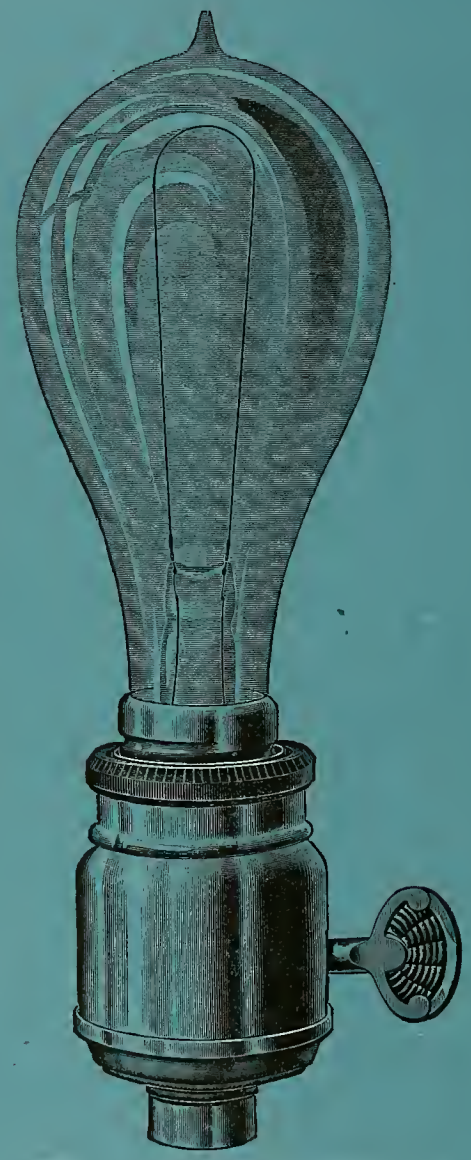

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INDEX AND CLASSIFICATION OF ADVERTISEMENTS.

ALPHABETICAL LIST.

American Battery Co..... iv
American Electrical Mfg. Co.. ix
American Electrical Works.... xiii
American Engine Co..... xii
Atwood, A. H..... x
Babcock & Wilcox Co., The.... i
Baggot, E..... xiv
Baker & Co..... xiii
Ball Engine Co..... xix
Ball & Wood Co., The i
Beacon Vacuum Pump & Elec. Co... i
Becker Mfg. Co., John..... xiii
Beggs, J. E., Mch. & Supply Co. xii
Bernstein Electric Co..... —
Blanchard, Albert..... —
Boston Braid Mfg. Co..... —
Bridgeport Mach. Tool Wks.. —
Brookfield, Wm..... xii
Brush Electric Co xvii
Bryan, W. H..... xiii
Bryant Electric Co..... xii
Buckeye Electric Co., The..... ix
Cabell, L. Breckinridge..... ix, x
Carpenter Enamel Rheostat Co. xvii
Central Electric Co..... v
Chicago Rawhide Mfg. Co.... —
Columbia Inc. Lamp Co..... —
Columbia Mfg. & Supply Co. xii
Crescent Ins. Wire & Cable Co. xiii
Crocker-Wheeler Electric Co.. xiii
Cushing & Morse..... vii
Cutter, Geo..... i
Cutter Electrical & Mfg. Co... —
Dayton Globe Iron Works Co.. xvi
Diamond Electric Mfg. Co.... xii
d'Infreville, G..... x
Dixon Crucible Co., Jos..... xv
Duplex Electric Co., Ltd..... —
Eastern Electric Cable Co..... xiii
Eastman Kodak Co..... —
Edwards, W. S. Mfg. Co..... iv
Electric Appliance Co xii
Electric Cons. & Supply Co.. xv
Electric Engr'g & Supply Co.. iv
Electric Secret Service Co.... xix
Electrician Pub. Co.....xv, xviii
Electrical Eng. & Supply Co. The.—
Electrical Mfg. Co., The..... iv
Electrical Supply Co., The ... xxii
Elektron Mfg. Co..... xvi
Empire China Works xii
Enterprise Electric Co..... xvii
Falls Rivet & Machine Co..... ix
Ferracute Machine Co..... xiv
Ford-Washburn Storelectro Co. iv
For Sale Advs. .....xii, xiii, xiv
Freeman & Sons Mfg. Co.
The S xix
General Electric Co..... ii, xx
Great Western Elec. Supply Co. —
Greeley & Co., The E. S..... i
Gregory, Chas. E..... xiii
Hart & Hegeman Mfg. Co..... xiv
Heisler Electric Co..... viii
Hill Clutch Works..... xix
Hine Eliminator Co..... —
Holmes, Booth & Haydens.... xiv
Hood & Co., Wm..... iv
Hughes Bros. Mfg Co..... xvii
India Rubber & G. P. Ins. Co. xxiii
Innis & Co..... xiii
Institute of Technology..... xvii
Interior Conduit & Insulation Co. x
International Okonite Co..... i
Jewell Belting Co..... i
Johns Mfg. Co., H. W..... xix
Kartavert Mfg. Co..... xvii
Klipstein, A..... xiii
Knapp Electrical Works..... xxi
Lake, J. H. & D., Co ..... —
Lake Erie Engineering Works. vi
Lane & Bodley Co..... —
La Roche Electric Works..... xvi
Leclanche Battery Co., The .. xiv
Lefmann, Julius xv
Leffel, & Co., Jas xvi
Loud, H. M. & Sons Lumber Co. xiv
Manz & Co..... x
Mass. Chemical Co..... x
Moore, Alfred F..... i
Morse & Co., A. M..... xiii
Munsell & Co., Eugene..... xii
National Electric Mfg. Co.... —
National India Rubber Co .... —
New York Insulated Wire Co. xvii
N. Y. Safety Steam Power Co. xii
New York & Ohio Co..... i
Otto Gas Engine Works..... —
Osborne Steam Engineering Co. xiii
Ostrander & Co., W. R..... i
Page Belting Co..... —
Partrick & Carter Co..... —
Pearson & Co., W. B..... vi
Pelton Water Wheel Co..... xiv
Penn. Electric Engineering Co xv
Perkins Elec. Switch Mfg. Co.— —
Phoenix Glass Co..... xix
Porter-Leavitt Elec. Motor Co. xiii
Queen & Co..... xiii
Racine Hardware Mfg. Co.... —
Railway Equipment Co.. ix, xxiv
Redding Electric Co..... xiv
Roebling's Sons Co., J. A .... —
Rose Elec. Light Supply Co... xii
Russell & Officer.. x
Samson Cordage Works..... xii
Scott Electrical Mfg. Co..... viii
Sechrist, Albert..... xvi
Shawmut Fuse Wire Co..... xv
Shultz Belting Co..... —
Siebert, G..... —
Siemens & Halske Electric Co. ix
Sioux City Elec. Supply Co... —
Sioux City Engine Works.... xix
Smith, A. T..... —
Sperry Elec. Mining Mach. Co. xvii
Standard Electric Co..... xxiv
Standard Paint Co xvi
Stanley Electric Mfg. Co..... v
Stearns Mfg. Co..... xix
Steuben Lamp Works..... xiii
Sterling, W. C..... xv
Stilwell & Bierce Mfg. Co. xiv, xv
Sunbeam Incand. Lamp Co.. xxiii
Taylor Engine Co..... —
Union Hardware Co..... xii
Utica Elec. Mfg. & Supply Co. x
Vulcanized Fibre Co..... xv
Waddell-Entz Company..... xii
Washburn & Moen Mfg. Co.. iv
Western Electric Co..... x
Westinghouse, Church, Kerr & Co..... vi
Weatinghouse Elec. and Mfg Co.....viii, xi
Weston Engine Co..... ... i
Worthington, Henry R..... xii

CLASSIFIED LIST.

Annunciators.
Central Electric Co.
Electrical Supply Co., The.
Knapp Electrical Works.
Ostrander & Co., W. R.
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Arc Lamps.
Beggs, J. E., Mchy. & Supply Co.
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Columbia Mfg. & Supply Co.
Electrical Supply Co., The
Ford Washburn Storelectro Co.
Greeley & Co., The E. S.
Knapp Electrical Works.
Leclanche Battery Co., The.
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Battery Jars.
American Battery Co.
Central Electric Co.
Electrical Supply Co., The.
Knapp Electrical Works.
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Western Electric Co.

Bells, Electric.
Central Electric Co.
Electrical Supply Co., The.
Greeley & Co., The E. S.
Knapp Electrical Works.
Ostrander & Co., W. R.
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Western Electric Co.

Bells, Magneto.
Central Electric Co.
Greeley & Co., The E. S.
Knapp Electrical Works.
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Chicago Rawhide Mfg. Co.
Jewell Belting Co.
Shultz Belting Co.

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Babcock & Wilcox Co., The.
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Freeman Sons Mfg. Co., The S.
Lane & Bodley Co., The.
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Stearns Mfg. Co.
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Electrician Publishing Co.

Burglar Alarms.
Central Electric Co.
Electric Appliance Co.
Electrical Supply Co., The.
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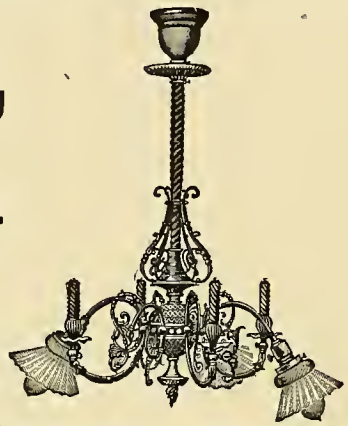

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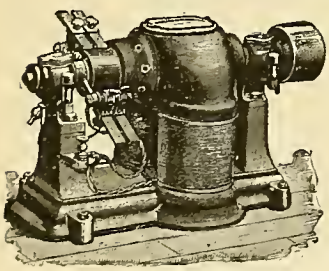

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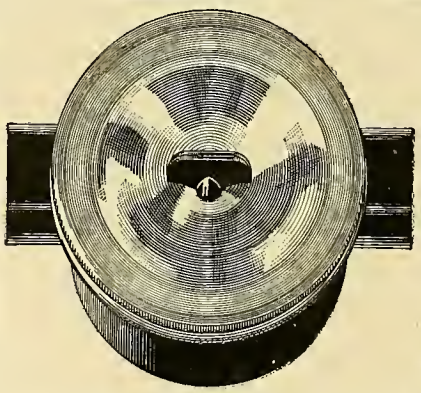

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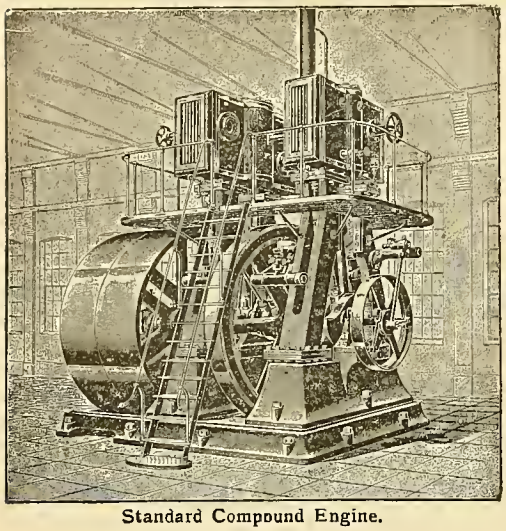

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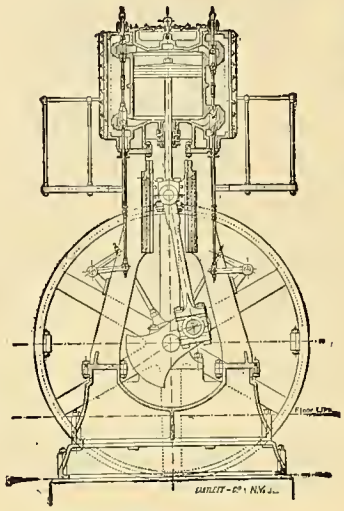

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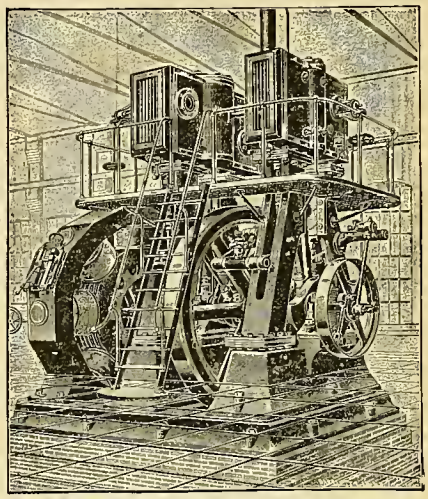

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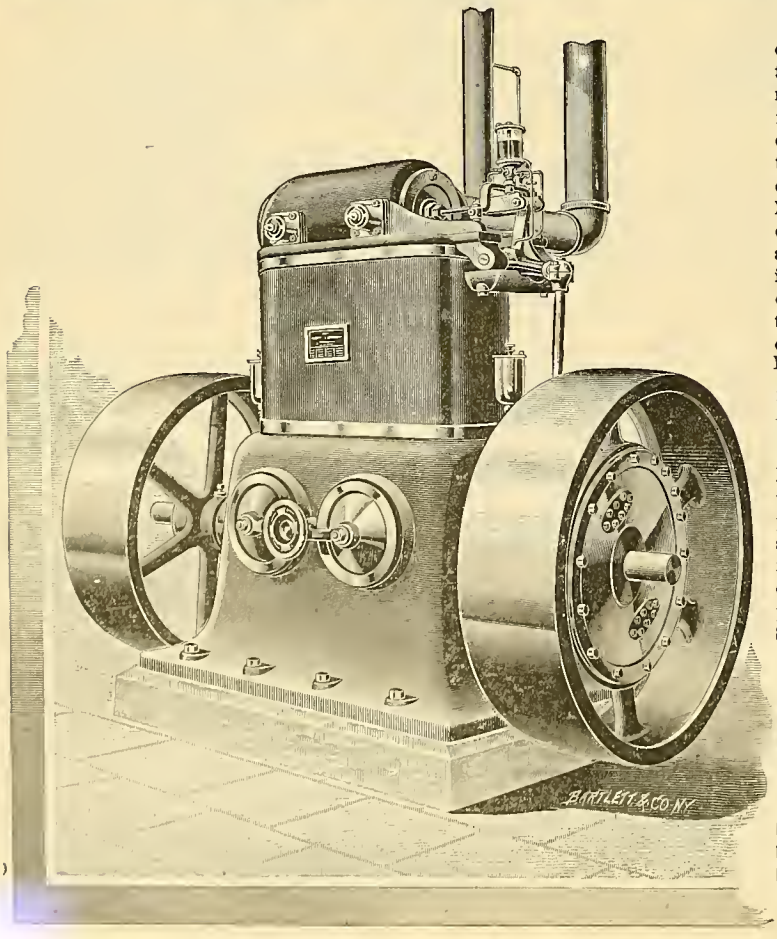

The Compound Engine, when non-condensing, so far from possessing an economy superior to the Simple Engine, has been decisively proven, "much to the disgust of the stockholder," to show normal economy only at or about its rated power, and to fall off in economy faster than a Simple Engine as the load falls off; moreover, very much faster under the extreme light loads that are common in Electrical Generation. This point is at last reluctantly admitted by the more candid builders of such engines, most of whom now advise against compounding for variable loads. The reason is in their inability to divide the load and range of temperature proportionately and automatically between the cylinders at all points of cut-off. Hence, the low-pressure cylinder expands its steam below atmosphere under a moderately early cut-off, thus converting itself into an Air Pump, and becoming a load upon the high-pressure cylinder instead of a co-laborer with it. This point was distinctly foreseen by the designers of the Westinghouse Compound Engine, and an entirely new principle was worked out, making expansion below atmosphere impossible under any load, however light. **For the first time in the history of Steam Engineering, either Simple or Compound, is built an Engine which maintains essentially uniform economy, irrespective of load,** and hence for the first time the Compound Non-condensing Engine has been made practicable. The results, demonstrated by test, show that where an ordinary Compound will range from 25 lbs. to 70 lbs. water per H. P per hour from full to quarter load, the Westinghouse Compound, between the same limits, will range from 23 lbs. to 29 lbs. We have not deceived ourselves in this matter, and propose that the facts shall be understood. To those interested in the nicer points involved, we will be pleased to send a reprint of the paper read by Mr. F. M. Rites on this subject at the late meeting of the American Society of Mechanical Engineers, at San Francisco.

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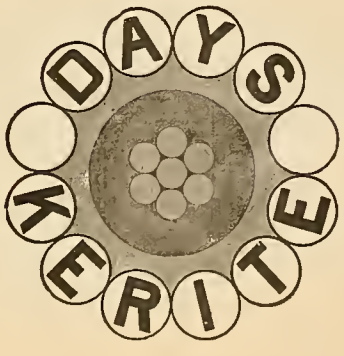

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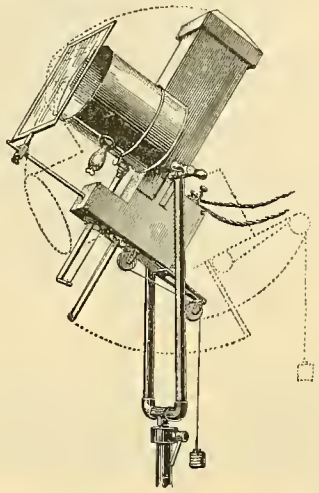

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Manufacturing AND Constructing Electrical Engineers.

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We make a specialty of the complete installation of our IMPROVED LONG DISTANCE SERIES SYSTEM **with reduction coils for reducing the voltage for domestic illumination, and permitting the use of meters if desired.**

DIRECT AND ALTERNATING CURRENT CONSTANT POTENTIAL INCANDESCENT APPARATUS with **Regulating** or ordinary sockets, for Isolated Plants.

TRANSFORMER APPARATUS of the Latest and Most Improved Type.

SERIES LAMPS for use on **Arc Circuits,** or any current and candle power, and to fit any **Series Sockets.**

C FAN MOTORS 1-6th and 1-12th H. P. Any voltage.

We invite investigation of the above apparatus.

Competent Engineers furnished to make estimates.

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MANUFACTURERS OF APPARATUS FOR

Arc Lighting, Incandescent Lighting,

LONG DISTANCE TRANSMISSION OF POWER,

Street Railway Generators, Motors and Appliances.

Our alternating current incandescent apparatus is in use in 430 central stations. 1,000 isolated plants. Our arc apparatus is in use all over the world.

We are now transmitting light and power various distances up to 28 miles from the source.

Our multipolar railway generators and noiseless single reduction motors have worked a revolution in the electric railway field in two years.

Orders for APPARATUS, REPAIRS and SUPPLIES formerly furnished by the United States Electric Lighting Co., Newark, N. J., should now be sent to this Company, where they will receive prompt attention.

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AGENTS FOR CANADA: AHERN & SOPER, OTTAWA, ONT.

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I have in my hands two gold mines easily accessible, in the United States of Colombia, South America, with ore of the most extraordinary richness, some of which carries as much as three thousand dollars ($3,000) in gold to the ton, and all being of high grade.

These mines are of ancient discovery, and were worked with great profit for a long period, being only abandoned on account of political troubles before and after the War of liberation.

These troubles have been happily settled for over a quarter of a century, and the Colombian Republic is based upon the theory of and similar to our own government, with civil and religious liberty and equal rights to all, and is as stable as any government in the world.

These mines are so richly endowed with auriferous material, from the easily-worked sand, gravel, and dirt (carrying virgin dust and nuggets), to the fissure veins of free milling quartz, that when properly equipped a profit of ten thousand dollars ($10,000) a day, or over three million dollars ($3,000,000) annually is a very low and conservative estimate.

There is an abundance of timber and unfailing water power, with a genial and healthy climate.

It is proposed to organize this property on a basis of five million dollars ($5,000,000), upon which there can be dividends earned of 60 per cent. or more, and the parties furnishing the original capital, in small or large sums, for this organization, which will be about twenty-five thousand dollars ($25,000), will be let in on a basis of two and a half cents (2½c.) on the dollar, with the privilege of purchasing pro rata at five cents (5c.) on the dollar, a sufficient amount to give them a controlling interest if they so desire.

There is also the right of prior possession to double the amount of contiguous land.

The poverty of the owners of this property, being land poor, is the reason of this unusual offer, and they will retain as much of the property as they possibly can, parting with only what is necessary in order to work it.

Situated in the Jurisdiction of Simite, District of Guamaco, Province of Mompos, State of Bolivar.

An experienced miner who has been over and thoroughly examined the property, says more gold is there than in the entire State of California, while another says so great is the evidence of mineral wealth I sometimes doubted my own sanity, and were I to tell California and Colorado miners even a tithe of what I actually saw, I would be branded as a foolish liar or raving maniac.

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For Long Life, High Efficiency, Full Candle Power and Freedom from Discoloring.

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INCANDESCENT LAMPS

ARE PRONOUNCED BY ALL WHO HAVE TRIED THEM TO BE THE BEST.

OUR SPECIAL RAILWAY LAMPS ARE UNEQUALED.

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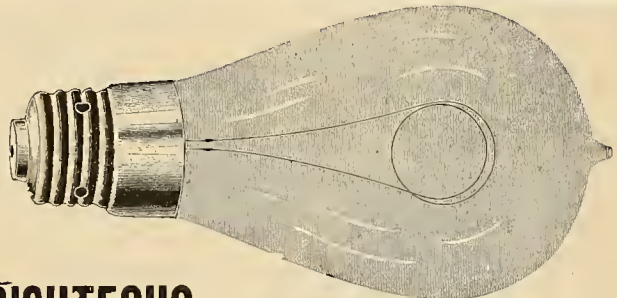

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Very truly, POWEL CROSLEY.

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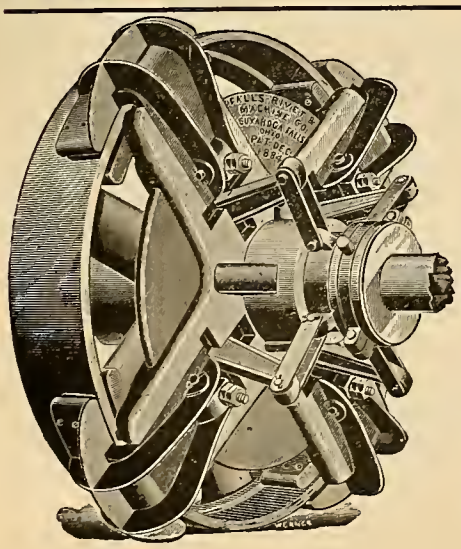

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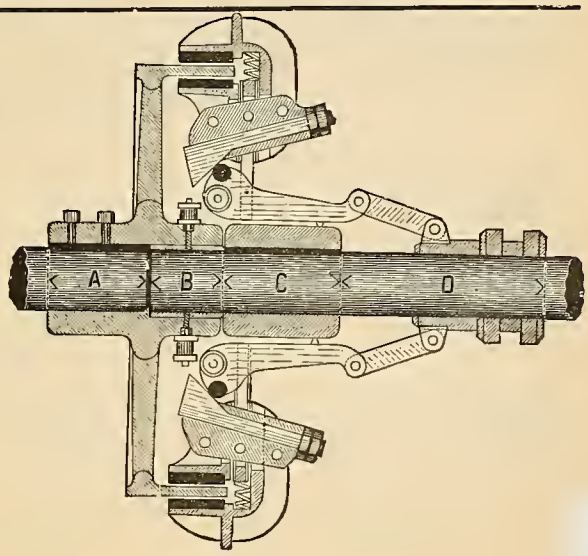

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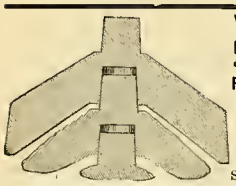

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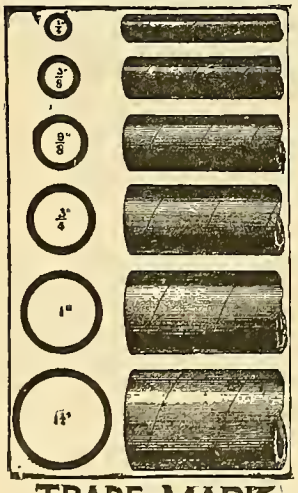

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"HERCULES" SWITCHES for Arc and Power Circuits.
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Nov. 30, 1892.

Lamps.

EFFICIENCY, LONG LIFE, NO DECREASE IN CANDLE POWER.

Sockets.

SIMPLE, ORNAMENTAL, RELIABLE, CHEAP.

OUR NEW LAMPS not only do not infringe the Edison Patent, but they are fully covered by patents of our own.

BY MEANS OF AN IMPORTANT DISCOVERY THE BURNER IS RENDERED STABLE, ITS EFFICIENCY INCREASED, ITS LIFE PROLONGED AND ITS NORMAL CANDLE POWER MAINTAINED.

PRICES.

By reason of economies effected in the manufacture of our new lamp in large quantities by the use of special machinery, we are able to

Quote the following Low Prices:

25 and 20 candle power lamps, - - - - $0.35 List Price.
16, 10 and 8 candle power lamps, - - - - $ .30 " "

DISCOUNTS.

Central Stations 10 per cent. discount, and to all others 2½ per cent. to 10 per cent. according to quantity.

ALLOWANCES.

A credit of ten cents will be given for every unbroken burned-out lamp delivered at the factory of the Company.

The saving by decreased cost of lamps and renewals should equal nearly one per cent. on the capital stock of any Central Station.

The constant effort of the agents of the General Electric Company to induce our customers to exchange Generating Apparatus of our make for Thomson-Houston Generating Apparatus is fully explained by the fact that

THE THOMSON-HOUSTON COMPANY PAYS US

through the Consolidated Electric Light Company Five Cents for every Incandescent Lamp it makes, for the right to sell such lamps for use in connection with Generating Apparatus of its own manufacture only.

While we do not sell our new lamp for use in connection with Thomson-Houston Generating Apparatus, the present users of the same may avail themselves of our new lamp by substituting our Generating Apparatus, the quality and efficiency of which will fully warrant the cost.

NOTE: A dealer came to our office and stated that he had **the exclusive sale** of second-hand apparatus for the **General Electric Company**; and he offered five of our Number One Alternating Current Generators for sale, to be delivered a few weeks hence as they are still in use. **We can of course Commend this apparatus if in good order.**

An official of a central station lighting company approached us recently for the exclusive right to the use of our apparatus in his town, stating that his company had already entered into a contract, Form D., with the General Electric Company, for the exclusive use of their apparatus. He frankly avowed that his purpose was, by securing a contract with us, to have a monopoly of electric light and power in the district covered by his station.

We thought it better to leave that place open for competition.

We have also been informed that one other Company had executed Form D contract of the General Electric Company. These three are the only instances we have discovered, where they have succeeded in doing business in the direction of inducing users of our apparatus to discard it for apparatus made by members of the Trust.

Although we have many tons of apparatus made by the various members of the Trust, taken in the course of trade, we have not cared to offer it for sale, for we believe the sale of inferior apparatus does great harm to the electric trade in general.

We have perfected devices that can be inserted in the various sockets now in use, thereby making them standard, for the use of our new lamps. The manufacture of these in sufficient quantities to meet the demand has been unexpectedly delayed, so that the delivery of lamps, and these attachments, will be made only from and after January 1st.

WESTINGHOUSE ELECTRIC AND MFG. CO.

STANDARD SCREW GLASS INSULATORS

MANUFACTURED BY

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Two 300-amperes shunt wound U. S. Dynamos.
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Two 500-light T.-H. Dynamos, compound wound, with Base, Rheostat and Ammeter.
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Ten 12-light Knowles Dynamos with lamps.
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One 90-h. p. Armington and Sims Engine.
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Dry Battery.

Write for Particulars and Prices.

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For the new year are in order and let one of them be that you will investigate the merits of our line of electrical specialties and supplies, and

"SWEAR OFF"

Using anything that comes along because it is new or cheap. Adopt our **"Best at any price"** material and specialties, and we will send with each order a written guarantee that your's will be

A HAPPY NEW YEAR.

Electric Appliance Company,

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Non-Conductive Blocks, Rosettes and Bases for Cut-Outs and Switches.

Also Insulators, Cleats, Lamp Trimmings and other Electrical Supplies.

Our production is a dense body. The glazing and body of our ware are of same composition, and are baked alike, which are the features of

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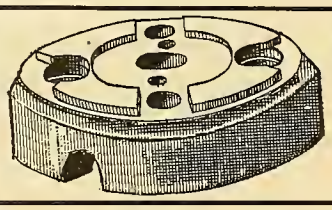

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One 300-Light Brush.
Two 65-Light Van Depoele Arc Dynamos.
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One 600-Light United States, 110 volt.
Fifteen 1,200-C. P. Brush Arc Lamps.
Sixty No. 16 Brush Arc Lamps.

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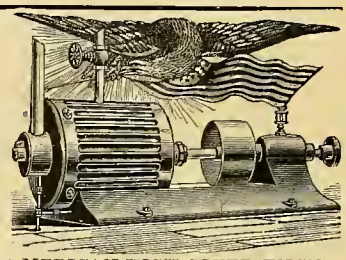

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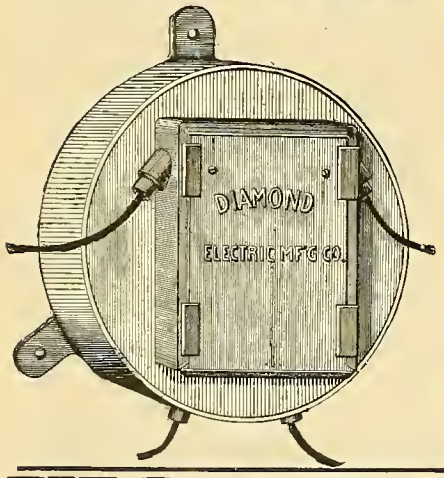

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NEW YORK SAFETY STEAM POWER CO.,

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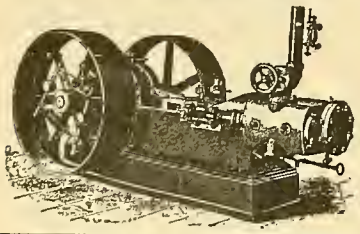

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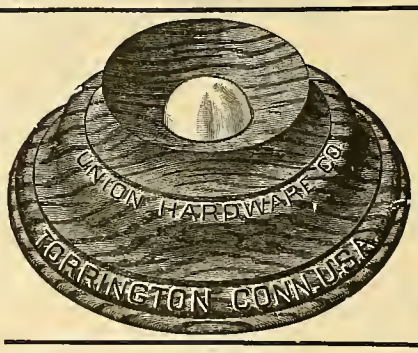

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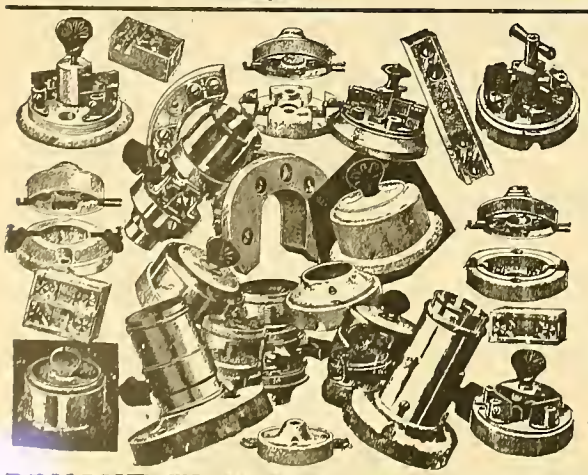

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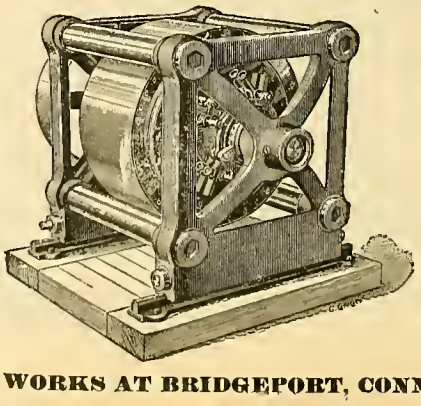

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Western Electrician.

EVERY SATURDAY.

Vol. XI. CHICAGO, DECEMBER 31, 1892. No. 27

Electricity at the World's Fair.

One of the queerest applications of electricity at the World's Fair is the attachment of a motor to a machine that is doing a large share of the painting—or kalsomining, to be strictly correct—on the interiors of the great buildings. The photographic reproduction that is given on this page shows the electric painting machine at work, very appropriately, in the electricity building. It was discovered some months ago that it would be very difficult, even with a small army of men, to do all the necessary painting by hand, and so C. Y. Turner, who is interested in the painting contract, devised the apparatus shown in the illustration, with the assistance of which two men can apply as much kalsomine in a day as forty men with brushes. The painting machine consists essentially of an electric motor, a rotary pump, a barrel of kalsomine, a line of hose and a flat nozzle. The nozzle consists of a gas pipe about a foot long, pounded flat at one end so as to leave an opening about an inch across and wide enough to insert a sheet of card board. The pipe is attached to a long piece of rubber hose, the other end of which is dipped into a barrel of paint. A rotary pump run from a countershaft operated by an electric motor forces a current of air and particles of paint through the hose. The force of the air scatters the paint in a fine spray as it comes from the gas pipe. A painter simply seizes the gas pipe, holds it about eighteen inches from the surface he is decorating, the electric motor is turned on and the work is done. Mounting two men with this device upon a movable platform scaffolding, the work of a gang of men for a fortnight can be accomplished in one day. The motor used is of the Edison type, of five horse power capacity. The arrangement has been in successful operation for some time. The color used for the interior of the electricity building is a very delicate blue, and it is evolved out of several component parts. A deep Prussian blue is the pronounced color taken as the basis. Dutch pink, which is not pink at all, but rather a reddish yellow, is another component, and these two are tempered with white in the proportion of 360 pounds of whiting, four and one-half gallons of Dutch pink and one and one half gallons of Prussian blue. All the great iron arches in the roof have been painted by brushes. Half a dozen men are still plying brushes above the galleries, but in other portions of the building hose lines are playing on the woodwork. The effect of the tinting is very pleasing, and the work is now nearly completed.

The contract for exhibiting "electrical fireworks" at the World's Fair grounds next year was awarded by the directory to a French company, in which Mons. Champion is the moving spirit. The latter, who makes a specialty of work of this kind, has prepared plans for a most elaborate exhibit of striking lighting effects, which, for the lack of a better word, are called fireworks. The most interesting and pretentious piece in the exhibit will be an allegorical representation, of which an idea can be gained from the accompanying outline sketch, Fig. 2. To represent this picture, lights by the thousand and scores of moving figures will be employed. The underlying idea, which is obtained from *L'Electricien*, is as follows: A figure representing the city of Chicago is seated at the base of the statue of "Liberty Enlightening the World," and is surrounded by the states of the Union. The various powers of the world file past, displaying trophies of their progress in civilization, and Chicago confers upon them palms of peace. In the illustration England, with its reward of

FIG. 1. ELECTRICITY AT THE WORLD'S FAIR.

merit, is leaving the stage at the left, while the chariot of France advances from the right to receive the palm. In accordance with the programme the proper national air will be played by musicians as each nation passes the dispenser of the palms. After this scene has been represented three figures will stand forth in a blaze of light reflected from 250 arc lamps to typify the fraternity of the nations of the earth. This picture has been planned on a magnificent scale. In width the symbolic representation will be 195 feet, while its height will be 130 feet. The figures will range in height from 10 to 12 feet, and the statue of liberty will hold her torch 33 feet above the base. The moving figures will be supported on carriages which will be concealed by the drapery. The other fireworks will be of a more conventional order and will represent cascades, bouquets of flowers, revolving suns, etc. It is stated that the effects produced by electrical means will be fully as pleasing and striking as those accomplished by the burning of powder, while there are the added advantages that danger from fire will not exist and that pieces may be repeated at will. Electricity is employed by groups of incandescent lamps, by arc lights and by sparks resulting from breaking and making a circuit, and by combinations of these three means. Champion will use at the World's Fair grounds, the French paper asserts, the astonishing number of 180,000 incandescent lamps of varying candle power, but the great majority will be of 10 candle power, together with 250 arc lamps. For the allegorical representation it is said that 70,000 incandescent lights will be required, and for producing the mammoth bouquet 110,000 incandescent lamps will be necessary. The other pieces will take from 3,500 to 15,000 lamps. For the supply of current sufficient for the purpose, but continuing for a few moments only, it is obvious that direct feeding from dynamos would be out of the question. Champion consequently employs accumulators, and according to his estimate about 210 tons of plates will be necessary. The batteries will be charged during the day, but the storing process will be continued by three 500 horse power generators during the performance. Champion is a great enthusiast in this line of work. He began the study of the subject in 1888 and took out his first patents in the following year. He encountered all sorts of difficulties in endeavoring to introduce his system of electrical fireworks, but succeeded in making an installation in 1890 in the Casino of Paris. Here he employed 2,500 16 candle power lamps, and his exhibitions given each evening were highly successful. Fire, however, destroyed his plant, and for this reason he was unable to exhibit at the Frankfort Electrical Exposition. Subsequently he introduced the system in the Casino of Boulogne sur Mer and achieved no little success in his exhibitions. His great effort, however, will be made at the World's Fair, where he expects to produce the most astonishing electrical effects to be seen in that great exposition.

FIG. 3. ELECTRICITY AT THE WORLD'S FAIR.

The first to be installed of the three electric traveling cranes for machinery hall is that shown in the illustration, Fig. 3. As heretofore described in this journal, this building consists essentially of three series of iron arches. The crane shown in the picture is operated in the center span and is of 20 tons capacity, like the other two. It was made by the Yale & Towne company of Stamford, Conn., while the other two are from the establishments of the Morgan Engineering company of Alliance, O., and William Sellers & Co. of Philadelphia. Each crane will be operated on a track 1,400 feet long and weighs about 50 tons without load. As shown in the illustration, the Yale & Towne crane has two trolleys, each of ten tons' capacity. It is operated by five motors of the United States company's Manchester slow speed type. One, a 25 horse power machine, suffices for the bridge travel, while two 10 horse power motors, one on each trolley, operate the hoists. The cross travel is taken care of by a three horse power motor on each trolley. Current is taken from two No. 2 B. & S. wires by Thomson-Houston under-running trolleys. The crane can travel at the rate of about 500 feet a minute. During the fair proper it will be fitted up for the accommodation of passengers, of whom about 300 can be carried at one time. An excellent opportunity will thus be given for viewing the busy scene beneath.

Electric elevators will not be neglected at the World's Fair, eight having been installed in the administration building by the Crane Elevator company. A view of one that is now in operation in given in Fig. 4. Power is furnished by a compound wound 25 horse power Eickemeyer motor, current being taken from a 220 volt C. & C. generator temporarily installed in machinery hall. So far these elevators have given much satisfaction. The photograph from which the illustration was made derives additional interest from the fact that it was taken by arc light.

On a recent Sunday evening a crowd of fifty persons, with new accessions every minute, was seen gathering on a street in Wooster, O. An investigation proved that this crowd was viewing with great delight the awful grandeur and brilliant display of Biela's comet. Suddenly, to the great surprise of everybody, it was discovered that the object they were admiring was not Biela's comet at all, but an ordinary every night electric street light at the outskirts of the town.

An Unfounded Report.

Considerable excitement was aroused among the members of the electrical fraternity in Chicago by the publication in the *Inter Ocean* of the 23d instant of an article entitled "Taken by the Trust," asserting that the General Electric company had absorbed the Westinghouse company and that it would complete the latter's World's Fair contract. After diligent effort the representatives of the WESTERN ELECTRICIAN were unable to find anybody in Chicago who could confirm the story. Lieut. E. J. Spencer was given as authority for the statement in the newspaper article, but he denies the authenticity of the interview.

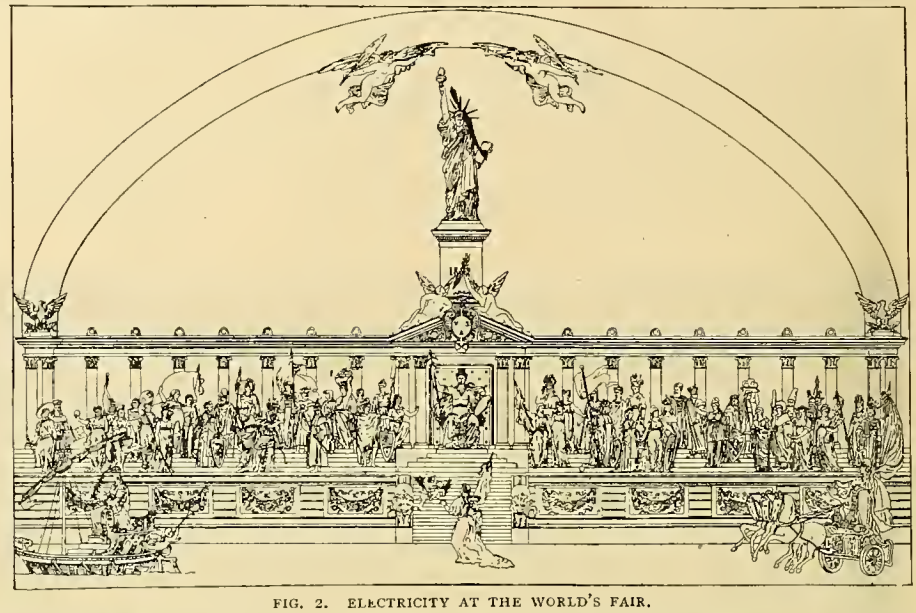


FIG. 2. ELECTRICITY AT THE WORLD'S FAIR.

This letter, dated New York, December 23d, from the United States Electric Light company, was published on the 24th:

The report that the contract for lighting the World's Fair has been turned over to the General Electric company by the Westinghouse company is without foundation. We are authorized to say that the Westinghouse company has had no negotiations, either directly or indirectly, with the General Electric company, or with any of its representatives, looking toward the turning over of this contract or toward a union of interest. The Westinghouse people claim that with the new lamp, which they say they can sell at less than half the cost of the Edison lamp without infringing the Edison patents, with the business now earning at the rate of 15 per cent. per annum, with orders on hand to keep the factory running night and day, and with the representatives of local companies of the General Electric company coming to ask terms for the use of the new lamps and their better machinery, they claim that there is every reason why the independent course decided upon should be maintained in the interests of the stockholders. The addition to the works of the company now being completed will raise the capacity of all its shops to an output of $10,000,000 per annum. The Westinghouse people say that these reports are evidently put out in the interest of the General company to prevent a large number of customers from transferring their business to the Westinghouse company, for it is evident that trade is interrupted so long as such reports are out and uncontradicted.

The Career of Mr. Herz.

Of the American career of Dr. Cornelius Herz, now so prominently mentioned in connection with the Panama Canal scandal that is agitating France, an exchange says:

He married a Boston lady and went to San Francisco in 1875 to live. There he practiced medicine and served several years on the municipal board of health. About this time he became interested in electricity. He dug into it deeply and made a success of it. He then started electrical works in San Francisco and other parts of the coast. Then he made up his mind that France was the field for him and he went to Paris. He founded *La Lumiere Electrique*, which was a success from the start and had correspondents all over the world. He was the head and front of the electrical exhibition of 1881, and in the congress of electricians held during the exhibition he was a representative of the United States. He sought this position to show his loyalty to his adopted country.

The Brush Electric Light company of Moline, Ill., has asked the city council for an extension of time to equip its electric line in the city, and the matter has been referred to the committee on ordinances.

The board of directors of the Westinghouse Electric & Manufacturing company has declared the semi-annual dividend of 3½ per cent on the preferred stock, payable January 3d. Transfer books closed on December 20th and will be reopened on January 4th.

Bellamyism in Chicago.

Alderman Tripp, a member of the city council, is endeavoring to bring about a "reform" by which the city of Chicago will go into the business of electric lighting on a commercial basis. At last week's meeting of the council he introduced a resolution providing for the appointment of a committee to go to Springfield for the purpose of inducing the next Legislature to amend the charter of the city in such a manner that the municipal authorities could set up as producers of electricity and gas to be sold to the public. The resolution was adopted. Not satisfied with the municipal ownership of street lighting stations, the aldermen now propose to sell light to the people at large. No doubt the next venture will be in the grocery or dry goods business.

On the part of the advocates of this socialistic measure, it is urged that the city has as much right to sell gas and electricity as it has to exact water rates, and that the municipality could furnish current for lighting at lower rates than now prevail and still make a profit. This idea is set forth in the following interview with Alderman Kent:

We have at the present time several electric plants with well equipped power houses through which the city lights many of our principal streets. To make the system more widespread all we require is permission from the Legislature to enter into the business of selling light, heat and power to private users. It is not necessary that we should attempt to get authority to issue bonds in order to raise money to buy electrical apparatus. Our existing apparatus is enough to begin with. Every year money enough could be made to extend the system, and in this way we would have a first-rate system in a few years. The Arc Light company at the present time charges $15 for a good-sized lamp used within a specified time. We own miles and miles of wires extending all over certain sections of the city. These wires could be tapped at intervals and light, heat or power supplied to merchants and business men along the route. The city could furnish lamps at $10 apiece and would then make money. Not much money would be required to make the connections between the main wire and the business places, but the returns would be immense. A slight extra expenditure is all that is required to begin. There need be no issuance of bonds and no appealing for money, for the profits would be sufficient to extend the light, heat and power system all over the city in a short time.

The mayor, too, thinks the idea a good one, for he says:

A new department should be organized to control the gas and electric business on an improved arrangement, but in the same general way as the water office transacts its business. The department will be created by ordinance and placed under a superintendent. The city would then be in a position to enter into competition with private corporations. If the city should come into competition with these other concerns the rates to consumers would be reduced.

If the scheme is ever put in practice it may be assumed that the city officials will know more about the electric lighting business before they get through with it than they do now.

An English Transmission Scheme.

An important project was brought before the British public in a paper read before the Manchester Association of Engineers on November 12th, by B. H. Thwaite. The scheme is, in short, nothing less than to generate power by burning coal at the pit's mouth, and to transmit the power electrically to manufacturing centers. The coal will first have its valuable "residual products" removed. As these form the most valuable portion of the coal, the fuel actually used may be itself fairly regarded as the residual product of the distillation. Gas engines are to be employed instead of steam engines and boilers, and the power is to be transmitted by high pressure alternating currents. Mr. Thwaite's scheme resembles that of the Niagara Power company, but it has this essential difference. At Niagara it seems to be taken for granted that, to a large extent, the consumers will come to the power, whereas Mr. Thwaite brings the power to the consumers. The Niagara plan has the advantage of using water which costs nothing, but in the English scheme the coal costs very little, being only 2 per cent. of the cost of the power delivered in London from the Midlands. For such a scheme England has an enormous advantage, because of its small size, over America. To supply light and power from Niagara to the various American manufacturing towns would be ruinous on account of the distances; in England the cost of conductors is a comparatively small portion of the total cost.

Mr. Thwaite and James Swinburne have drawn up a report upon the project for transmitting power from the South Yorkshire coalfield to the metropolis. The same trunk lines and way-leaves can be utilized for serving the large towns, including Derby, Nottingham, Leicester, Northampton and Bedford. It is suggested that an auxiliary generating station be located in South Staffordshire, the trunk line from which would serve Wolverhampton, Birmingham, and the industrial areas in the line of its route across to the point where it joins the main trunk line serving the metropolis. Two alternate specifications have been obtained, one from the Maschinen Fabrik Oerlikon, and the other from Messrs. Brown, Boveri & Co., Baden, Switzerland.

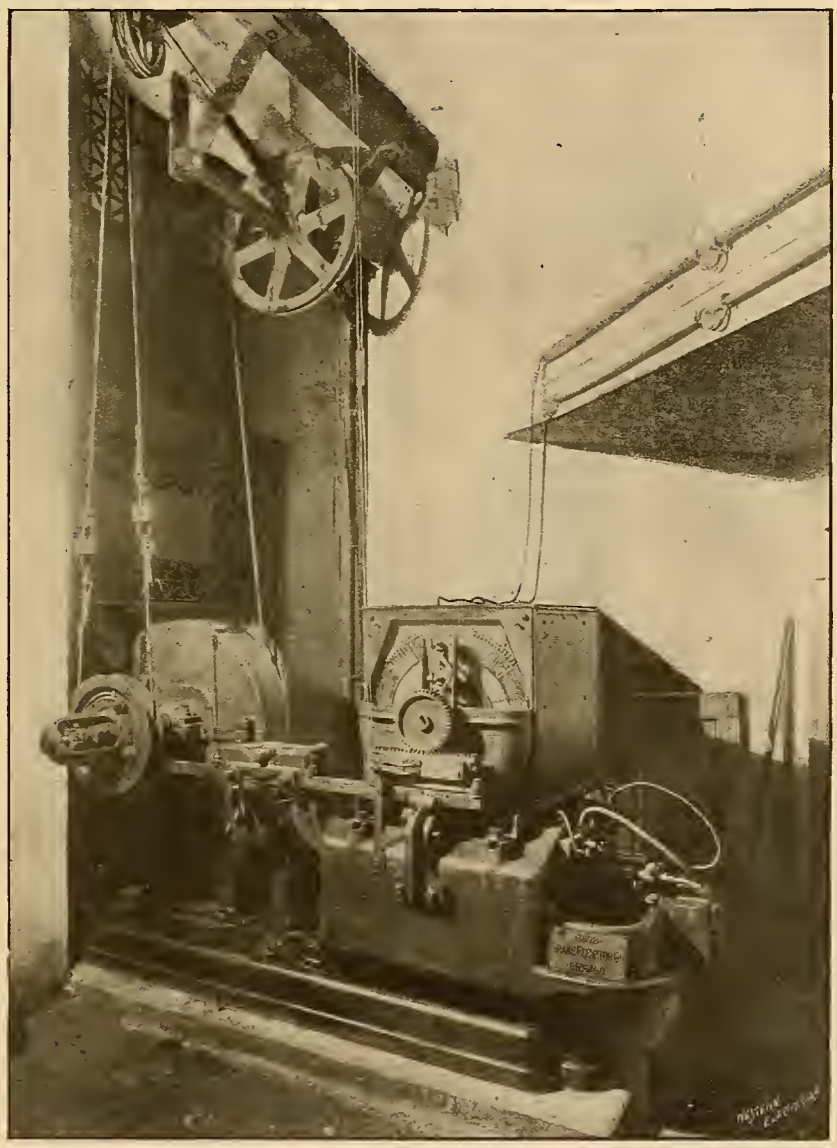


FIG 4 ELECTRICITY AT THE WORLD'S FAIR.

A movement is on foot for the erection of a monument in Goettingen to Gauss and Weber.

The managing committee of the Frankfort Exhibition of 1891 recently issued its final financial statement. The total disbursements were $321,000, and the total receipts $345,000, thus leaving a profit of $24,000. Of this balance 15 per cent. was handed over to Oscar von Miller, in accordance with his agreement; and the surplus was devoted to repaying subsidisers, the latter obtaining about 25 per cent. of the sums originally paid by them for space.

West End Car Stables Burned.

[Special dispatch to the WESTERN ELECTRICIAN.]

BOSTON, December 24.—The mammoth new car stables of the West End street railway at Everett were burned to the ground last night, entailing a loss of $135,000 upon the company and causing the death of four employes.

The fire was discovered just before seven o'clock, and was caused, according to the testimony of the engineer in the boiler room, by a sudden back draft as he threw the furnace doors open. A large body of gas rushed out, and catching fire, an explosion took place which sent coals flying all over the room. The flames spread quickly and the men in the building had barely time to escape. A few of them rushed back into the building in an attempt to save some of the property, but this move resulted fatally to four of them. John Clark, Luke Glennon and George Wallace, motor men, and Hugh McGuinness, night watchman, never came out again, and their bodies were found in the ruins.

The building was of wood 80 feet wide, 283 feet deep and 35 feet in height. It had just been built for the purpose of storing electric cars, and there was a large amount of rolling stock in it. A great deal of inconvenience is being caused the West End, for the reason that a large number of new car heaters with which they were experimenting were stored in the building and were all destroyed. Some of them had been put in place in cars and others were being manufactured in the basement of the building. Eight box cars, twenty open cars, two electric snow plows, two horse plows, office furniture and all the mechanical apparatus were destroyed. J. C. E.

Electricity in South African Gold Mines.

At the second ordinary general meeting of the shareholders in the Champ. d'Or (Transvaal) French Gold Mining company, the chairman, E Montfort, made the following interesting statement: "Among other things, we might mention to you that we have been the pioneers of the introduction of electricity as a motive power for mines in the district. In the month of September last we introduced on our mine the first permanent plant for the electrical transmission of power, and since that time it has been running without stopping either night or day. Since its inauguration the plant has been increased, and now consists of two dynamos, driven from the mill countershafting, and connected by overhead copper wires to the motors at the reservoir, which is seven hundred feet from the mill. These motors drive the pumps and supply water for the whole mill. A starting switch at the mill allows the motor pump to be started, stopped, or regulated in speed, so that no attention is required at the motors or pumps. Thus a considerable saving of labor and wear and tear is effected. Previously the pumps had been driven by a wire rope, which was always giving trouble, and necessitated frequent stoppages of the mill for repairs, and it also wasted considerably more power. The estimated saving and gain from this source alone is reckoned at the rate of nearly £4,000 per annum."

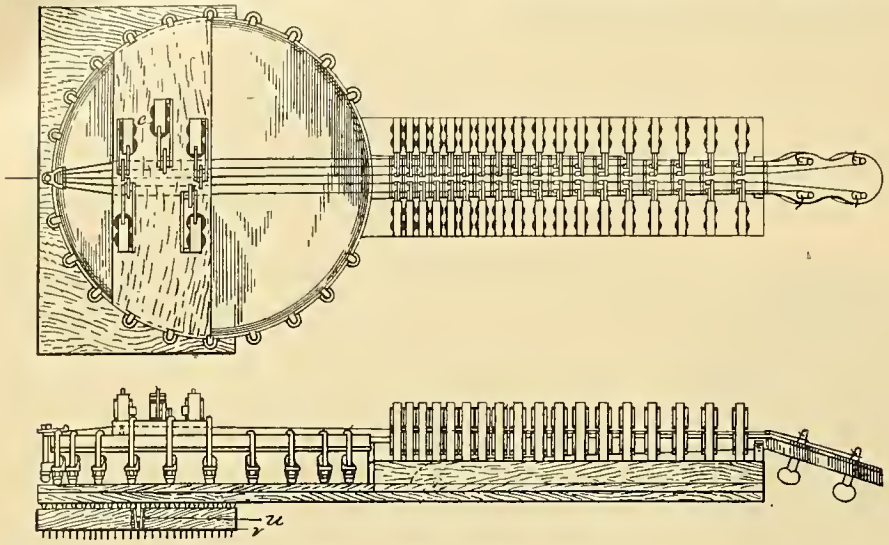
Progress in Italy.

The municipality of Milan, in Italy, has made a compromise with the Edison company regarding the installation and working of an electric tramway from Piazza del Duomo to Porta Sempione and to the Arena. The concession has been given for a period of one year for trial, and the Edison company has the option of adopting the electric system which it considers best, either with overhead or underground conductors. If at the end of one year the results of the working of the electric tramway are satisfactory, electric tramways are to be substituted for omnibuses, and in course of time the entire tramway service of the city will be placed in the hands of the Edison company. The power for developing the necessary current is to be obtained from the falls of Penderno and Tornavento.

Playing a Banjo by Electricity.

The accompanying cuts illustrate an arrangement devised by W. H. Gilman of Boston for the purpose of operating stringed musical instruments by electricity. By this contrivance tunes may be mechanically played upon a banjo, mandolin, guitar, harp, or other similar stringed instrument.

The arrangement consists of movable fingers set over



FIGS. 1 AND 2. PLAYING A BANJO BY ELECTRICITY.

the strings of the instrument at the frets, and adapted upon the closing of an electric circuit to be depressed upon the string to change their vibrating lengths in order to vary the tone. Star wheels, arranged in proximity to the strings, are adapted to be moved, upon the closing of an electric circuit, to "pick" the strings and sound notes.

Of the illustrations Fig. 1 is a plan view of the arrangement, and Fig. 2 is a side elevation, a small part being shown in section. Fig. 3 is a plan view of a piece or a sheet of "music" and the means which act directly upon the music sheet. Fig. 4 is a side view, partly in section, showing the means for picking the strings. Fig. 5 is a diagram illustrating a way of forming the electric circuits to actuate the means for picking the strings and depressing them at the frets. Fig. 6 is a sectional end view of the means for depressing the strings at the frets.

In the cuts a banjo is shown which is arranged upon a suitable frame or base board of wood. Electromagnets are arranged along on opposite sides of the neck of the instrument opposite the several frets, there being in the present instance two electromagnets, one placed above the other on each side of each fret.

The armatures of the electromagnets, upon the inner free ends of which is a downwardly extending finger, are arranged directly over the strings, as shown in Fig. 6. The finger on the lower electromagnet on one side is arranged over string 1 of the banjo, the finger of the magnet thereabove over string 2, the finger of the lower magnet on the opposite side over string 4, and the finger of the magnet above that last mentioned, over string 3.

In Figs. 1 and 2 are shown electromagnets arranged with star wheels, Fig. 4, upon a board supported over the

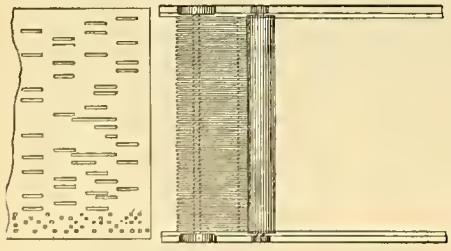


FIG. 3. PLAYING A BANJO BY ELECTRICITY.

head of the banjo, there being five electromagnets and star wheels in this instance, one for each string of the instrument. There is therefore one star wheel to each magnet on the board and to each string of the instrument. Each star wheel is so constructed and arranged that when it is turned to the extent of one of the teeth formed on its periphery, it will pick the string which it is intended to sound.

The ratchet wheel connected with the star wheel is actuated by a pawl connected with the armature of the electromagnet arranged upon the board, as is clearly represented in Fig. 4.

The "music," shown in Figs. 3 and 5, is a sheet of fiber board or fiber paper, or other non-conducting material, provided with slotted apertures throughout the major portion of its breadth, and small holes upon one side. A series of fingers n are pivoted upon a bar o their free ends being arranged to drop down into contact with another series of fingers p secured upon a bar q, extending between standards r. Connected with the fingers n and p are wires s t of an electric circuit, so arranged that the circuit may be closed when the finger n rests upon the finger p, and be broken when finger n is raised from the finger p. From each finger n its wire s extends to a thimble u which projects through the baseboard v, Fig. 2, under the head of the banjo, and this thimble is in electrical connection with a wire which extends to one of the electromagnets on

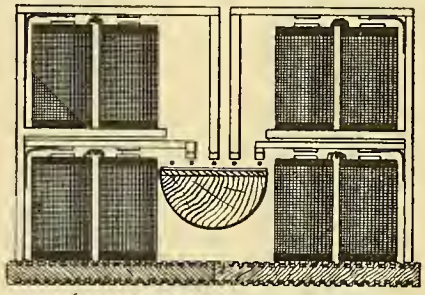


FIG 6. PLAYING A BANJO BY ELECTRICITY.

opposite sides of the neck of the instrument. The return wire, which is in electrical connection with each magnet, is the wire t, which, as was before stated, is connected with each of the fingers n.

The wires from certain of the fingers n (in the present instance the lower five fingers shown in Fig. 3) extend

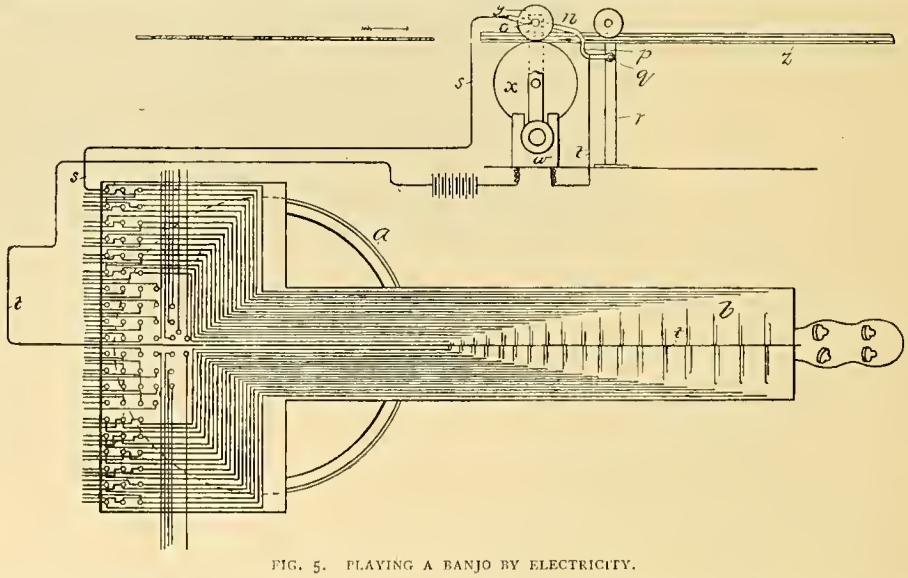


FIG. 5. PLAYING A BANJO BY ELECTRICITY.

to the electromagnets on the banjo head, these magnets being also in electrical connection with the return wire t. An electric motor rotates a roll which moves the music along.

The use of the device may be described as follows:—Supposing a sheet of music to be placed in the guideways and the motor to have been set in operation. As the sheet is passed forward in the direction of the arrow, Fig. 5, the free ends of the fingers n falling within the lines of the slots will drop through them into contact with the opposite fingers p, closing the circuit through the fingers, energizing the electromagnet in circuit, with the effect of attracting its armature d and depressing a string at a fret on the neck of the instrument by the descent upon it of the finger e. As the free ends of the five fingers represented on the lower side of Fig. 3 meet and drop through the holes of the sheet they will in like manner effect the closing of electric circuits, resulting in the energizing of the magnets on the banjo head and the turning of the star wheels to the extent of one tooth, thus picking the strings. In this way it will be seen that a sheet of music may be prepared so as to close the frets

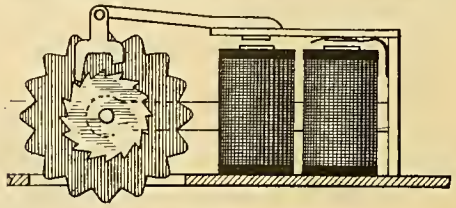


FIG. 4. PLAYING A BANJO BY ELECTRICITY.

and pick the strings of a musical instrument with absolute correctness.

The Specialization of Accumulators.[1]

We are rapidly coming to the time when it will be considered as loose to speak about or specify an "accumulator" as it is to specify a "dynamo." The time was, and not so many years ago, when, for ordinary purposes, there was only one kind of dynamo made—the shunt Gramme ring type—and this was used for any purpose that might be required, bolstering up its incapacities with resistances or other makeshifts. Nowadays, the requirements of a situation are accurately determined, and the dynamos are specified and made—direct or alternating, shunt or compound, or over-compounded, with light fields or heavy fields, large air gap or small air gap—according to the conditions for which it is required. The same specialization of the accumulator has not yet been achieved, but it must come. There are two entirely different ways of considerating the accumulator, as we have already had occasion to point out, in that the accumulator may be considered, in any generating plant, either as belonging to the plant, the capital side of the account, or to the fuel or maintenance side. The tendency which at first was to consider the accumulator entirely as plant has lately swung over, to a very large extent, to the tendency to consider it as a factor in the maintenance account. The two points of view are distinct. They require different methods of calculation and arrangement. Both are equally necessary, and although it is evidently well to pay attention to the maintenance theory, the other must not be left too much out of account.

The two views differ more particularly in this: that, considered as plant, the accumulator should be of the utmost perfection at all points, price being to a large extent a secondary consideration. The same thing is seen with other plants—dynamos, for instance. Where power is dear, it is certainly better to buy the very best dynamo, even if considerably dearer. On the other hand, if the accumulator is to be considered as maintenance, an item to be gradually used up, of the same relation, in fact, to the output as coal itself, then cheapness, combined with a fair efficiency, is the quality required, the wearing out being calculated as part of the cost of production of the current. On the one hand, then, the accumulator is deserving of the same extent of skill, of investigation and improvement which has given us the dynamo of 98 per cent. efficiency, and on the other, is subject to the same considerations which lead an engineer to select his type of coal. Requirements differ, and accumulators, therefore, must

1. From the *Electrical Engineer* of London.

receive the same amount of specialization that has been given to the dynamo, each occasion for their use being considered on their merits. We shall find, primarily, four different types of accumulators—portable, traction, house, and station cells. The requirements for the first are extreme lightness, with capacity for a steady discharge; the traction cells are also required to be light, but with the capacity of responding without deleterious effect to uneven and heavy discharges; the third, the house cells, are required to be of a nature not necessarily very light in weight, which can be charged regularly, will render a high efficiency at heavy discharges, and will maintain their charge without local action for days or even weeks; the fourth, the station cells, also need not be light, but must be able without bad effect on the plates to respond to heavy and sudden demands to fill up the breach in case of failure of dynamo, for a few hours at a time. Now these requirements differ almost as largely as those for dynamos, and in the same way that the cost, proportions, and weight of these machines are considered beforehand and provided for by the designers and manufacturers, must the design and manufacture of secondary cells be considered. A method of perfection costing a shilling or two extra for accumulators would not, perhaps, be worth application for one type of plate, which might render the most efficient service for another. We make, therefore, a plea to both consulting engineers and manufacturers for still further efforts in the direction of the specialization of accumulators, confident that greater attention to this point must prove of advantage to the industry at large. Qualities that militate against the use of one type of cell may certainly prove of advantage in other fields of work, and it will be of utility that the outside consumers should be aware that they can obtain cells of this or that character as accurately as they now can their dynamos.

An Ideal Central Power Station.[1]

By C. J. Field, E. J. Cook and F. Bourne.

It was with some reluctance that we accepted the title of this paper, realizing all that the words imply and the difficulty of fulfilling their requirements. We therefore have tried to carry out the idea as fully as possible by taking as a design a type of station which seems to indicate more fully than anything else the latest and prospective development of the best practice in central power stations.

We will, therefore, take the subject up and divide it into several different heads or divisions, and try in general to indicate, by the plans and specifications illustrated herewith, what we believe to be an ideal central power station, and will treat it by giving a brief general outline of the several points and close it by attaching to the paper what may be termed a sort of general specification covering the important points—as building, engines, boilers, generators and piping.

UNIT OF POWER.

The unit of power to be selected for the central power station is one of the first and most important elements to be considered after deciding on the capacity of the station. We have selected for this ideal station 6,000 horse power as the total capacity. The question immediately arises, How many units of power shall it be divided into? We have found the following as a good rule to follow in deciding on the size of units, and that is, the number of units in any power station shall be the fewest consistent with safe and economical operation of that station. This shall be our foundation stone to build upon, and should be followed in the broadest possible sense. Experience has too often proved that power stations have been divided into too many units. This has been occasioned largely by two reasons: First, uncertainty of the development of the capacity of the station; and, secondly, inability or inexperience of manufacturers in the development and building of large generators.

The business now of building power stations and manufacturing the apparatus has reached such a commercial stage of development that both of these factors are eliminated. We now find capital ready and willing to invest in large power station enterprises, both for railway and general power work; also manufacturers with experience in machinery and ability to develop and build any commercial size of generator required or called for.

The unit of power should be proportionate to the size of the station, and in the size of station we selected we believe a thousand horse power unit to be one which fulfills our requirements in every respect, both for safety and economy in operation. The engines are so built that where a small amount of power may be required for light loads late at night, the engines can be operated with economy on reduced capacity, even down to a few hundred horse power. This removes the necessity for one or two small units, as has been customary to install in some stations of this class of work. They, as a rule, fill the space which could be taken by a larger size generator. A larger number of units proportionately than here laid out means additional expense in handling and caring for the machinery, also additional building space and real estate. The problem is now to concentrate all power into as few units as practicable.

DIRECT CONNECTION OR BELTING.

The problem is still in the minds of many people whether to use generators directly coupled to engines, or belted, as in the earlier type of station. Formerly we had no choice in the matter. Generators, except in a few cases, were not built in this country for direct connection work in a commercial sense. We could only belt to the engine directly or through countershaft. We do not propose to go into any extended controversy or argument on the three styles of connections, but only point out a few facts to be considered in this connection before deciding.

In a power station of the size herein indicated and located, as would generally be the case, in or about a large city, entailing considerable expense for real estate, and more expense for the building, the problem which at first reaches the engineer's mind is how to concentrate this power within as small a space as is practicable without crowding, and also to economically operate the plant.

Looking at it from this point of view, the relative space required is, roughly, as two to one; in other words, a belted plant would require about five square feet of floor surface per horse power as against two and one-half square feet with direct connection plant. This means a saving of one-half the cost of real estate in building and also concentration of the power for handling. On the other hand, we have not secured flexibility of connection between the engine and generator, which we have in the belted plant, and the relief to the engine which is afforded by belt against the shocks of short circuits, etc. These are facts which should be more fully considered than they have been in the designing and building of a proper type of engine for direct connection. Ample fly-wheel capacity is one of the most important requisites for such an engine and ability to withstand direct shocks of short circuits and overloading of the generators. When these problems have been fully met, both theoretically and practically, we have no doubt that the development of the direct connection station will be rapidly extended. At present we are just beginning to enter what might be termed the era of direct connection work commercially, having as a basis for experience small practice in this country in special cases and a more extensive practice in Europe in this line.

POWER STATION BUILDING.

For power station building there are shown in Figs. 1, 2 and 3 general features and details of construction of a building adapted for this style and capacity of station.

The power station building is a factory for producing a commercial commodity and should be treated in that sense, the essential requirements being solidity of construction and protection against fire or any other accident to the machinery contained therein. The design of these buildings is too often placed in the hands of local architects, inexperienced and unacquainted with the requirements of such a building, and we find as a result many power stations in which the machinery has to be placed to fit the building, instead of, as it should be, the machinery laid out and the power station built to cover and properly protect it; being built, therefore, from an engineering point of view instead of an architectural one.

Without attempting to go into details or producing a regular building specification, we have tried, under the head of "Building Specifications," to cover the main features required in such a building.

BUILDING SPECIFICATIONS.

Excavation—Excavate the entire space under the engine room to a depth of ten feet, so as to get clear head room of eight feet in basement. Excavate for all side, cross and gable walls, all foundations, and also central space between boilers to form a basement under the boiler room for ash and coal handling apparatus, flue and pipes.

Foundations—If ground is good, lay base of concrete (four broken stone, two sharp sand, one hydraulic cement) and make footing courses of brick work or coursed rubble masonry of good, firm building stone, laid in cement mortar of three parts sand to one part cement. In case piling is necessary, test piles should be driven on different parts of the property in order to determine the bearing capacity of the pile under the conditions present, noting the amount the pile sinks under the last blows of the "monkey." Allow a factor of safety of from 4 to 15, depending on the conditions present. Piles should be of hemlock or spruce, perfectly straight and round, a 40 foot pile having not less than a 12 inch butt—the piles, after being driven, to have heads sawed off below mean low water to a uniform level; all piles in water to be capped with granite foundation stone, while those with heads in earth to be capped with a grillage of 12 by 12 spruce and 3 inch plank timber, and the whole filled with concrete well rammed. Lay foundation proper on this grillage.

Walls—All walls should be of brick work from 16 to 20 inches thick, with pilaster at each roof truss, having at least 8 inches projection and 24 inches face. Carry these to a height of at least 25 feet, so as to allow clear head room of at least 20 feet below the traveling crane in power house. All brick should be burned and should have clean, sharp edges, no salmon or light colored bricks being allowed. All brick work should be laid in cement mortar. The cement should be Dyckerhoff's or English Portland. All bricks in the face of the wall should be selected. All joints should be pointed. Pilasters on side walls of engine room should be built out by offsets and capped with stone binder for carrying rails of traveling crane. Set side ventilators in walls near ground line.

Roof—The roof should be iron truss, riveted type, furnished with iron louvre, with side ventilator that can be operated from the floor. The top of louvre should be furnished with heavy hammered glass. The roof should be covered with Norway pine plank, splined and then covered with black slate of good quality laid with not more than 5 inches to the weather. All flashing around walls and all gutters to be of 16 ounce copper. The whole to make a weather-proof job.

Engine Floor—The engine floor should be of two layers of plank, the first of yellow or Norway pine splined with hard wood, this floor to be covered with about one-eighth inch of plaster and then with a second floor of seven-eighths inch second quality maple laid at right angles to the first. The first plank to be not less than eight or more than 12 inches and securely bolted by hook bolts at every beam to the iron I beams. The second floor should not be over 4 inches in width and should be blind nailed. All plank should be neatly fitted about all foundations and hand planed and smoothed and finished with two coats of boiled oil put on warm.

Engine and Boiler Room, Basement Floor—This floor should be made of not more than 6 inches concrete, well rammed and graded to drain, and finished by means of fine stuff floated smooth by means of hand trowel.

The boiler room floor between boilers should be made of steel I beams covered by means of cast iron plates of suitable pattern. All other parts of the fire room should be

[*Continued on page* 335.]

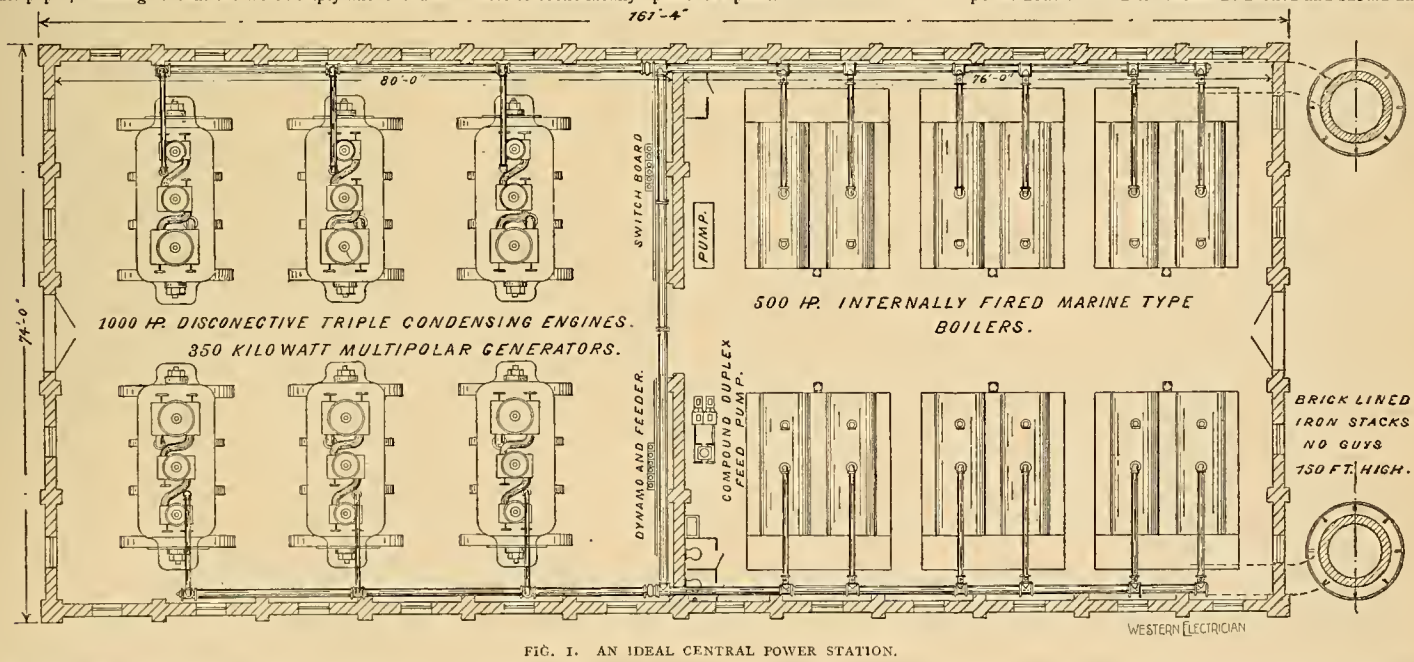


FIG. 1. AN IDEAL CENTRAL POWER STATION.

1. Read before the Chicago Electric club, December 19, 1892.

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CORRESPONDENCE relating to electricity, or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

PAGE.

Electricity at the World's Fair. Illustrated. 329, 330, 331
An Unfounded Report..... 330
The Career of Mr. Herz..... 330
Bellamyism in Chicago... 331
An English Transmission Scheme..... 331
West End Car Stables Burned..... 331
Electricity in South African Gold Mines..... 331
Progress in Italy... 331
Playing a Banjo by Electricity. Illustrated..... 332
The Specialization of Accumulators.....332, 333
An Ideal Central Power Station. Illustrated. By C. J. Field, E. J. Cook and F. Bourne. (Chicago Electric club). 333, 335, 336, 337
Editorial..... 334
Pfluger's Line Tightener. Illustrated..... 337
Queen's Portable Reflecting Galvanometer. Illustrated..... 337, 338

DEPARTMENTS.

Correspondence..... .....338, 339
New Incorporations..... 339
Electric Lighting..... 339
Electric Railways..... 339
Electric Mining..... 339
Telephone..... 339
Telegraph..... 339
Miscellaneous..... 340
Trade News..... 340
Business..... 340
Electrical Patents 340

SOMETHING of a novelty is announced as a feature of next year's street railway convention in Milwaukee. Mr. Payne, the vice-president of the Villard syndicate of that city, has offered electrical exhibitors the privilege of displaying and operating their goods on the various street car lines, and of suitably placarding them. Manufacturers and supply men will appreciate this courtesy, which will no doubt contribute largely to the success of the exhibition held in conjunction with the meeting.

THE excellent paper of Messrs. Field, Cook and Bourne on "An Ideal Central Power Station," presented in this issue, deserves the careful attention of all interested in central station problems. It would be a difficult matter, doubtless, to select an existing plant meeting the exacting requirements of the authors, but it will be generally conceded, we think, that the station described may, for thoroughness and careful engineering, be accepted as a model. The paper is well written, and no engineer or central station manager will lose time by a thoughtful perusal of it.

PIANO playing by electricity was at one time a great novelty. The electrical pianist, however, will now have to take a second place among the novelty designers, for stringed instruments—that is, instruments which are "picked"—can now also be played electrically. The arrangement of an "electrical banjo" is described in another column. Just what sort of timbre, though, will result from the electrical fingering of frets, and how the music will compare with that born in Dixie, we are not prepared to say. However, the apparatus is ingeniously arranged and is well worth the study of those experimenting along this line.

On Friday of last week the electric car barns of the West End company of Boston were burned. The loss of property was estimated to be $135,000. Four men were killed and four others were injured. Two interesting points in connection with this fire may be made. First, the conflagration was not due to the electric current—a fact deserving the attention of our daily contemporaries; second, here is another bitter experience for somebody, which should serve as an example to electric station and car barn builders to frighten them into the adoption of the most approved fire-proof construction. The West End people will have the sympathy of electric railway people, for this company's was the first very extensive city system that was electrically equipped. We think it can be safely said that had it not been for the Boston company's advanced ideas and its nerve in backing the project in such a substantial manner, the overhead electric street railway system would not now have to its credit so many hundred miles of track in cities large and small.

No little excitement was caused one day last week in electrical circles by the appearance in a Chicago daily paper of a story to the effect that the Westinghouse company had been absorbed by the General Electric company. Numerous indeed were the "I-told you-sos;" but the wiseacres, who "knew it would come sooner or later," were nowhere to be found the day after the news of the alleged consolidation. Perhaps the bustle of Christmas preparation accounted for their disappearance.

There was to be found in Chicago or New York no person who would attest to the truth of the report. The gentlemen to whose credit the Chicago daily newspaper had placed the alleged statements not only asserted that they were false, but characterized them as outrageous. One gentleman whose name appeared at the head of one of the interviews, and whose alleged statement had evidently constituted the foundation upon which the over-ambitious reporter had built his interesting tale, is quoted as having asserted that he had not been interviewed for four months.

NEW ENGLAND, dotted thickly with populous and thriving cities, offers peculiar advantages for the extension of electric railways. The latest scheme is one which will unite Boston and Gloucester, and it is something more than a plan on paper. The company has been incorporated, and is composed of a syndicate of Boston and Gloucester capitalists who are energetic, have plenty of money behind them, and think they see a good profit in the enterprise. The corporation name is the Gloucester, Manchester & Beverly Street Railway company. A petition for a charter has already been filed at the secretary of state's office. The termini are to be at some place in Beverly, to be decided upon later, and at the postoffice in Gloucester. The route is to be mostly in the public highways, but it will cross private property in some places where the distance can be shortened by so doing. It will connect Beverly Farms, Manchester, Wenham and Essex, the most fashionable portions of the ultra-fashionable North Shore resorts. This will make a continuous route from Boston to Gloucester through some of the most beautiful seashore scenery in the country. It is rumored that a similar project is under contemplation in the South Shore resorts. There is but little doubt that the time is rapidly coming when Massachusetts, Connecticut, Rhode Island and the southern portions of New Hampshire and Vermont will be covered with a network of electric railways.

THE *Chicago Tribune* is again threshing over the newspaper-worn question of the advisability of giving the municipality the power to furnish the citizens of Chicago with electricity for light, heat and power. This question is now, however, likely to be again agitated, as the city council has adopted resolutions asking the legislature so to amend the city charter as to give the city government this power and also to give it authority to manufacture its own gas. The *Tribune* believes that the city should not go into the manufacture of gas for public or private use, because as it says in a recent editorial, "gas is a decaying illuminant which is being forced out of the field by electricity." But our contemporary sees no reason, "why the city should not do its own electric lighting in whole as well as in part, nor why it should not furnish electricity to private parties along the line of its wires, provided the plants are run with some approach to economy and efficiency, and are not taken in hand by the ward politicians."

It seems a very curious thing that a paper as well versed in the ways of the politician as the *Tribune* should not have become aware by this time that politics would most assuredly rule in the lighting station as in all other city departments. The *Tribune* itself admits that "if the department of electricity is to be as supersaturated with politics as other departments it will be a source of grievous expense." But does the *Tribune* suppose for a moment that it would be possible for the city of Chicago to operate such an electrical supply system without the politicians making it subservient to selfish ends? Could the city enter the field just as a private company might, that is, unfettered by political obligations, then the municipality would have a chance to compete with existing private companies. But with the knowledge of how the city's affairs are at present managed we fear the thinking tax payer will not be inclined to favor the establishment of new departments—and new departments, too, that are not only liable to increase taxes but to interfere with private electric lighting enterprises.

No; Chicago has enough to do without undertaking an enterprise of this sort. Let the present city lighting system take care of itself; extend it by all means if you will; but do not let the people as a whole attempt to play the pirate upon the legitimate businesses of a few. The Chicago city councilmen might better employ their time cleaning the city and preparing for the influx of visitors next year.

IN spite of the obstacles that have beset the path of the accumulator, this much maligned piece of apparatus has gradually advanced until, on the other side of the water at least, it holds a most useful position, not only as an adjunct in the central station, but in other lines as well. In this country, however, litigation has been the chief cause of backwardness, and the accumulator has not been given the same opportunity to prove its usefulness. At the present time, however, the tangle made by the lawyers is gradually being cleared away, and it is fair to presume it will not be long before some of the manufacturers will feel that their positions on patent matters will admit of an aggressive campaign to convince American electricians that they are losers by their failure to make a greater use of the storage cell. When this time comes doubtless we will be able to see that, despite our claims about the great progress that has been made on this side of the water, we are decidedly behind the times. At least such will be the reader's impression after a perusal of the opinions of the London *Electrical Engineer* on the "Specialization of Accumulators," presented elsewhere in this issue.

Our contemporary feels itself to be in a position to point out that the time is rapidly coming when it will be considered "as loose to speak about or specify an 'accumulator' as it is to specify a 'dynamo.'" To-day in drawing up specifications for a dynamo the requirements of a situation are accurately determined, and the dynamo is specified and made—direct or alternating, shunt or compound or over-compounded, with light fields or heavy fields, large air gap or small air gap—according to the conditions for which it is required. "The same specialization of the accumulator has not yet been achieved," says the London *Engineer*, "but it must come."

There seems to be no question but that our contemporary is right in the opinion expressed above. Our foreign cousins make use of the storage battery in a way which leaves no doubt that they at least appreciate its value. And the fact that in England the time is rapidly approaching when the "specialization" of the accumulator will be deemed an advisable procedure on the part of the manufacturers, may be looked upon as a most encouraging sign. The time will come on this side as well as on the other when this step of specialization will be a necessity. We have experienced already, like the English, a demand for several types of cells each specially suited to a particular class of work. The call for portable work is one thing; the call for traction work is another. Then again for house and station service different provisions should be made to insure the best service.

We concur, therefore, most heartily in the opinion expressed in the article referred to, that "greater attention to this point must prove of advantage to the industry at large."

[*Continued from page* 333.]

finished by means of concrete cement same as basement.

Doors and Windows—All floors or main doors should be of some wood ceiling and made, say, 2¼ inches thick and finished with large wrought iron hinges (oxidized hinges and knobs). All doors in cross or partition walls should be made of beaded white pine ceiling laid diagonally and securely nailed, covered with a layer of asbestos board and then entirely covered with black sheet iron fastened by means of round-headed nails. These doors should be sliding with friction rollers, track, etc. All windows should have box frames, all sashes having four lights of American glass, best quality, well bradded and back puttied, fitted with noiseless pulleys, cast iron weights, brass chains and sash locks.

Painting—All woodwork should have not less than three coats of first-class lead paint ground in oil; this includes under side of roof, windows, doors, etc. All iron should receive two coats of metallic paint, one before erection and one after the structure is completed.

ENGINES.

Engine manufacturers and designers to-day are devoting their best time and attention to the development of a type of engine best adapted for electrical power work. We find, therefore, more progress being made this year and still more promise for the year to come than has been made in a number of years on this work. The old high speed engine has done well and the Corliss engine too. Present work and requirements seem to tend to a type of engine combining, it might be said, the good features of both, filling a middle ground and adapting itself more fully to the demands and requirements of large central station work with direct connection. Engines meeting these requirements are now being built and manufactured by such firms as the Lake Erie Engineering Works, Dickson Manufacturing company, Cramp & Sons' Ship & Engine Building company, Pennsylvania Iron Works company, McIntosh & Seymour, E. P. Allis and other builders. We have tried to indicate the requirements of such an engine in the following specifications:

ENGINE SPECIFICATIONS.

Duty—Electric railway and power work. All parts extra heavy.

Type—Vertical, three crank, triple condensing.

Power—Ability to develop for short periods of time a power of at least fifty per cent. above its rated capacity without dropping off in speed of revolution.

Regulation—Regulation effected by means of a shaft governor acting on the valves of high pressure cylinder alone. Governor designed to cut off all lead of steam valves when practically all load is thrown off the engine. The momentary variation of speed of revolution (i. e., the variation that would take place in three to five seconds) not to exceed 2½ per cent. when one half the rated load of the engine is thrown suddenly on or off; indicated by means of a tachometer belted direct to the engine shaft.

Economy—Economy, with condenser under average economical load, to be not more than fourteen (14) pounds of steam per indicated horse power per hour with 150 pounds initial steam pressure and 26 inch vacuum. This assumes that the steam is not to exceed 2½ per cent. of moisture and the first cylinder steam jacketed with full boiler pressure.

Valves—To have four valves to each cylinder. The steam and exhaust valves to be independent, with exhaust valves moved by separate gear. Valves on high pressure cylinder to be either of the piston type or flat valve, balanced, with pressure plate. Valves on intermediate pressure and low pressure cylinders to be of flat type, either four ported, partially balanced grid-iron or Corliss type.

Clearances—Clearances not to exceed eight per cent. in the high pressure cylinder and three per cent. in the intermediate and low pressure cylinders. Cylinders to be protected by non-conducting covering, such as magnesia or asbestos and steel or cast iron jackets for finish. Cylinders in receivers to be protected by means of relief valves.

Frames—To be cast iron box girder type "A" frame.

Shaft—Of best forged steel with built-up cranks and counter-balanced in one piece.

Bearings—All main bearing surfaces such as shaft bearings, slides, etc., should be water jacketed.

Gallery—Engine to be furnished with one or more galleries from which it can be operated as well as from the floor, and offering easy and safe means of access for lubrication and inspection.

Lubrication—Engine to be provided with either oil or grease lubricating apparatus, such that it can be lubricated as thoroughly when in motion as when at rest. Each cylinder to be provided with sight feed lubricators as well as oil pumps, and the entire engine, if oil is used for lubrication, to be fitted with sight feed lubricators. In the case of grease lubrication provision is to be made to allow any part to be lubricated individually, as any system of grease distribution from a common center involves the possibility of stoppage of tubes with dirt or foreign substances.

Fly or Belt Wheels—The engine should be provided with intermediate wheels between the cylinders where possible, so as to bring the shaft as near the condition of uniform load as possible. Allow 48 pounds per indicated horse power in case of electric lighting and 70 pounds in electric railway and power work for weight of fly wheels. Rim of wheels on a basis of 5,000 feet velocity of the rim per minute. Piston speed, 650 feet per minute.

Rotative Speed—A mean figure between a high, or what is commonly understood by high, and low speed; say 120 revolutions per minute on a 750 horse power triple.

Remarks—The power the engine should develop when connected direct to an electric generator should be determined by the capacity of the generator first, and also its capacity for overload. The engine should have an ultimate capacity approximating that of the generator.

Experience has proved that an engine of large power can be regulated closely as regards speed of regulation, by means of a shaft governor acting directly on a properly designed valve and gear on the high pressure cylinder alone of a triple expansion engine. The governor should have a "gravity balance" in case the steam valve on the high pressure cylinder is placed in such a position that it is free to move vertically, as is generally the case in this type of engine. The governor should also have a centrifugal or "running balance" when the engine is in motion. As mentioned in specifications, the governor should be designed to cut off all lead of the steam valves operated by the governor, so that when practically all load is thrown off the engine, the governor will admit absolutely no steam to the high pressure cylinder, thus compelling the engine to decrease in speed by having only the remaining speed in the first and second cylinders to draw on, instead of the amount that would be admitted by the lead of the high pressure cylinder valves, as usually done to-day.

The specifications for valves in the engine described follows logically when the regulation of the engine is obtained by means of a shaft governor, acting directly on the high pressure steam valves without the intervention of any intermediate gearing to assist the centrifugal force of the governor, thus depriving it of its sensitiveness in changes of speed. The piston type of valve is open to the objection of leakage, but inasmuch as any leakage would be expanded in the next two cylinders of a triple, the simplicity of the valve and its action under high pressure steam tends to balance this argument. It is essential to have the valve balanced on account of the high steam pressures used in this cylinder. The valves on the intermediate and low pressure cylinders, as already specified, would give a practically perfect steam distribution when moved by the eccentrics, and the engine can then be adjusted to the service required, be it condensing or non-condensing.

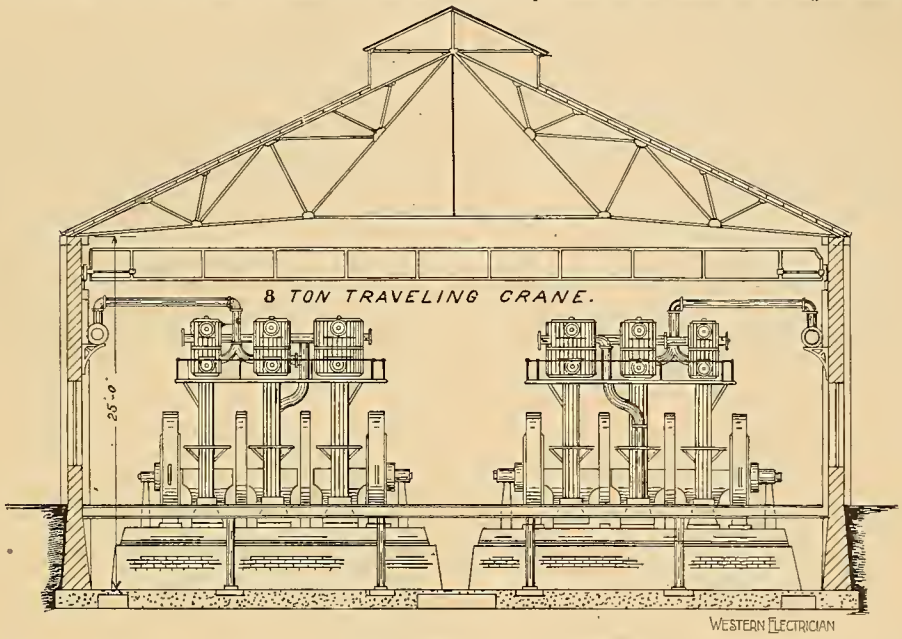


FIG. 2. AN IDEAL CENTRAL POWER STATION.

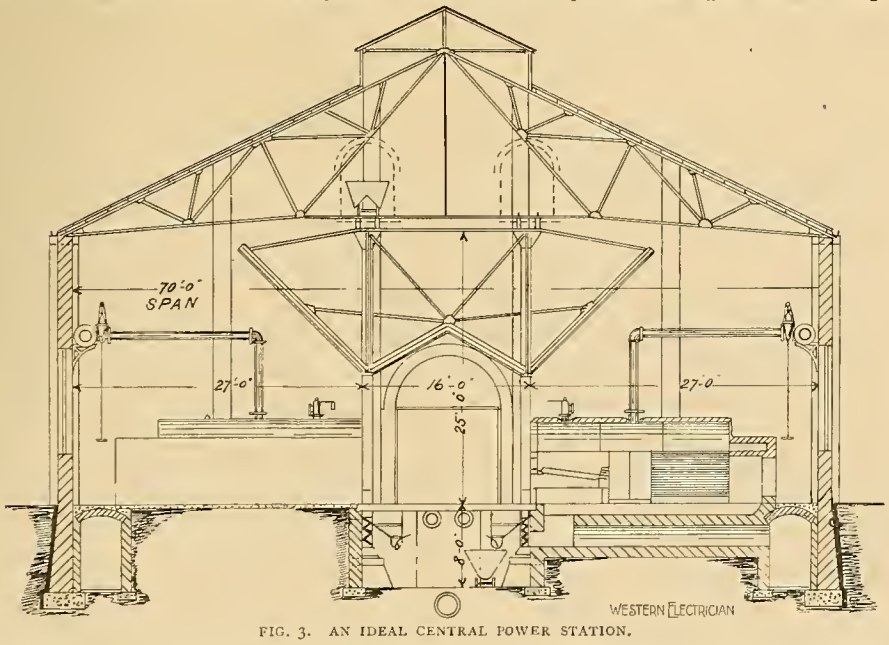


FIG. 3. AN IDEAL CENTRAL POWER STATION.

One of the most vital points of an engine for electric service is that of main bearings. They should have a surface velocity of not exceeding 350 feet per minute, with a mean bearing pressure per square inch of projected area of journal of not more than eighty pounds. This is considerably within the safe limit of cool performance and easy operation. If the bearings are designed in this way, it would admit the use of grease on all the main wearing surface, which in a large type of engine for this class of work we think advisable.

In regard to the location of fly or belt wheels, we said in the specification that the engine should be only with intermediate wheels between the cylinders, so as to bring the shaft within the condition of practically uniformly loaded beam. This will prevent excessive wear on any one main bearing of the shaft, and in that way allow it to become other than a straight line.

In regard to rotative speed it is a mutual condition between the engine and generator, and is too often determined by financial considerations. The faster speeds permit less cylinder condensation in the engine, but require a greater amount of care in the engine room. The tendency to change among large engines of the type for which we are furnishing specifications is toward the medium rotative speed.

BOILERS.

After the engines, one of the next most important factors of a power station is a good type of boiler. There may be said to be boilers and boilers, many types of them, but if we look carefully over the field we can in general bring them down, as far as concerns a power station of this kind, to three types or classes: First, the plain horizontal return tubular boiler, which has probably been more largely used in power station and mercantile work than all the other boilers combined, and where there is ample space and a working pressure not exceeding 120 or 125 pounds is required this type of boiler probably more fully meets general requirements than any other. Under the second head comes in the sectional or water tube type of boiler as manufactured by Babcock & Wilcox and many other firms in the same line. This sectional water tube type of boiler has been more extensively used, probably, than any other where high pressures were required, and it has in general cases met the requirements of this practice. We found, however, in some particular parts of our work, especially ipower work, where the load is subjected to violent

fluctuations, that this sectional type of boiler lacks steam room capacity to stand the violent fluctuations of load. This has caused engineers to look around for some other boiler which would combine the advantages of the horizontal return tubular and of the sectional. Without experimenting too much it seemed, on looking over the field, that the boiler which had been so largely developed for marine practice, as the internally fired marine type of boiler, offers the best solution of the difficulty with some modifications and changes. We therefore classify this as the third style of boiler adapted for this kind of work and have used it in this station. Its advantages in development for high pressures have been demonstrated by long experience, also for economy in space occupied, economy in operation and good steaming capacity. Such a type of boiler is described in the following specifications:

BOILER SPECIFICATIONS.

Type—Internally fired, direct fire tube marine boiler.

Pressure—To be tight under 160 pounds working pressure and tested to 210 pounds hydrostatic.

Capacity—To evaporate 3 pounds water from 100° and 70 pounds pressure (M. E. unit) per square foot of heating surface. In other words, 10 square feet of heating surface per horse power.

Economy—To evaporate 9 pounds of water from 120° F. at temperature corresponding to 160 steam pressure per pound of good Scranton anthracite pea coal when developing its rated capacity.

Quality of Steam—The steam furnished by boiler when developing its rated capacity shall not exceed 2½ per cent. of moisture as determined by calorimeter.

Furnaces—To be of either the corrugated or Adamson type, having a common combustion chamber.

Riveting—Longitudinal seams of shell to be butt jointed and double butt strapped and triple riveted each side of butt. Circumferential seams to be double riveted. Flanges and heads to be single riveted. All holes to be drilled when sheets are in position for riveting.

Staying—Boiler to be stayed in the most approved manner to withstand 160 pounds working pressure. Strains on welded braces must not exceed 6,000 pounds per square inch section. Solid stays must not have strains to exceed 9,000 pounds per square inch of section. All stays, braces and rivets to be of the best double refined iron.

Manholes and Handholes—Each boiler to have at least four manholes to facilitate cleaning as well as a sufficient number of handholes for the same purpose.

Plates—All plates to be of the best marine steel of 60,000 pounds tensile strength.

Fronts—Each boiler to be supplied with neatly designed furnace fronts and cast iron bridge walls.

Fixtures—Each boiler to be supplied with necessary supporting lugs or saddles, one set of grate bars for each furnace, all necessary dampers, flue and cleaning doors and frames.

Fittings—Each boiler to be supplied with pop safety valve, steam gauge, water column, gauge cocks and stand pipe, asbestos blow-off cock, stop and swinging check valves and necessary flanges for steam pipe connections riveted to boilers.

General Conditions—Boiler to be set to return the gases to the front underneath the bottom of the boiler. All material and workmanship to be first-class in every respect and certificate of test and inspection furnished.

Remarks—That the type of boiler here specified has demonstrated its ability to perform its work is unquestioned; not only under the pressure specified and called for in electric service, but even the higher pressures used in the merchant marine to-day; taken in connection with its ability to work under high pressures successfully, it has good average economy. The other point that makes it most fitted for the service mentioned is the small space occupied, together with its enormous capacity or ability to furnish almost any amount of steam when forced, and this, too, of good quality as regards percentage of moisture. This, however, is easily accounted for by the large liberating surface at the water line. The firing of the boiler internally is another advantage offered by this type of boiler, when contrasted with the repairs necessary to furnaces boiler settings, etc.

PIPING.

Piping is a part of the power station which, in the minds of many people, does not require much attention. We believe, however, that it is one which should receive the most careful and earnest attention of the constructing engineer. The safety, good working and reliability of a power station is dependent on the piping as much as any other factor in its outlay. We have tried to generally outline here, under the head of "piping," a few thoughts and suggestions which are supplemented by some sketches of what has been our practical experience of the requirements in this line.

PIPING SPECIFICATIONS.

The sketch, Fig. 4, shows a type of joint at flange on pipe to fittings or valves. The flanges are recessed, male and female, for gasket, to prevent the "blowing out" of the same. This effect is considerable if the gasket is thick. The flange is screwed on the pipe and then calked in on the inside. The small recess in the back of the flange around the body of the pipe is to be filled and calked with babbitt or steam metal in case of leakage of screw joint when circumstances will not permit, for the time being, to break the joint and recaulk the pipe itself. The threads on the pipe should be cut by the same person, chasing the threads on flanges so as to secure the same taper on both; a very essential condition to a tight job. The screw joint should be made up in plumbago, to be removed, if necessary, at a future time without breaking. The flange should be designed to be equally strong through bolt holes as any other part of the flange. This is easily done by means of bosses about bolts.

There is one thing that should be remembered in the design

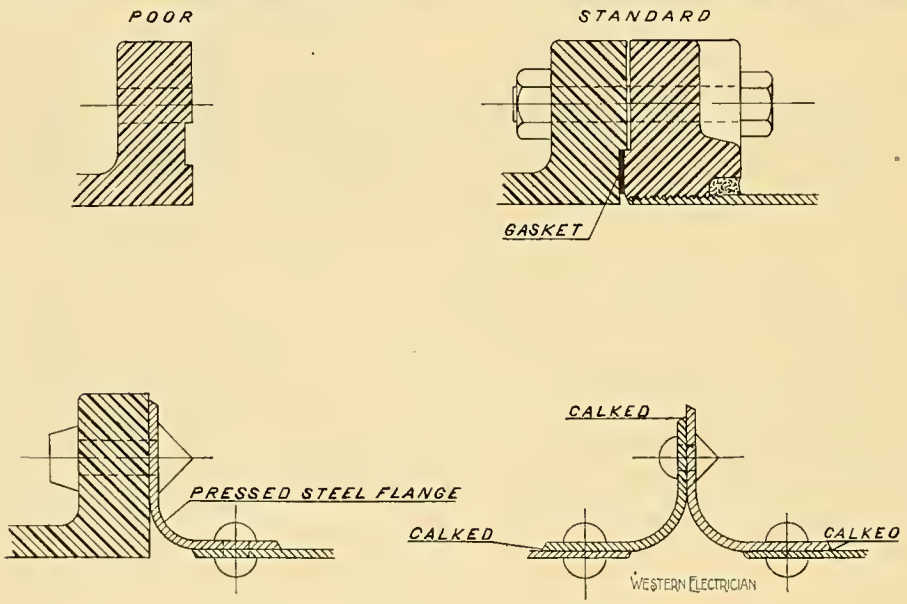


FIG. 4. AN IDEAL CENTRAL POWER STATION.

of cast iron flanges, and that is that it is hardly possible to get them too heavy for the work. The initial strain due to screwing them on the pipe is so large that the factor of safety that remains is not usually sufficient to withstand the higher steam pressure, together with the increased expansive strains due to the increased temperature at the higher pressure. The weak point in the theory of cast iron flanges is as follows:

Conceive the flange to be made up of laminæ in the form of concentric circles. In case the first lamina is strained beyond its ultimate strength by screwing up, then although no disastrous results will be detected immediately the life of the flange will be very short, and it will fail by cracking, commencing nearest the threads, i. e., at its smallest diameter and gradually radiating outward. This theory is similar to the one used in the design of hydraulic cylinders, and is equally applicable so far as screwing up the flanges is concerned. From this, one can see that it is possible to screw up a flange too tight; a fact too often overlooked in the anxiety to get a tight job, and usually done when the threaded work is poor.

Gaskets—Copper corrugated gaskets are all right in the case of mains, where the joints are made up with the ends of the pipe free to move; in fact, they could be omitted altogether in such a case, and the joint made iron to iron; but there is the practical consideration that in case of repairs (and that time is sure to come) the line will be always distorted from its original position; i. e., it will have initial strains, due to some part of it having steam on to run a portion of plant; and when the joint is broken for repairs, it is possible to bring the flanges back in the same relative position they previously occupied, and for this reason alone, I prefer the use of a wire insertion rubber gasket of very thin material, say not over 1-16th inch thick. This will make up, or rather allow, for this slight inequality of the flange facings, and permit a tight job to be made where a copper gasket or iron to iron would leak.

Another type of connection for high pressure is shown in Fig. 4. The weak point in these designs is the fact that all calking is done from the outside at the joint, and that it makes a series of small traps for water of condensation. The system would give more trouble after it once commenced to leak than the one mentioned. The use of steel is good practice, and by making such a system with long radius bends of the pipe itself, would give good satisfaction.

Expansion Joints—The average slip joint will not answer at all for high pressure, for when the packing is adjusted sufficiently tight to prevent leaking, it will also be sufficiently tight to keep the joint from moving to take up the expansion, and if loose enough for this, it will be found to leak.

The corrugated copper expansion joint offers a solution to the difficulty of expansion joints, but when made as most of them are to-day in this country they almost defeat the object they seek to attain. The corrugations in these joints are made literally like the threads of a screw, whereas they should be made without longitudinal pitch, so as to prevent any torsional action tending to make them rigid. Probably the best way to take up the expansion in a high pressure system is by means of long pipe bends of easy radius, and with all branches so located, and of sufficient length to take any expansion of the mains by means of their flexibility on account of their small size. Judicious arrangement of this sort can be made without the use of any expansion joints whatever. Under restricted and peculiar conditions copper bends with iron bands can be used with good effect, if commercial considerations are not prohibitive.

Pipe—Wrought iron or steel lap welded pipe will answer most conditions successfully, even in case of long bends or elbows made from this material. The tests should be rigid to avoid defective seams caused by bending. Extra heavy pipe will not be found necessary.

Fittings—These should be of the best charcoal iron, true to pattern and of workmanlike finish. The flanges should be ribbed in preference to being thickened up, on account of shrinkage strains in metal.

Valves—There should be gate valves, operated by an outside screw. The spindle should be of steel, and tinned. The body should be extra heavy and ribbed to prevent any springing, which would cause the valve to leak around the seats when closed. The valve body should be stiffer than any other part of the system in order to have all the valves tight. The seats of valves should be bronze or brass, and able to withstand the high temperatures of the high steam pressures, as well as very non-corrodible.

All valves over 7 inches diameter of port should have a by-pass valve (a smaller valve about 1½ to 2½ inches in diameter) of exactly similar type, so that the pressures can be equalized on both sides of the large valve before it is opened by means of the smaller one. This relieves the excessive strain on the spindles and seats, and should always be used on high pressure work.

Support—A high pressure steam pipe should always be supported, when possible, from underneath, by means of some solid mass, so that its weight would rest directly upon this support. This method, when it is possible to follow it, will be found to eliminate that vibration so often noticed, and the result of which is leaky joints caused by the racking and straining of the whole piping system. When the suspension method is used there is always one or two points which, if held firmly, will stop the vibration of the whole system. Other positions will cause a general leakage. Experiment will determine these points. Piping should be rigidly secured by proper means.

Bolts—All bolts should be of double refined iron or low grade steel. Their weakest point is directly under the head, and a good test is to place one in a vise, holding it by the head and bending the shank over by means of blows from a hammer. A good bolt should stand this without showing any cracks whatever at the head. Both head and nut should be hexagonal on account of the limited space in which it is often necessary to use a wrench. The whole system of piping should be blown out thoroughly with steam before the engine connections are made, to prevent any chips or dirt from being carried through to the cylinders.

GENERATORS.

In describing the type of generator required, it is necessary to be more specific as to the class of work it is required to perform, and particularly as regards the voltage, etc., than in our other departments. We will therefore in the main describe, as far as concerns the generator and switch-board, apparatus especially adapted for railway power service.

Generators for electric railway service should be constructed with a view to efficient handling of variable loads and excessive overloads for short periods. They should be mounted on a brick foundation set on a bed of concrete. The top of masonry should be provided with a wooden foundation base; this wooden base to be built up of two layers of timber, with tar paper or some good insulating material between the layers, the first layer bolted by means of foundation bolts direct to masonry, the upper layer being bolted to the lower layer, thus insuring good insulation between the iron foundation frame of generator and the ground. This precaution is taken with a view of protecting the generator from lightning coming in over the line.

Generator Frame in Belted Type—The foundation frame of the generator should be bolted directly to the wooden cap of the foundation and provided with grooves and sliding arrangement for tightening the belt. The general design of frame and magnets in the latest type of generators of large capacity is a circular casting built up of two or more parts and concentric with the shaft of machine. The pole pieces are in many cases made of laminated iron cast direct into this frame; the field wire, both shunt and series, being wound on adjustable spools, which, by suitable flanges and clamps, are bolted direct to the frame when slipped over pole pieces. The compound field of the machine should provide for sufficient fall in potential due to loss in armature at variable loads, and to maintain a constant electromotive force at the switch-board. The practice of over-compounding a machine so as to obtain an increased electromotive force with increased load—in some cases 10 per cent.—is not a good method where a number of generators are in operation, for the following reason:

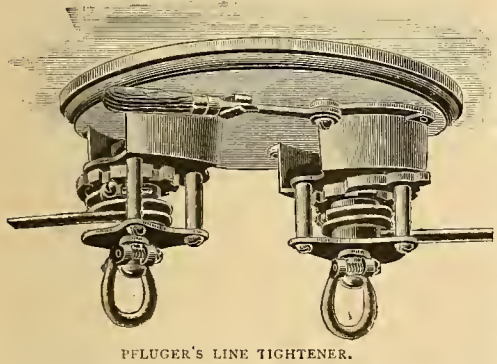
The machines over-compound in proportion to the load on themselves, and not in proportion to the load on any individual feeder, the result being that if, for instance, two machines are running under condition of full load and have increased electromotive force 10 per cent. at the switch-board, they may be feeding into two feeders; one feeder which is considerably overloaded, and the other which is very lightly loaded. The result is that the lightly loaded feeder is supplied with a high electromotive force, higher than necessary, and the overloaded feeder is the only one benefited. When a third machine is thrown into this combination the electromotive force is reduced, as the load is divided then between three machines instead of one, and consequently the overloaded feeder is not assisted to the extent which it was before.

A better method in large installations is to provide an auxiliary bus which can be connected at any time with any one or more generators, this auxiliary bus to be run at a higher electromotive force, say at 575 volts to 600, and run in connection with it the heavily loaded feeders, or those feeders which are of much greater length than the average of the system. This method reduces the quantity of wire required to run a system and maintain a fairly uniform pressure over the different lines. Arrangements should be made on the switch-board so that any feeder or any generator may be connected to or disconnected from this auxiliary bus, or to or from the main bus, the main bus to be run with an electromotive force of 500 volts, the same as in ordinary practice. In other words, this divides the switchboard up into two distinct arrangements, electrically separated from each other. This has been tried in practice and has proved very satisfactory.

To return to the construction of the generator, the armature of the machine should be run in self-oiling bearings, made with adjustable globe seats, so as to insure perfect alignment, and provided in the larger sized machine with outboard bearing at the pulley end of the shaft.

The commutator should be of ample width to insure good contact service between commutator and brushes, for a 500 volt machine. Carbon brushes have proved very satisfactory, and are almost universally used at the present time. The machine should be so constructed that the brushes should not need readjustment for any change of load from zero to 25 per cent. overload. There should be practically no sparking at the points of contact. The generator should be provided with a double pole switch, so as to enable the operator to disconnect the generator entirely from the system when it is required to do repairs, overhaul the machine or shut it down.

The generators should be capable of developing their



PFLUGER'S LINE TIGHTENER.

normal output for a continuous run, and also capable of developing at least 25 per cent. above their normal capacity for short periods without undue heating of any part of the armature, bearings or fields.

There are several methods of connecting the generators with the switch-board, and the two following are given.

The three wires from the machine, namely the positive, negative and equalizing wires, are all carried direct to a 3 pole switch; the equalizing wire is connected to an equalizing bus, and the ground wire to ground bus. The line wire of the machine from the switch is connected to an ampere meter and also to an automatic cut-out, and from there to the main bus If an auxiliary bus is used the wire, instead of being connected directly to bus, is connected from the automatic cut out to a transfer switch, which enables the wire to be connected through to auxiliary or the main bus. The main bus is in connection with a main ampere meter, the other terminal of the ampere meter being connected directly to the feeder bus. The feed wires are brought in the station to the switchboard and attached to a single pole switch; from this to an ampere meter, then through an automatic cut-out; then to the feeder bus, each feeder being provided with a lightning arrester. The line wire from the machine above described should be taken from the series field side of the machine, as this series winding affords a very good protection from lightning coming in over the line, acting as a very efficient "kicker coil." The ground bus should be connected direct to the rails near the station and also to a suitable ground bus within the station.

To insure an equalization of load between the various generators all the dynamo mains of the same potential should be of equal resistance, provided the machines are of equal capacity, and have a resistance inversely proportionate to their capacity, if of unequal capacity. The usual method followed is to calculate the size of the mains required for the generator farthest from the switchboard; then make the generator mains of the other machines of the same length as this, using the same size wire. In other words, all the positive mains will be of equal resistance, all the negative mains will be of equal resistance, and all the equalizing mains will be equal. It is not necessary to make the equalizing mains of any larger carrying capacity than the others.

Great care should be exercised in making joints between the different instruments and mains, to insure good conductivity, as a poor joint will throw the most careful calculations out. The usual method adopted now for making joints is to use a mechanical clamp having the contact surfaces perfectly clean and of ample surface contact. In operating the switchboard, care should be taken that all instruments required to be used to throw a generator in or out of line should be so arranged that the operator is not required to leave his position at the switch controlling the generator at the board. To obtain this result the voltmeter may be arranged on a carriage which can travel along the length of the board and make automatic connection to any generator as it reaches a position exactly opposite the instruments connected with that generator. By suitable arrangement the volt meter can be switched, when in position, with the feeder bus, and also with the generator which it is to test, so that without moving the instruments, the pressure of the line or pressure of the machine may be taken and the machine brought up to the same electromotive force of that of the line before being connected into service. The automatic regulators on the generator should be adjusted to cut out the generator when the overload of the machine is more than it will safely carry even for short periods. The automatic regulators on the feeders should be adjusted for an excessive overload on that feeder, as in many cases of railway service the feeder is subjected to excessive overloads for very short periods, and it is a source of great inconvenience to have an automatic regulator continually cutting out the line on overloads of very short duration.

The latest types of switchboards are built up of fire proof material perfectly incombustible. The framework may be built up of iron pipe or of angle iron, and if located near the wall it should be set up at least twenty to twenty-four inches from the wall, and iron braces from top of frame anchoring into the wall. The general design of this frame is dependent entirely upon the number of instruments and their location on the board, as care must be taken that, with the present method of back connections on the instruments, the cross bars of the frame do not interfere in any way with the bare wire coming through back connections, and should be a safe distance to prevent any danger from grounds. To this iron frame should be securely bolted large slabs of marbleized slate or white marble. Asbestos cloth or other cushioning device should be interposed between the slate and the contact points of the iron frame, so that the slate slabs may be securely fastened without risk of breakage. If slate is used, it should be carefully tested after all holes are drilled, to insure perfect installation. All instruments to be used on board should then be connected directly to the slate slabs and not set on independent sub-bases unless absolutely necessary. As before mentioned, all connections on instruments should be made from the back of the board and no wiring exposed from the front. At the same time, all connections and wire should be so located as to be easily accessible for repairs or inspection. Where wires are passed through the floor below the switchboard, the holes should be fitted with a floor insulator of hard rubber made water tight so that the floor beneath the switchboard may be kept perfectly clean, and if any water accumulates, it shall not be able to follow the wire down through the floor.

In addition to the foregoing arrangement of the switchboard, the following plan may be used: Instead of running three wires directly from each generator to a three-pole switch on the switch-board, take the equalizing wire from each machine and run to a common point, using a short bus, or any method of connecting which may be deemed most practical; so that all equalizing wires shall be of equal resistance to this point. Then take the ground main from the generator and run directly to the ground bus. The line main from the generator is then taken directly to the switchboard and connected to a single pole switch. From this switch connections will be made similar to the board already described. This arrangement provides a switchboard in which all wires are of the same polarity, and it insures a very safe method of operating. The only objection to this is that it is impossible to cut out the machine entirely from the switchboard, and it is therefore advisable in using this method to have each generator equipped with a double pole switch attached directly to the generator controling both lines.

Regarding the grounding of positive or negative wire, a great variety of opinion is expressed by engineers as to the better method; some advising the grounding of positive, and others the neutral wire, the result which it is desired to obtain being a condition which will produce the least electrolytic action at contact points in the ground return, such as bond wires, supplementary, etc.

We have tried to outline in general here the important factors for consideration in an ideal central power station; our desire being more to lead up to general line of thought or discussion on the matter, and point out some of the most desirable features in relation thereto. If we have accomplished this, our purpose has been fulfilled.

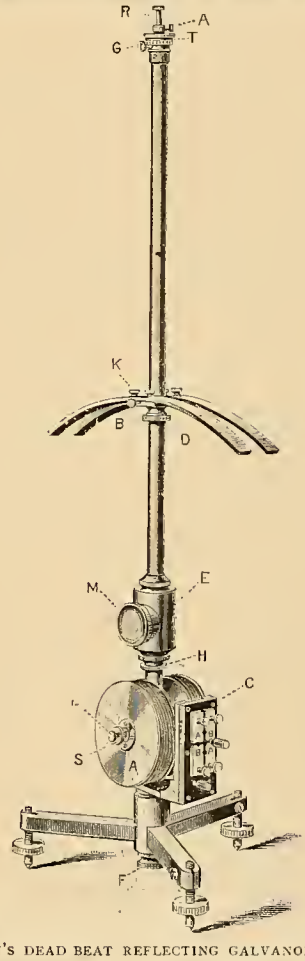
Trusting the matter will meet with your earnest and careful consideration and free discussion, it is very respectfully submitted.

Pfluger's Line Tightener.

In wiring a building for an arc circuit the wires should be taut and straight. To accomplish this insulators must be screwed to the ceiling at different intervals between ceiling boards to keep the wire from sagging, which not only disfigures the ceiling, but is in many instances the cause for grounds in the circuit. To obtain a perfectly taut line wire the lineman is put to considerable trouble and has to use different tools, such as "come-alongs," tackles, pulleys, etc., which cause a great waste of time. All this trouble can be obviated, it is claimed, by the use of the ceiling-board, shown in the accompanying illustration, which was invented by Chas. A. Pfluger of the Standard Electric company, Chicago. In describing it Mr. Pfluger says: "Place the ceiling-boards in their proper position, where lamps are required, and cut off pieces of wire reaching from one ceiling-board to the following one, being careful not to cut them off too short. Then fasten both ends of the wire in the revolving binding posts of the two different ceiling-boards and wind those binding posts up with a wrench till the wire is straight and taut. The dogs engaging the ratchet will prevent the unwinding of the wire. The lamps are hung in the usual way to the ceiling-board. Each ceiling-board is provided with a switch to take the lamps out of the circuit when it becomes necessary. The advantages of this ceiling-board are very easily seen—first, in obtaining a perfectly straight and taut circuit without any insulators; second, in saving a great deal of time in the construction and therefore considerable expense; third, all kinds of wire, no matter how crooked, can be used; fourth, the wire can be removed instantly for the purpose of cleaning the ceiling without any damage to the wire and board; fifth, any person can handle it. He need not be an expert." This ceiling-board is patented.

Queen's Dead Beat Reflecting Galvanometer.

The instrument illustrated herewith is a modification of the Wiedemann galvanometer, and is adapted for both dif-



QUEEN'S DEAD BEAT REFLECTING GALVANOMETER.

ferential and direct work. The coils *A* are graded, having five changes of wire, and slip upon copper rods forming part of the damper. Automatic connections are made with the binding posts on the switchboard *C* by means of small spring contacts upon the back of the board which press against platinized studs attached to the coils. By shifting plugs on the switchboard the coils may be quickly connected in series, multiple, or differentially. To obtain perfect differential adjustment a horizontal movement of the coils is secured by turning the micrometer screw *S*. The vertical tube is 24 inches long. The suspension being quartz fiber instead of cocoon silk, torsion is practically eliminated, while great tensile strength is secured. An essential feature of the apparatus is the arrangement of the control magnet employed. In place of the usual single piece with the suspension tube passing through it, the magnet is divided into two parts, each of half the usual cross section, as illustrated. The advantage of the construction, it is claimed, is that should it be necessary to make very delicate observations in the vicinity of the instrument, the magnets may be temporarily removed without disturbing any adjustments, and then replaced in exactly the same position.

Owing to the mass of copper in which the magnetic system moves, the galvanometer is almost absolutely dead beat, and observations may be taken in rapid succession. This apparatus is of recent design, and is placed on the market by Queen & Co., Philadelphia.

CORRESPONDENCE.

New York Notes.

NEW YORK, December 24.—An electric car equipped according to the system of the Acme Storage Battery company is now being operated experimentally on the tracks of the Ninth avenue street railroad. This car weighs 6¼ tons and is provided with 144 cells, each weighing 27 pounds and having a capacity of 140 ampere hours at an average discharge rate of 25 amperes. The grades on the Ninth avenue road from Fifty-fourth street to One Hundred and Sixteenth street, a distance of three miles, are exceedingly heavy, one of them, at the end of the route, being no less than six per cent. for a distance of more than 200 feet. On the up-trip thirty-one amperes are usually consumed; a capacity of seventy-five amperes may be called upon at any time. The time usually occupied on the up-trip is 24 minutes and 50 seconds. On the return trip, during which the grades are mostly descending, the average current drawn from the battery is 19 amperes, or little more than half of that required on the up-trip. The average time of the down-trip is about 22 minutes and 30 seconds. The entire trip both ways has been made in 47 minutes and 20 seconds. A specially designed motor, the company alleges, is one of the features of this system. The aim has been to make a cell which, while having the least weight for its storage capacity, shall at the same time be so constructed as to avoid the deteriorating influences which have usually caused the rapid destruction of storage cells employed in this class of work. The car made one trip last week when the tracks were in a wet and slushy condition. A fair speed was made and maintained on all the grades. The company manufacturing this system claims that it can run it cars at a cost of only nine cents a mile.

The daily press reports that the legal killing of Fred McGuire in Sing Sing prison this week was unattended by any distressing incidents. Death ensued with the first shock. In twelve seconds the painful work of the prison officials was accomplished. The smell of burned flesh was absent, and no discoloration of the body resulted. The execution, it is said, was the quickest and most successful that the prison has witnessed. The execution was in a new building which has just been completed within the prison court. The warden and principal keeper, Connaughton, walked first to the place of execution, followed by McGuire and two clergymen, while two guards were behind. They reached the room where the witnesses were sitting at 11:10 o'clock. McGuire was pale as marble. He walked without any assistance, and without looking at the spectators went straight to the chair and sat down. In forty seconds the straps had fastened him firmly and the electrodes had been adjusted—one at the head and one at the calf of his leg. The method of applying the current was new in that it was not completely shut off until the physicians were sure that the man was dead. Fifty seconds after the victim appeared in the room the signal was given, and the current at a pressure of 1,800 volts was sent through him. The body became rigid against the straps. The current was on four seconds. Then, instead of shutting it off altogether as has been done at previous executions, its pressure was simply diminished to 150 volts, and that current was kept on for five seconds. Then the full strength was switched on for three seconds, and that ended it. Dr. Irvine examined the victim, and there was a slight fluttering of the heart. In a few seconds that had stopped. There were no evidences that McGuire had suffered an instant. There were none of the indications of burning which have been noticed at other executions by electricity. The autopsy, the physicians said, showed that the conditions of the body were almost the same as if the man had died a natural death.

The truth is that increased familiarity with the process of execution by electricity on the part of the officials intrusted with the duty has resulted in removing the chief causes of complaint against the new method. As conducted and supervised by experienced men, the new system has robbed the death penalty of its horors, so far as the great body of our citizens is concerned. Yet even now, when the revolting incidents of capital executions are things of the past in this state, a movement is again on foot to induce the legislature to repeal the law punishing murderers with death. W. F. O.

New England Notes.

BOSTON, December 24.—The Boston Electric Light company has just purchased a lot of land in Dorchester containing 44,700 square feet on which it will erect a plant for the purpose of supplying electric light for Dorchester, Washington Village and South Boston.

The first metallic circuit line in the police telephone system of Boston has just been put in between police headquarters and the Brighton station. Other lines will be put in as soon as the city fathers make the necessary appropriations. There is much complaint in Boston by users of the old ground circuit lines on account of induction from electric light and other wires. The telephone people say this is beyond their control, and the only remedy they suggest is the adoption of metallic circuits and long distance transmitters. But as these are considerably more expensive than the old system many people object to the added cost.

Consolidation is the motto of the street railways in Worcester and vicinity. The Worcester, Leicester & Spencer road has asked the legislature for permission to purchase and consolidate any and all roads in those towns and to issue new bonds to increase their capital. Their name they also want to change to the Worcester & Suburban Street Railway company.

The West End Street Railway company is to heat some of its electric cars by electricity this winter. The Dorchester avenue line is now running electric motors.

E. C. Wilcox & Co., dealers in electrical supplies at Hartford, Conn., have been attached for $9,000.

A Boston inventor has perfected a new block system of railroad signals for preventing collisions that has received a favorable trial recently and is regarded with approval by the commissioners.

The Giant Electric Motor company of Portland, Me., is about to increase the capacity of its works.

The Edison company will furnish the electric lighting plant for the new mill of the Bates Manufacturing company at Lewiston, Me.

The fire underwriters allege that the electric installations of Brockton, Mass., are in a very poor state, saying that there are at least a hundred cases in the city where the insulation is poor. In consequence they threaten to raise insurance rates unless the condition of affairs is improved at once.

W. H. Francis, formerly assistant manager for New England for the General Electric company, is now connected with the Edison Illuminating company of Boston.

The Frank E. Fitts Manufacturing & Supply company of Boston has taken the agency for New England of the Hercules electric motors and dynamos. It has fitted up its store and can show a plant in operation.

Quite a lively fight is now on between the storage battery people who want to start a street railway in Cambridge and equip it with storage batteries and the West End officials of Boston, led by President Whitney. The new company calls itself the Cambridge Storage Battery Electric Street Railroad company. The articles of association provide that the road shall start from a place near the junction of Putnam avenue and Mt. Auburn street, go through Mt. Auburn street to near the gate of the cemetery, thence by Mt. Auburn and other streets to Fresh Pond station and back to the point of beginning. Henry D. Hyde, attorney for the West End, appeared before the railroad commissioners to oppose the petition. He said that a storage battery road in the present state of the electrical science is an impossibility. The West End spent $17 000 three years ago in an effort to introduce it in Cambridge and failed. He said if a practical storage battery system could be shown the West End would be the first to adopt it.

Rockville, Conn., has been considering the project of establishing an electric light plant, but has finally decided to contract with a local company to furnish the lights.

The Quincy & Boston Street Railway company has been granted permission to build and maintain the trolley system from Dorchester across Neponset river to the present track on Hancock street.

The fight between the town of Wakefield and the Citizens' Gas Light company of Reading has been settled by the action of the town in town meeting. The selectmen were instructed to petition the next Legislature for authority to purchase and operate that portion of the gas company's plant in the towns of Reading and Stoneham, to manufacture gas and electric light for those towns and to supply electricity for power.

The Providence Telephone company has been granted permission to construct underground conduits. These are to be so built that they can contain the fire alarm and police signal wires. The company is required to pay a tax to the city equal to 1½ per cent on its gross receipts.

The Lynn & Boston Railway company has appointed Chas. F. Heath division superintendent for Lynn, and Henry Grover purchasing agent. The company is progressing well in its efforts to introduce electricity as a motive power. Thirty new box cars are being built for it, and a trial of electric heaters is to be made. Twenty of the latter have been ordered, and their merits are to receive a thorough test. The trouble seems not to be the difficulty of furnishing sufficient heat to make passengers comfortable, but to keep the temperature low enough to prevent their being too warm with their wraps on. The company expects to get some power from the new Chelsea station in a day or two, and by January 15th electric cars will be running from Boston to Lynn.

The Bay State Trust company is attempting to foreclose a mortgage of $285,000 on the Dubuque Electric Railway, Light & Power company. The latter company owes $400,000, and is in the hands of a receiver. The question raised by the Boston company is whether judgments having priority over the first mortgage are not equal to the selling value of the property. The purpose of the petitioner, as expressed in its petition, is to rehabilitate the road and extend the line.

Frank W. Baker, a collection agent of the Edison Illuminating company, has been indicted on six counts for alleged embezzlement at various times in 1891 and 1892, the amounts aggregating something over $1,000. His bail was fixed at $2,500.

The Lowell & Suburban Street Railway company is putting up a 20 tenement block near its power station for the use of its employes.

Holyoke telephone wires are to be put underground. The company's business is increasing so fast that its switch-board is to be enlarged.

An electric road is to be built between Monson, Palmer and Wilbraham, Mass.

The Portland, Me., Electric Railway company is using vaseline to keep snow from clinging to its wires and breaking them down. It is applied by men with sponges who stand on top of the cars and make the application while the cars are making their regular trips and moving at their usual speed. The vaseline will be kept on the wires while the weather remains cold. It only takes a gallon for the entire road.

Prof. Thomson denies the report that his company has at last found a serviceable storage battery and bought it of a Peabody inventor.

John Beattie, Jr., president of the Fall River board of aldermen, is an aspirant for further electrical honors. He is already known as the inventor of the Beattie zinc and self-governing motor. Now he has applied for a patent for a device for insulating telephone wires so as to prevent the whirring noise prevalent in cities where the trolley system is used on street cars. It can be attached to any telephone system, and will necessitate no change in its construction. But few men have seen it, but a syndicate of capitalists have placed enough money in his hands to enable him to pursue the matter to a profitable ending.

The officers of the Camden, Rockland & Thomaston, Me., Electric Railway company are proceeding to develop their freight carrying business. They are looking about Camden for a suitable site for a freight depot.

J. C. E.

Little Rock, Ark.

LITTLE ROCK, December 24.—The Edison Electric Light company contemplates moving its plant and making extensive improvements, adding new machinery, etc., to meet the proposed competition of the new electric light company. The Consumers' Electric Light & Power company, recently incorporated at Little Rock, has established an office here. The Arkansas Electric Supply company, of Little Rock, has closed a contract with the Longview Cotton Oil Mill for an electric light plant at the mills.

The electric light company at Morrilton is still in litigation regarding the plant and has suspended operations. The prospects are that it will be some time before it gets its affairs straightened out.

E. S.

Nashville, Tenn.

NASHVILLE, December 24.—The work of converting the Overland dummy railway into an electric line is still in progress, but it proceeds very slowly, much to the annoyance of the citizens who were induced to purchase lots and build homes in the beautiful suburbs of Glendale and Waverly, with the understanding that the dummy cars would make regular trips for a five cent fare. The dummy line is about six and a half miles in length and has never paid operating expenses. The first step the railway company took was to raise the fare to ten cents and re-

duce the number of daily trips one-half. Finding it still unprofitable, permission was obtained to convert it into an electric line. The wires and poles have been erected for about one-half the line, and the power plant is in process of construction.

The charter of the United Electric Street Car company expressly provides that the company shall transport passengers from any point in the city limits to any other point reached by its lines for a uniform fair of five cents. In order to effect this in the quickest and simplest manner the company built a commodious transfer station through which all its cars pass on each trip. The superintendent, Mr. Cannetti, states that his company is transporting passengers at the rate of 7,000,000 annually, a very large number for a city of only 76,000 population. The estimated receipts and expenditures of the company for the fiscal year ending October 31st were: Receipts, $391,196,72; operating expenses and taxes, $208,577.71; net earnings, $182,619 or interest on bonds, $20,619.01. Upon this and similar showings the company issued $200,000 6 per cent. income bonds, interest payable monthly, and the interest coupons receivable for car fares at the rate of 25 tickets for $1.00, or four cents for a trip. The bonds were all placed in this city and are considered a great investment.

Notwithstanding this fair showing the company has filed a petition before the city council praying to be released from the transfer obligations contained in the charter, which in the form of a bill will come up for third reading at the next meeting of the council. The main plea in the petition is financial embarrassment. The filing of the petition provoked a storm of indignation among the people. Mass meetings were held and the most vigorous protest entered against the surrender of the transfer privilege. The daily papers denounce the measure mercilessly. They boldly charge that the company's property is bonded and stocked up to more than three times its cash value and are backing the people in their protests against the surrender of the right of transfer.

The most interesting event that has occurred in electric circles here was the removal recently of the telephone central office to the new and elegant building just completed. The tranfer was made between the hours of 9 P. M. and 6 A. M. next morning, and was done so quietly that not one in fifty of the citizens knew of it until they read their morning paper. The old central office was in the third story of 125 North Market street, and the new building is on the next street—College—diagonally across the block and about 100 yards distant. An elevated trackway was built from the old to the new building over two livery stables, and at 9 o'clock the connections were cut, and the switch-board, containing connections for 1,750 telephones, fifty feet in length and weighing 8,000 lbs., was quickly slid into the new office and placed in position. Duplicate wires had been previously run into the new office. These are contained in thirty tables of 100 wires each, and by midnight 300 telephones were connected, and the entire work completed by daylight. Leland Hunne, assistant manager, with twenty-six linesmen under Foreman J. D. Russell, performed the work. George Hodge, E F. Vickers, William Edwards and Carroll Hughes made the connections.

The country lines, of which there are several, have a new switch board of the latest Berlainer patent. It is made up for long distance telephoning of the same kind as recently used between New York and Chicago. A line, double wired, is in operation from this city through Murfreesboro and Shelbyville to Tullahoma, a distance of about 95 miles, and works entirely satisfactory. All the country lines are to be rebuilt and furnished with long distance transmitters. N.

Indianapolis, Ind.

INDIANAPOLIS, December 24.—The Jenney Electric Motor company of this city has secured contract for an electric lighting plant for a large manufacturing establishment in Berlin. The contract calls for 200 arc and 3,600 incandescent lights. The company has also just shipped a large motor to Minneapolis and one to Cincinnati, and a large lighting plant to Lynchburg, Va.

The Indianapolis Cabinet company is negotiating for a large motor and electric lighting plant, the former consisting of sixty motors for running different machines and the latter of 400 incandescent and 20 arc lights.

Negotiations are pending between the Southern Pacific Railroad company and the National Electric Headlight company of this city for the equipment of locomotives with electric headlights.

The deal by which street railroad property in this city will pass into new hands has been closed and the new company will take possession January 1st. J. C. Shafer, a prominent street railroad man of this city, in an interview says that the new company will extend electric lines rapidly and have them in readiness for great crowds during the Grand Army encampment next fall.

The sleet storm of Friday last gave the electrical branch of the street railway service a severe test; with the exception of two motors giving out the equipment came through in good shape, although the service was somewhat irregular. M.

PERSONAL.

C. C. Allen, manager of the Boston Electric company, was in Chicago last week.

George A. Dallett, general manager for Thos. H. Dallett & Co., of Philadelphia, was in New York last week and called on many friends in the electrical trade. Mr. Dallett reports good outlook for business in '93.

NEW INCORPORATIONS.

Genesee Electric Light & Power company, Genesee, Idaho; capital stock, $20,000; general illuminating and power business; W. H. Thomas, Genesee, Idaho.

Kendrick Electric Light & Power company, Kendrick, Idaho; capital stock, $10,000; to sell electricity for illuminating and power purposes; M. Jacobs, Kendrick, Idaho.

Law Battery company, Jersey City, N. J.; capital stock, $50,000; to make, purchase, use, rent, and sell electrical and other manufactured articles; Chas. Shaw, 85 John street, New York, N. Y.

Electric & Gas Fixture company, Portland, Ore.; capital stock, $25,000; to carry on the business of buying, selling and dealing in electrical and gas fixtures; Frederick V. Holman, Portland, Ore.

Ellwood Electric Light company, Ellwood City, Pa.; capital stock, $1,000; supplying light, heat and power by electricity to the public at Ellwood City; John A Glenn, 118 Diamond street, Pittsburg, Pa.

Palouse Electric Light & Power company, Palouse, Wash.; capital stock, $30,000; to operate in Palouse and elsewhere electric light and power plants, telephone lines, etc.; S. Z. Mitchell, Portland, Ore.

Juniata Valley Electric Railway company, Bellewood, Pa.; capital stock, $100,000; constructing and operating an electric railway from Altoona through Bellewood and Tyrone; Edgar B. Kay, Bellewood, Pa.

Associated Electric company of New Jersey, Trenton, N. J.; capital stock, $20 000; the erection, maintenance, use, operation, and sale of telegraph, electric light and power plants, lines and works; J. Wallace Hoff, Trenton, N. J.

Chicago General Street Railway company, Chicago, Ill; capital stock $3,000 000; to construct and operate horse, electric and dummy street railways in Chicago; to acquire by lease or purchase existing lines; and to construct an elevated railway from Union Stock Yards to Lincoln park; and to construct a loop in South Division of Chicago North of Harrison street. Also constructing and operating a heating, lighting and power supply in Chicago. C. L. Bonney, 513 Tacoma building, Chicago, Ill.

ELECTRIC LIGHTING.

The city electric light plant of Dexterville, Wis., was burned recently.

An elargement of the electric light plant at Plattesville, Wis., is contemplated.

The Piedmont Electric Light company and the Lynchburg Va., Street Railway company have consolidated.

The citizens of Monroe, N. C , have voted an issuance of $15,000 of bonds for the equipment of an electric light plant.

The board of fire commissioners of St. Paul, Minn., has urged the city authorities to take steps toward compelling the electric light and telephone companies to put their wires in the business part of the city underground.

J. Green & Son, who control the electric lighting supply of Placerville, Cal., in a recent announcement remarked: "There is no dirt, no smell, no grease, no danger from fire and no bother. All you have to do is to push the button and we do the rest."

A recent explosion at the electric light plant at Lawrenceburg, O., plunged the city in darkness and entailed a damage of several thousand dollars, but in ten hours time the entire wreck was removed, new machinery replaced, and the city again illuminated.

The Dundee Place Electric Light plant of Omaha was levied upon recently on an execution issued on the judgment rendered in the case of the Merchants' National Bank of Kansas City against the Metropolitan Railway company, which is for the sum of $40,000.

The Des Moines Motor, Power & Electric Light company's plant was partially destroyed by fire a short time ago. The fire was caused by friction, a belt coming in contact with a pile of wood, igniting the latter. The loss, which is wholly on machinery, will amount to $87,000 and is fully covered by insurance.

The new engine at the electric light works at Cedar Rapids, Ia., "ran away" recently, and the fly-wheel was bursted. One casting weighing several hundred pounds flew over the partition into the light room, another cut in two one of the large timbers which supported the steam pipes and dropped the fragments upon the new dynamo. Other fragments of the wheel cut the arc light wires, leaving the city in darkness. The broken steam pipes filled the room with steam, but the engineers stood by their posts until they had shut it off. Fortunately neither of them was injured. The gentleman who has been putting up the new engine and the dynamo estimated the damage at $3,000 or $4,000.

The electric company at Genoa, Italy, disposes of a water power of 100 effective horse power during the twenty-four hours of the day, by means of which two dynamos giving 275 amperes and 115 volts each are run during the evening. These dynamos ranged in series supply current to 1,100 16 candle power incandescent lamps. During the day no use is made of the water power, and it has, therefore, been decided to make use of it in the charging of accumulators. An installation has already been made of 126 Tudor accumulators. As it was not convenient to put down new dynamos for charging the accumulators, it was decided to make use of the reserve dynamo, which, working in connection with the other two, gives the voltage necessary.

ELECTRIC RAILWAYS.

An electric railway is to be built at Amherstburg, Mich., by the Walkerville, Sandwick & Amherstburg Electric Railway company.

Work is progressing on the electric railroad at Manistee, Mich., and it is expected that eight miles of road will be in operation on January 1st.

An injunction has been obtained against the City Electric Street Railway company of Chattanooga, Tenn., from using "T" rails in double tracking its lines.

New York and Boston capitalists have purchased the Halifax Motor & Illuminating company of Halifax for $200,000 The new company will control the street railway and intends to run it by electricity.

The new snow sweeper of the Curtis Bay, Md., Electric Railway company was given a trial run over the tracks a few days ago. The run was made from the power house in Brooklyn to the end of the line at Curtis Bay and return. Part of the trip was made at the rate of ten miles an hour. The machine is a heavy affair with a large revolving broom of rattan at each end. The car is inclosed, with the machinery operating the brushes inside, as well as several electric heaters, to make the work as comfortable as possible for the operators. The motor for revolving the brooms is separate from those running the car, so that it may be run while the latter are still. The system will be of advantage when the snow has become packed or is in deep banks. The car can be run up to a deep portion and stopped while the broom clears a space to allow for farther advance The car is on an elevated platform on the trucks, giving room for the brooms underneath. One is at each end, placed diagonally across, and arranged to clear half the track. A scraper at the side further assists in throwing the snow from the tracks. Canvas aprons around the front and rear platforms prevent the brushes throwing the snow about when the sweeper is passing along a city street. The car weighs 18,000 pounds without the motors, which are three in number and weigh 2 500 pounds each. The motors are of 25 horse power each, two for the car and one for the brooms.

ELECTRIC MINING.

Schuckert & Co., of Nuremburg, have recently completed an electric power plant at the Marien coal mines, near Menselwitz, in Saxony.

The owners of the Dardanelles drift mine of Forest Hill have made a contract with the Electrical Engineering company of San Francisco for the introduction of an electrical plant for lighting, pumping and general power purposes.

TELEPHONE.

Houston and Galveston, Tex., are to be connected by telephone.

The Strowger Automatic Telephone exchange is to install at the World's Fair a complete system of its automatic telephone exchange. This company wishes to have the exhibitors in the electrical building connected with one another by its telephone system.

TELEGRAPH.

The telegraphers' strike on the Central Railroad of Georgia has assumed a serious aspect, and two of the strikers, J. W. Stephens and Mr. Haggard, have been arrested, charged with contempt of the United States Circuit Court. The charges against Stephens were preferred by Trainmaster W. P. Epperson, and those against Haggard by Judson Manuel. Stephens is charged with joining in an illegal conspiracy formed between D. G. Ramsey, grand chief of the Order of Telegraphers, and Deputy Grand Chief Tobey to embarrass the court in the management of the Central railroad, now under its control. The charges against Haggard are more serious. He is charged with destroying the property of the road.

MISCELLANEOUS.

The *Cincinnati Post* makes the announcement that "the filtration of electricity is new."

Work is rapidly progressing on the Mobile, Ala., electric road. James H. Wilson is the principal projector.

Providence, R. I., is to have an "inspector of light and

wires" with a salary of $2,500 and power to appoint an assistant.

A franchise has been granted to G A. Whitiog to build an electric street car line to connect Stevens Point and Whiting, Wis, three miles distant, at a cost of $150,000.

The city council of Providence, R. I., is considering the application of the Interstate Street Railway company for a franchise to construct and operate a line of electric railway throughout the city.

The strike of the wiremen of the Chicago Edison company has been settled by mutual concessions. The men will receive the union scale and hours, and no objections will be made in the future to members of the union. In returo the unioo does not insist that the company sign its agreement.

The Chicago Underwriters' committee of three electrical experts to examine automatic fire alarm systems has substantially been appointed, although the names are withheld. Its work of ascertaining the utility of the various fire alarm systems now seeking recognition from the board will be begun in a few days. This committee's appointment is due to a resolution adopted at the last meeting of the association. The three systems that will be examined are the Singer fire alarm, the National fire alarm, and the Western Electric fire alarm. Since the rebate on the patent of the last named was ended December 1st by vote of the board in November last, all the systems have been placed on an equal footing. The committee of experts is to test the devices to see whether they conform to the association's rules.

A press dispatch from Minneapolis asserts that, after investigation, Henry Villard has, in connection with Thomas Lowry, made a large investment in the Cooper-Hampton electrical patents. Villard is supposed to be especially interested in the portion of the inventions which relate to motive power, and especially the use of the car patents applied to the operation of street railways. Cars are to be fitted out and run experimentally on the Minneapolis system, and Mr. Lowry will himself direct the full practical test. Mr. Lowry will have some of the Minneapolis cars fitted out immediately by having some of the motors made in New York and put on and tried in Minneapolis If the thing proves to be the success expected the motors, as well as the other inventions, the pump and the elevator, will be at once manufactured on a large scale.

A writer on machine shop improvements says that just as we are feeling pleased with electric lights, telephones and electric buttons, we find that a wire is to be led to to the engine lathe to assist in turning tapers and irregular outline work that must be turned from a pattern. Two friction wheels attached to the cross feed revolve continually in opposite directions, and are thrown into gear by electro-magnets. A pointer reaches from the tool post to the gauge line that is given to work from, and the electro-magnets take great care to keep the lathe tool in a position where the pointer just reaches the gauge line. Another man has set up behind his lathe a battery of his own make, and finds that it assists his eyesight wonderfully. When he wishes to see if he has clamped his work on true, he sets in the lathe a tool that has a wire attached, and a bell rings the instant it touches the highest point of revolution.

It will take at least three years to complete the work of electro-plating the iron work of the new Philadelphia City Hall tower with aluminum. This is the surmise of the contractors, who add, "provided the work is carried on as fast as it has been this year." It is more than probable, however, that the tower will not be in place for four or five years yet. The reason given for the slowness of the work is that aluminum coating is very tedious work and that there is a surface of 50,000 square feet to be covered. About one eighth of the work has been finished since April last, when the huge tanks and electrical appliances were set up in the building erected for the purpose. The iron work is first given baths of caustic soda, of diluted sulphuric acid and of copper solution in immense tanks 28 feet long, 4 feet wide and 5 feet deep, each holding about 3,800 gallons. The aluminum tank holds about 7,000 gallons and receives the iron after it has been thoroughly cleaned with copper. It will require 20,000 pounds of aluminum to plate the entire surface of 50,000 square feet. Four large dynamos furnish current to the tank.

The Pennsylvania Railroad company is now ventilating its tunnel through Baltimore by fans driven by electric motors, the current being transmitted from a power house situated near the North avenue end of the Bolton yard. A ventilating stack and fan have been erected over the northern section. The current for the operation of the fans is conducted through the tunnel to the ventilating shafts. Arrangement is also made to light the tunnel by electricity. The ventilation is accomplished by means of a slanting subway eight feet wide by sixteen feet high from the side of the tunnel, near its top, to the foot of the ventilating stack, which on account of the heavy foundation necessary is located at the side of the tunnel. At the foot of the shaft a large fan, fashioned like the blades of a steamboat propeller, revolves on a vertical shaft, forcing a strong upward draft. The vacuum created at the middle of the tunnel causes the smoke and gas to be drawn from the end of the tunnel to the center, and out the top of the stack. The stacks are 100 feet high and 18 feet square. Adjoining each stack there is a small ornamental brick house for the storage of oil and materials used in operating the system. By this system the tunnel is cleared of smoke and gas in less than two minutes after the passage of a train.

TRADE NEWS.

H. S. Grier, well known in the electrical circles of Boston, has accepted a position with the branch office of the Eddy Electric Manufacturing company in that city.

The Electric Appliance company reports large sales of its new Acme wire guards. It is placing large numbers of them with eastern and western jobbers as well as supplying them to large users all over the country. The company reports that the new Whitney instruments for alternating currents will be ready for the market very shortly, as well as a line of cheap switchboard instrumeots

Although it has been in business only eight months, the Enterprise Electric company's trade has more than tripled, forcing it to new quarters, which have been found at 307 Dearborn street, Chicago, and which are composed of a store 25 by 125 feet, with a basement. The Enterprise company handles the National India Rubber company's wire, which is now getting a footing in Chicago, and is being appreciated by contractors.

The Central Electric company of 118 Franklin street Chicago, finds that the increased demand for interior conduit and the Lundell motors requires a department devoted exclusively to this branch of the business. H. H. Small, for six years in charge of the western supply department of the Thomson-Houston Electric company, has been appointed manager of the new department, and is prepared to furnish all information and prices on the products of the Interior Conduit & Insulation company, New York.

BUSINESS.

The co-partnership known as F. P. Little & Co. will go out of business on January 1st, and will be succeeded by the F. P. Little Electrical Construction & Supply company of Buffalo.

The Joseph Dixon Crucible company of Jersey City, manufacturers of Dixon's "American graphite" pencils, is taking time by the forelock by putting a fifth story, 175x 75 feet, on its pencil factory.

The Franklin Battery company, of New York, is busy preparing apparatus for a number of installations. Mr. Charles Blizard, formerly connected with several western electric enterprises, has accepted the position of secretary and general manager of this company.

The Railway Equipment company, Chicago, manufacturer of the Ahearn electric heater, has just issued a circular that will undoubtedly be interesting reading both to dealers and purchasers. The circular has reference to electric heater patents, and is for the trade. It is a reply to one that was sent out by the Burton Electric company of Richmond.

The Lunkenheimer Brass Manufacturing company of Cincinnati, O., has just issued a very tasteful Christmas circular, in which it extends to the trade the compliments of the season. The increased demand for the Lunkenheimer brass and iron specialties and the introduction of new products has compelled the company to double its capital to $500,000, and as soon as possible, too, the manufacturing facilities will be extended. This will place the Lunkenheimer company in a position to give all orders even more prompt and satisfactory attention than heretofore. The company will after January 1, 1893, transact its business as the Lunkenheimer company, with officers as follows: Edmund H. Lunken, president; C. F. Lunkenheimer, vice-president and treasurer; D. T. Williams, secretary.

The Electrical Repair & Construction company is the name of a new concern that has just started in business in Chicago. The officers of the company are: S. W. Lawrence, manager; C. J. Reilly, electrician, and H. G. Carter, superintendent Mr. Reilly was formerly superintendent of the Excelsior Electric company. It is the purpose of the Electrical Repair & Construction company to deal in new and second-hand dynamos and motors and other electrical machinery. Special attention will be given to repair work of all sorts, and estimates will be made on all kinds of electrical construction. The new firm starts under favorable auspices, and, from the fact that its members are practical and experienced men, it will undoubtedly come in for a good share of construction patronage. The department for handling second hand goods, too, is one that should do a good business, in that there is now little competition in this line in Chicago. The company's address for the present is 142 Michigan avenue.

ELECTRICAL PATENTS.

Issued December 20, 1892.

488,179. Trolley Stand for Electric Cars. Edward M. Bentley, Boston, Mass.

This invention consists of a cylindrical standard in which another cylinder freely revolves. Mounted upon this inner cylinder by means of ears is the trolley pole which is provided near its point of mounting with an extension which rests upon a plate within the rotatable cylinder, this plate being supported by a spring. This standard for the trolley pole allows the trolley to accommodate itself readily to any change of direction in the trolley wire.

488 198. Electric Distribution Box. William H. Hart, Brooklyn, N. Y.

488,205. Lamp Socket and Terminal Therefor. Joseph Hutchinson, New York, N. Y.

488 222. Incandescent Electric Lamp Base. Frederick C. Rockwell, Hartford, Conn.

488,225. Railway Signal. Edmund Schaefer, Lynchburg, Va.

488,299. Induction Apparatus. Charles Willms, Baltimore, Md.

488,233. Storage Battery. George A. Washburn, Cleveland, O.

488,256. Process of Uniting Broken Pieces of Arc Light Carbons. Nathan P. Stevens, Concord, N. H.

The ends of the broken carbon are faced, joined and cemented together by a cement composed of pulverized carbon and coal tar, heated to a consistency of thin paste, after which the carbons are put in a retort.

488,261. Dynamo Regulator. Charles J. Bogue, New York, N. Y.

Automatic regulation is accomplished by shifting circumferentially movable pole pieces. A solenoid for this purpose is included in the circuit, which responds to a change of the load. Operated by this solenoid is a lever, which controls the position of the segmented pole pieces which are linked together. Manual adjustment of the brushes is also provided for.

488,285 Signal Repeater. Thomas H. Patenall, Rahway, N. J.

488,305. Electric Motor. Charles S. Bradley, Yonkers, N. Y.

This motor consists of two oppositely rotating members, each member comprising a circular series of electro-magnets, suitably mounted upon a shaft and divided into two separate circuits, such that the magnets in one circuit alternate in position with those in the other circuit.

488,306. Alternating Current Motor. Charles S. Bradley, Avon, N. Y.

This motor has two armature circuits in shunt relation to each other, the self-starting circuit being provided with a commutator to maintain a progression of the polar line, and the synchronous circuit being adapted to offer a higher counter electro-motive force when the motor is starting and wound to make fixed poles in the armature core.

488,307. System of Distribution for Polyphase Alternating Currents. Charles S. Bradley, Avon, N. Y.

Claim 1 reads:
A system of local distribution for polyphase alternating currents having the several wires distributed in pairs among a number of lamp circuits, two or more adjacent circuits including all wires of the polyphase system and motor circuits connected with the wires of the several lamp circuits so as to include all of the polyphase currents in the motor system.

488,329. Electric Arc Lamp. Albert De Puydt, Liege, Belgium.

488,351. Closed Conduit for Electric Railways. Leon O. Dion, Natick, Mass.

The top plate of the conduit is provided with conducting sections insulated from each other. Pivotally mounted beneath these sections are magnets which support the conductors. Operated by two sprocket wheels upon the axles of the car are sprocket chains which support a number of magnets. As these magnets are brought in opposition to the pivoted magnets the conductor supported thereon is brought into contact with the insulated section from which the current may be taken by the trolley.

488,367. Telephone. Parnell Rabbidge, Sydney, New South Wales.

The microphone of the transmitter consists of a piece of India rubber or other like flexible insulating material, with interstices thereto which contain fine granulated carbon. The receiver is hung pendant to the transmitter, and is provided with a vessel which contains mercury. In the idle position of the receiver the circuit will be closed with line and earth through to the bell magnet. When in use the circuit will be closed from line to earth through the receiver, battery and transmitter.

488,385. Guard for Telephones. Edward B. Chase, Philadelphia, Pa.

488,388. Fire Alarm Apparatus. Augustus G. Davis, Baltimore, Md.

488,415. Means for Operating Station Indicators. Ruben B. Ayres, New York, N. Y.

488,424. Safety Attachment for Elevators. Louis W. Butler, Brooklyn, N. Y.

488,462. Car Starter. William Weaver, Westport, assignor to himself, and others, Norwalk, Conn.

488,466. Electric Forge. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass.

Claim 2 is:
The combination of two rings constituting opposite poles of an electric converter, rigid conductors connected with said rings, clamps at the outer ends of said conductors, an electrode supported in one of said clamps, and consisting of a solid bar provided with a cup-shaped socket at its inner end and another electrode supported in the other clamp and consisting of a solid bar provided with a cup-shaped socket at its inner end, said electrodes being adapted to receive the opposite ends of the bar to be heated.

488,467. Electric Metal Heating Apparatus. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass.

Claim 7 is quoted:
The combination of a converter for converting electrical currents of high potential into those of low potential, conductors leading from said converter and provided with metal heating appliances at a suitable distance therefrom, and a liquid bridge or short circuit placed between the converter and said metal heating appliances.

488,468. Electric Metal Working Apparatus. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass.

488,469. Electric Metal Heating Apparatus. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass.

488,470. Process of Reducing Franklinite Ores. George G. Convers, Salisbury, Pa.

488,471. Process of Treating Franklinite and Willemite. George G. Convers, Salisbury, Pa.

488,502. Telephone System. Charles C. Jennings, Chicago, Ill.

This system is designed to be used on ranches, farms and railroad rights of way where the inclosures are fenced by wire. A portable transmitter and receiver is provided which may readily be connected into circuit formed by two of the fence wires.

488 520. Electrically Operated Stringed Musical Instrument. Willard H. Gilman, Boston, Mass.

488,532. Electrical Switchboard. James W. Lyon, Brooklyn, N. Y.

That portion of the socket which forms the terminals for the line is surrounded by rubber. A row of sockets is so surrounded separately, after which the rows are formed into a switchboard. The terminals of the plug are also mounted or molded upon India rubber.

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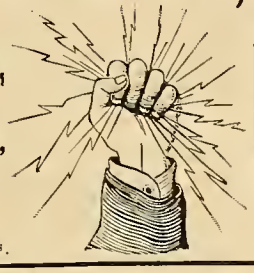

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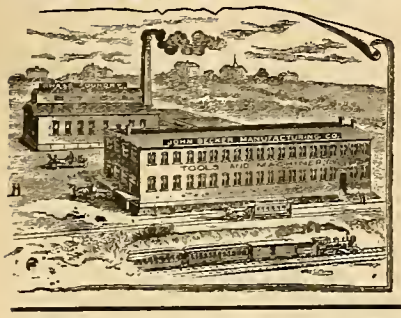

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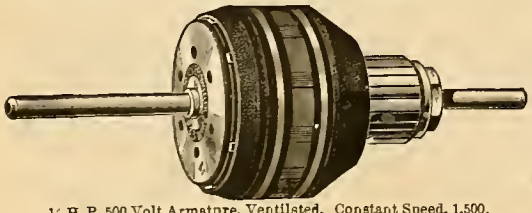

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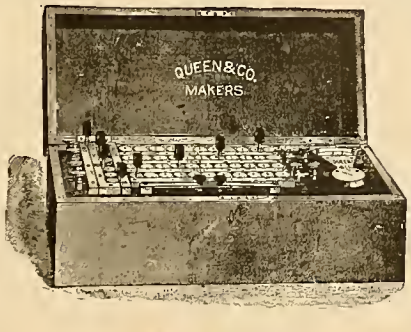

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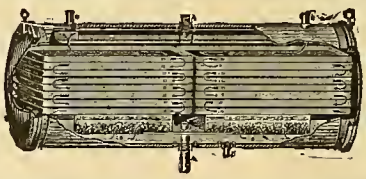

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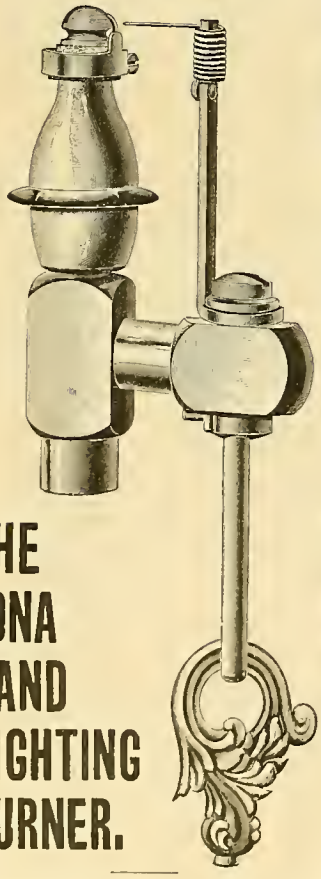

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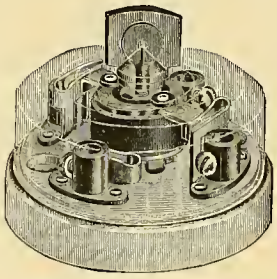

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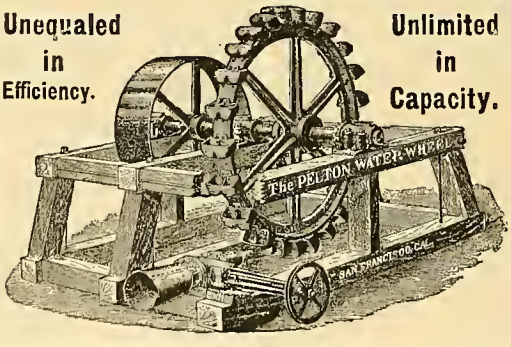

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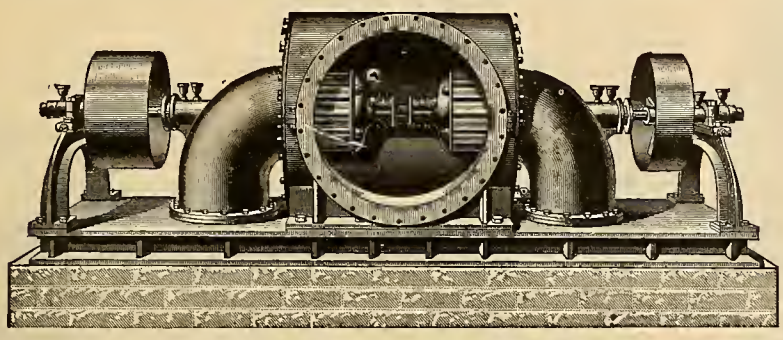

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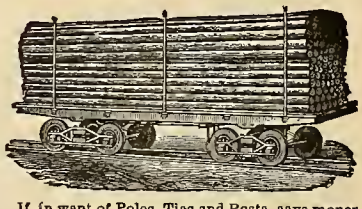

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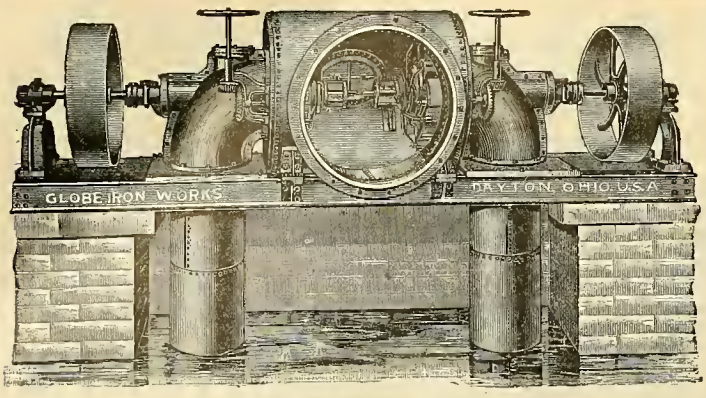

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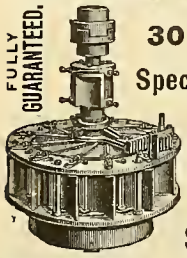

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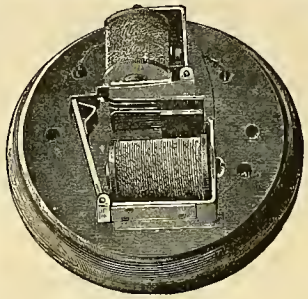

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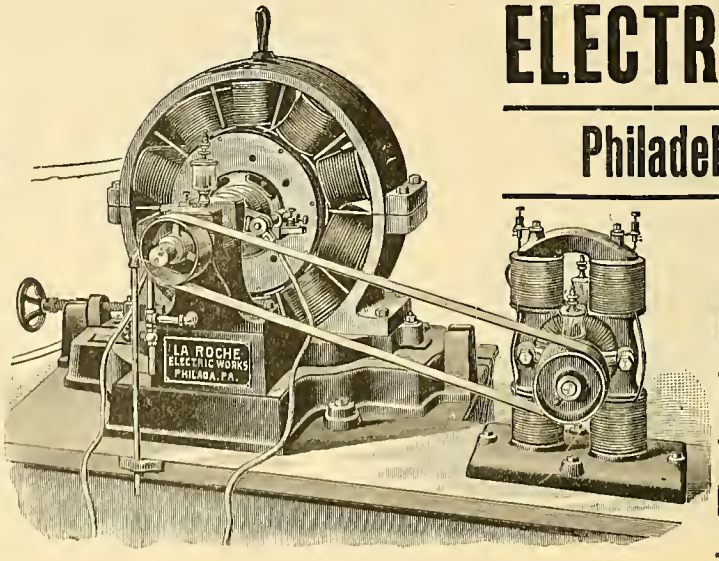

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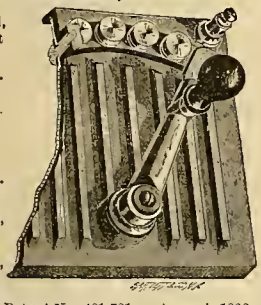

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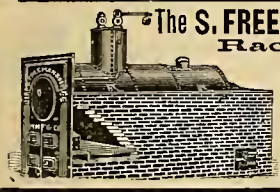

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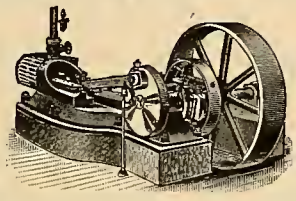

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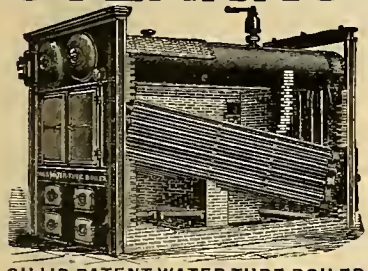

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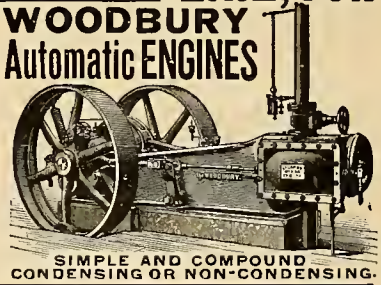

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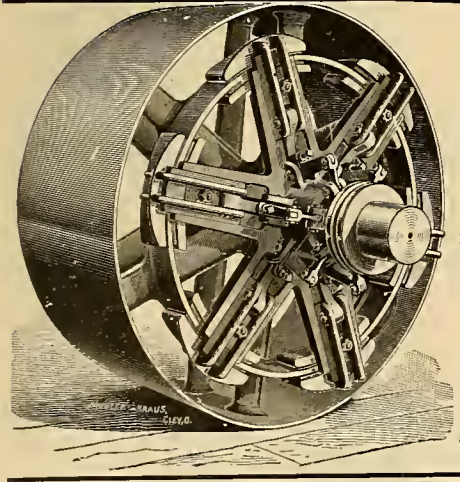

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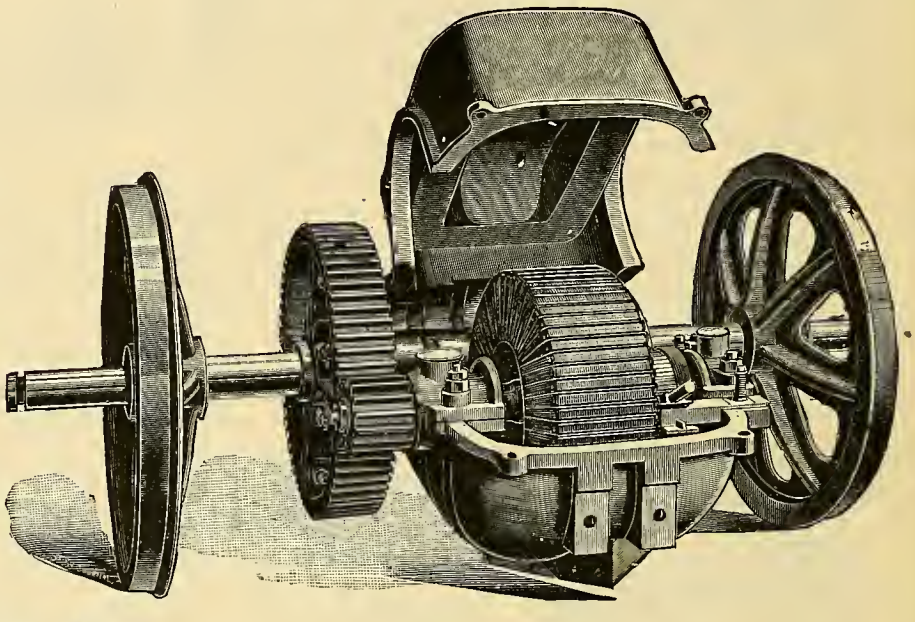

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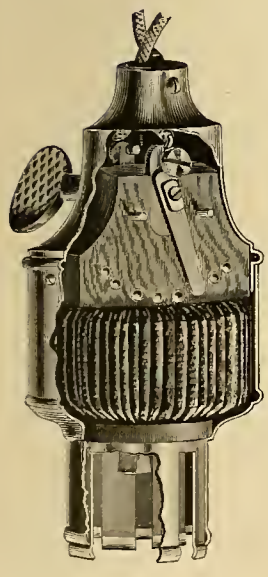

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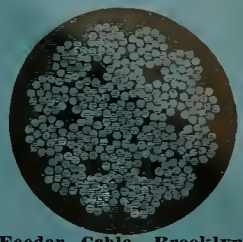

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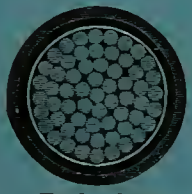

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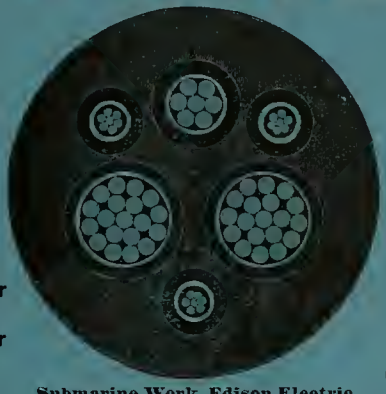

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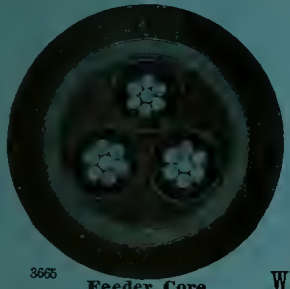

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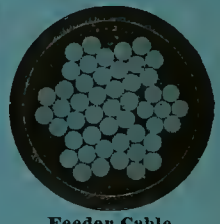

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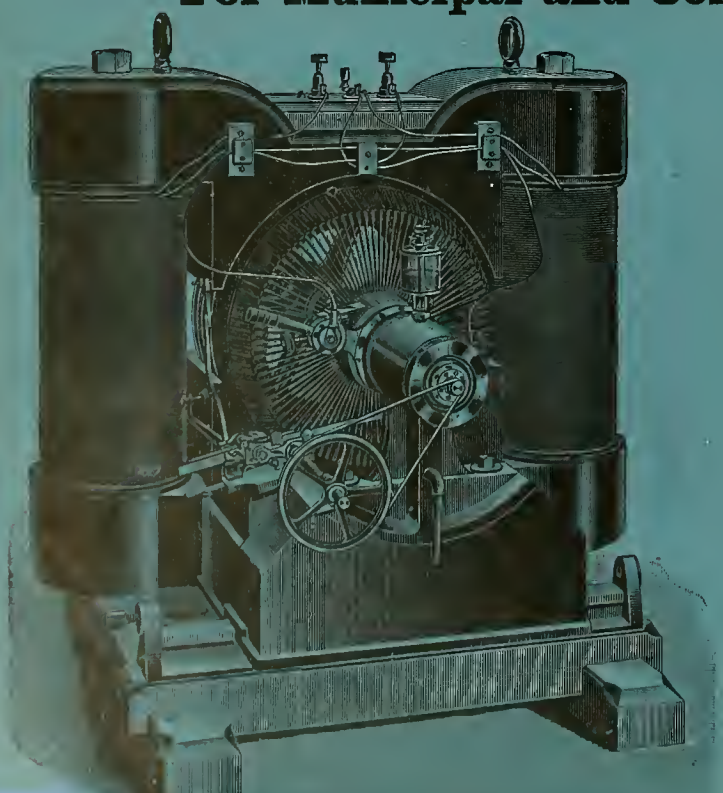

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